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# GEMA

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Operating Instructions EN

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# 1 Preface and general information

## 1.1 About this manual

This manual makes you familiar with the *GEMA* system and its designated use. It contains important information for a safe, proper and efficient installation and operation of the *GEMA* system.

Observing the instructions given in this manual helps to avoid hazards, repair costs and down times caused by incorrect installation or operation. Furthermore, it ensures a high reliability and a long durability of the *GEMA* system.

This manual always has to be kept available on the site where the *GEMA* system is used.

- ▶ Prior to installation and commissioning, this manual and the contained instructions must be read and observed by the persons responsible for the installation, maintenance and commissioning of the *GEMA* system. The safety precautions listed in chapter 2 on page 7 always have to be observed.
- ▶ Before operating the *GEMA* system for the first time, users must read and observe the following parts of the manual and the instructions given there:
  - ▶ Chapter 1 "Preface and general information" on page 5
  - ▶ Chapter 2 "Safety precautions" on page 7
  - ▶ Chapter 3 "Description" on page 9
  - ▶ Chapter 6 "Operation" on page 36
  - ▶ Chapter 7 "Maintenance" on page 43

When installing and using the *GEMA* system, all applicable national safety requirements and regulations for accidental prevention and environmental protection must be observed.

## 1.2 Presentation of warnings

The following warnings for avoiding hazards are used in this manual:



### DANGER

Death or severe injury will occur if the appropriate safety instructions are not observed.



### WARNING

Death or severe injury can occur if the appropriate safety instructions are not observed.



### CAUTION

Minor or moderate injury may occur if the appropriate safety instructions are not observed.

### NOTICE

Equipment damage possible.

## 1.3 Designated use of the *GEMA* system

The *GEMA* system is a modular-designed generator system for magnet plates. It is intended for permanent installation in excavators or in conjunction with power sets or hydraulic aggregates and must not be used for any purposes other than the generation of power for magnet plate systems in conformity with the specifications in this manual.

The *GEMA* system must not be connected to other power distribution or electricity generation systems (such as other generators or the public electricity supply network, for example).

The usage of the *GEMA* system is only allowed for applications described here and in conformity with the specifications in these operating instructions. Any other application is considered to be improper use and is not permitted.

In case of improper use, misuse or abuse of the system or of parts of it, KW-Generator GmbH & Co. KG will not assume any liability.

Single-bearing generators are exclusively intended for direct mounting to a combustion engine which complies with the applicable regulations, rules and requirements.

Two-bearing generators are usually driven via a belt, clutch or directly by the engine.

The *GEMA* system complies to DIN EN 60034/VDE530 and is conform to RoHS.

## 2 Safety precautions

Always observe the safety precautions listed in this chapter when working with the *GEMA* system. These safety precautions are supplemented by additional specific warnings which only apply to certain actions and activities. The specific warnings are listed and highlighted accordingly in the relevant passages through the manual.

### 2.1 Personnel qualifications

Installation, maintenance and reconditioning work on the *GEMA* system may only be performed by authorized and electrically qualified personnel.

### 2.2 General safety precautions and symbols on the system

The warning symbols on the *GEMA* system have the following meaning:



During and after operation, generator components may be very hot. Risk of burns.



During operation, the generator supplies highly dangerous voltages. Never touch the generator or the connected magnet plate with wet hands during operation. Mortal danger by electrocution.

### 2.3 Safe operation

The following safety precautions must be observed when operating the *GEMA* system.

- ▶ The strong electromagnetic fields of the magnet plate may affect the correct function of cardiac pacemakers. Persons with cardiac pacemaker must not carry out any work on the *GEMA* system and have to keep sufficient safety distance to the magnet plate during operation.
- ▶ The *HMI* control unit is mounted by means of two permanent magnets on its rear side. The magnetic fields of these permanent magnets may affect the correct function of cardiac pacemakers. Persons with cardiac pacemaker must always keep sufficient safety distance to the *HMI* control unit.
- ▶ Do not operate the *GEMA* system in explosive environments.
- ▶ Do not operate the *GEMA* system without the protective covers for the drive mounted as specified.
- ▶ Never switch on the magnet plate unless you need it for your work. An energized magnet plate suspended in the air can attract material inadvertently. Risk of personal injury caused by metal parts attracted by or dropping from the magnet plate.
- ▶ The presence of persons within the swivel/work area of the magnet plate is prohibited.
- ▶ The *GEMA* system components must never be exposed to the jet of high-pressure cleaners. The system could thereby be damaged.

- ▶ Visual inspections for maintenance purposes and cleaning work on the *GEMA* system must not be performed during operation. Always turn off the engine first and make sure that it cannot be restarted accidentally (e.g. by removing the ignition key and keeping it safe).

## 2.4 Safety during installation, maintenance and reconditioning

The following safety precautions must be observed during installation and during any work on the *GEMA* system.

### 2.4.1 Safety rules for working on electrical equipment

Always observe the five safety rules for working on electrical equipment when working on the *GEMA* system:

- ▶ Disconnect completely.
- ▶ Secure against re-connection.
- ▶ Verify that the installation is dead.
- ▶ Carry out grounding and short-circuiting.
- ▶ Provide protection against adjacent live parts.

### 2.4.2 Safety precautions for installation, maintenance and reconditioning

- ▶ The strong electromagnetic fields of the magnet plate and the magnetic fields of the permanent magnets used to mount the *HMI* control unit may affect the correct function of cardiac pacemakers. Persons with a cardiac pacemaker must not carry out any work on the *GEMA* system and always have to keep sufficient safety distance.
- ▶ Work on electrical installations and on the *GEMA* system may only be performed by adequately trained qualified personnel and in conformity with the applicable national rules and regulations.
- ▶ Work on electrical installations and on the *GEMA* system may only be performed in the off and de-energized state. Engines that have been turned off must be secured against accidental restarting (e.g. by removing the ignition key and keeping it safe).
- ▶ Any modifications on the *GEMA* system or individual components of the system are strictly prohibited. Any modification, improper repair or use of unsuitable external components will terminate all and any claims under a warranty. In this case, the manufacturer will not assume any liability.
- ▶ The *GEMA* system is intended for permanent installation. Commissioning is prohibited until the entire installation has been confirmed to comply with the requirements of all applicable rules and regulations.
- ▶ Never connect the *GEMA* system to the public electricity supply network or to any other systems for power generation. Never connect several *GEMA* systems to each other. Risk of death and destruction hazard by high voltages and currents.
- ▶ Connecting the *GEMA* system's output (i.e., the positive or negative conductor of the power cable leading to the magnet plate) to ground supersedes the protective measure "electrical separation" and is therefore prohibited.



### 3 Description

#### 3.1 System overview

Figure 1:  
GEMA system overview

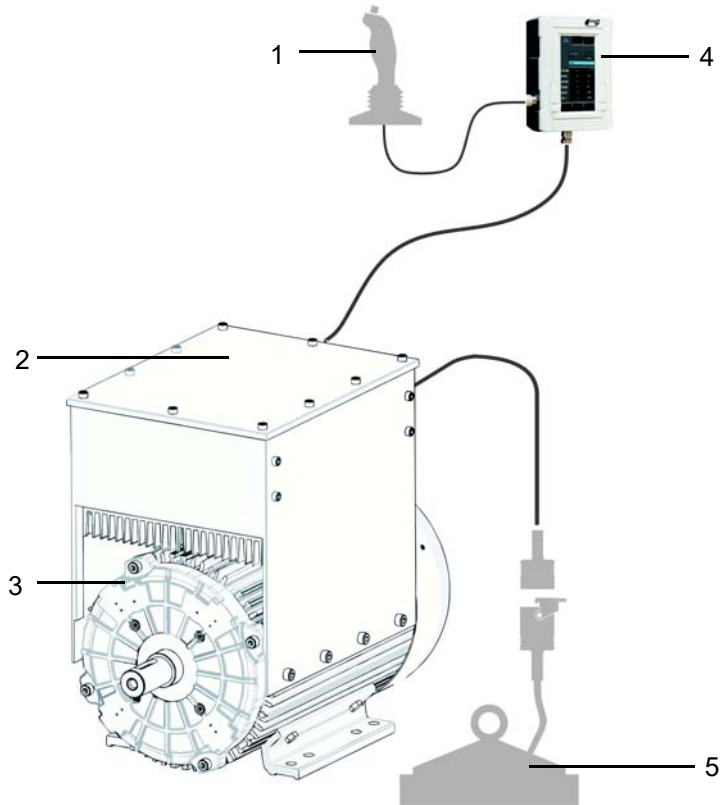


Table 1:  
Components of the  
GEMA system

No.	Designation	Function
1	Manual control	Operator pushbutton (joystick)
2	Controller box	Contains the complete control electronics in solid casting.
3	Generator	Electronically controlled brushless synchronous generator.
4	HMI control unit	HMI control unit for displaying system states and for controlling the generator via the touch display. Interface for connection of the operator pushbutton (joystick).
5	Magnet plate	Magnet plate system (third-party manufacturer).

The GEMA system is a modular-designed generator system for magnet plates which, for example, can be used in excavators or in conjunction with power sets or hydraulic aggregates. The maintenance-free system is splash-proof according to IP54 specifications. It consists of a generator with built-on control electronics and an HMI control unit (Human Machine Interface).

The generators are available as single-bearing generators and two-bearing generators. By providing 2-pole and 4-pole versions, various model variants from 9 to 30 kW for a large speed range (1500 - 3600 rpm) are available.

The HMI control unit transmits the operator inputs to the control electronics of the generator. Furthermore, it displays system data and operating states. The interface for connecting the operator pushbutton (joystick) is also part of the

control unit. The control electronics controls the generator in order to provide the connected magnet plate with the corresponding voltages and currents.

Regarding the generator drive, there are various options to choose from. Mostly, the belt drive type is used. Alternatively, the generator can be driven by direct drive, direct flange mounting or by a hydraulic motor. Further information can be found in section 5.5.5 on page 32.

## 3.2 Advantages of the system

Besides the well-known features of electronic magnet plate systems (e.g. high-speed magnetization, high-speed demagnetization, various mounting options), the *GEMA* system distinguishes by the following special advantages:

- Exact visualization of all system data on the *HMI* control unit.
- Effective and quick work with completely different materials by the use of preset programs.
- The magnetic force can be adjusted by just one keystroke on the *HMI* control unit.
- Customer-specific requirements can be implemented quickly by means of graphically adjustable software parameters.
- Large speed range for the engine speed. All *GEMA* systems are available as 2-pole and 4-pole versions.
- Extremely quiet generator operation due to special housing design.
- Communication between *GEMA* components is based on CAN bus (SAE J1939), which allows an easy connection to superordinated controls.
- Maintenance free due to electronically controlled brushless generator and self-protecting electronics (cable break, short-circuit, underspeed, overspeed and overtemperature).

## 3.3 Operating modes "normal mode" and "inching mode"

In the preset programs of the *GEMA* system, two operating modes are distinguished: "normal mode" and "inching mode".  
What is the difference?

The system reaction when pressing the **Mag.** button on the *HMI* control unit or the corresponding button on the joystick depends on the operation mode selected. In "normal mode", the magnet plate is switched on by pressing the **Mag.** button and switched off by pressing the button again. In "inching mode", the **Mag.** button has to be pressed and held as long as the magnet plate is to be energized. Releasing the **Mag.** button in "inching mode" switches off the magnet plate immediately (the magnetization parameters of the currently selected program are applied).

The following figure shows two of the preset example programs using both operation modes, and the current and voltage characteristics at the magnet.

Figure 2:  
Example programs and  
their function

**Program 3: "Normal 50"**

Operation mode: Normal mode  
Characteristic: Demagnetization with 50 %  
reverse magnetization.



← Voltage at the  
magnet

← Current at the  
magnet

**Program 5: "TIPP 2"**

Operation mode: Inching mode  
Characteristic: No reverse magnetization  
during demagnetization.



← Voltage at the  
magnet

← Current at the  
magnet

### 3.4 The HMI control unit

#### 3.4.1 Overview

Figure 3:  
HMI control unit



Table 2:  
Components of the  
HMI control unit

No.	Designation	Function
1	Type plate	Type plate showing the serial number and software version.
2	Touch display with control buttons	Display for visualization of system/operating data and error messages, with integrated control buttons for operating the system.
3		
4	Magnetic clamps	Two magnetic clamps (either on the back or side) for mounting the HMI control unit.
5	Connection socket	Socket for connection of the operator pushbutton (joystick) (see section 3.4.3).
6	Connection socket (symbolic)	Socket for connection to the generator (see section 3.4.3).

The HMI control unit (Human Machine Interface) transmits the operator inputs to the control electronics of the generator. Additionally, the unit displays system data and operating states.

The HMI control unit is installed in sight of the operator, enabling him to check the operating states of the system displayed on the HMI and enabling him to react quickly, if necessary.

At the HMI control unit, the operator selects the desired program and switches the magnet on and off. Additionally, the magnet voltage can be adjusted and programming tasks can be carried out. Further information on the preset programs can be found in section 6.3 on page 38.

### 3.4.2 Indicators and operating elements on the HMI control unit

The HMI control unit displays all system and operating data as well as possible error states of the GEMA system in its touch display. The system is operated using the control buttons integrated in the user interface of the touch display. The meaning of the individual elements is described below.

Figure 4:  
Indicators and operating elements on the HMI control unit (main page of the software user interface)

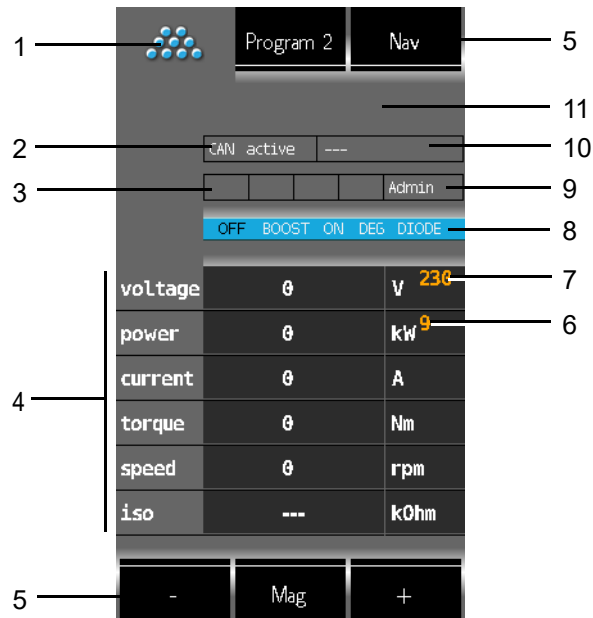


Table 3:  
Indicators and operating elements on the HMI control unit

No.	Designation	Function
1	Program symbol	Indicates the currently selected program.
2	CAN status	Indicates whether the CAN bus is active.
3	Status of inputs and outputs	Indicates whether inputs or relay outputs are active (input active: operator pushbutton on joystick pressed; output active: external LED on).
4	Display of actual values	Displays the present actual values: <b>voltage</b> : Voltage at the magnet. <b>power</b> : Power at the magnet. <b>current</b> : Current through the magnet. <b>torque*</b> : Torque at the generator drive. <b>speed*</b> : Speed of the generator drive. <b>iso</b> : Insulation resistance between the phases and the housing. * The frequency of the supplying power grid is displayed in Hz for applications where the GEMA system is supplied through a power grid instead of a generator.

No.	Designation	Function
5	Control buttons	<p>Control buttons for controlling the system.</p> <p>- button: Reduces the target voltage for the magnet plate by 5 V per step. Display of target voltage value, see no. 7.</p> <p>+ button: Increases the target voltage for the magnet plate by 5 V per step. Display of target voltage value, see no. 7.</p> <p><b>Mag.</b> button: Switches the magnet plate on and off.</p> <p><b>Nav</b> button: Displays the navigation page of the software user interface.</p> <p><b>Program</b> button: Selects a preset program. The currently selected program is displayed in the button ("Program 2", for example). The selected program is additionally indicated by the program symbol displayed on the left. Refer to section 6.3 on page 38 for a detailed description of the programs.</p>
6	Nominal power	Nominal power of the system in kW.
7	Target voltage	Target voltage at the magnet plate in V.
8	Magnet plate status	<p>Indicates the present status of the magnet plate:</p> <p><b>OFF:</b> Off</p> <p><b>BOOST:</b> Boost</p> <p><b>ON:</b> On</p> <p><b>DEG:</b> Demagnetization by reverse voltage</p> <p><b>DIODE:</b> Demagnetization in diode mode</p>
9	User	Displays the currently logged in user.
10	Yellow Box status	<p>Indicates whether a <i>Yellow Box</i> (YB) is installed and whether the <i>Yellow Box</i> tripped.</p> <p><b>YB OK:</b> <i>Yellow Box</i> is installed.</p> <p><b>YB missing:</b> <i>Yellow Box</i> is not installed.</p> <p><b>YB trig. (red):</b> The protection circuit of the <i>Yellow Box</i> tripped.</p> <p>---: No <i>Yellow Box</i> intended.</p>
11	Display for error and warning messages	Displays error and warning messages. For further information, please refer to chapter 8 on page 45.

**Note:** Figure 4 shows the main page of the software user interface as an example. The main page contains essential system and operating data and integrated control buttons for operating the system. Please refer to document "KWG-3HMI User Manual" for information about the other pages of the *HMI* software user interface. These pages contain (amongst others) event logs, hour meters or diagnostic functions.

### 3.4.3 Connections on the HMI control unit

CAN bus and supply; connection to GEMA controller box

#### Available variant no. 1

Socket on HMI			Plug on connection cable		
Type: HARTING STAF 6 STI-S			Type: HARTING HAN 3A-GW-PG11 STAF 6 FE-L		
1	n. c.	-	1	n. c.	-
2	CAN0_L	Brown	2	CAN0_L	Brown
3	CAN0_H	Green	3	CAN0_H	Green
4	Shield_GND	Yellow	4	Shield_GND	Yellow
5	+15 V	Gray	5	+15 V	White
6	GND	Pink	6	GND	Shield

#### Available variant no. 2

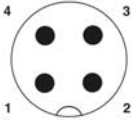
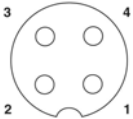
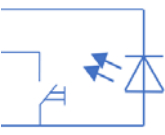
Socket on HMI			Plug on connection cable		
5-pole M12 circular plug connector, female Type: SACC-E-FS-5CON-M16/0,5 SCO			5-pole M12 circular plug connector, male		
1	Shield_GND	Brown	1	Shield_GND	Brown
2	CAN0_L	White	2	CAN0_L	White
3	CAN0_H	Blue	3	CAN0_H	Blue
4	GND	Black	4	GND	Black
5	+15 V	Gray	5	+15 V	Gray

#### Available variant no. 3

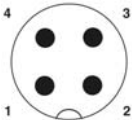
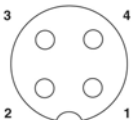

Socket on HMI			Plug on connection cable		
8-pole M12 circular plug connector, female Type: SACC-E-FS-8CON-M16/0,5 SCO			8-pole M12 circular plug connector, male		
1	Not used	White	1	Not used	White
2	CAN0_L	Brown	2	CAN0_L	Brown
3	CAN0_H	Green	3	CAN0_H	Green
4	Shield_GND	Yellow	4	Shield_GND	Yellow
5	+15 V	Gray	5	+15 V	Gray
6	GND	Pink	6	GND	Pink
7	Not used	Blue	7	Not used	Blue
8	Not used	Red	8	Not used	Red

Connection for operator push-button (joystick)

Variant no. 1 (standard)

Socket on <i>HMI</i>	Plug on connection cable	Pin assignment			
		Pin	Function	Color	Wiring
4-pole M12 circular plug connector, male SACC-E-MS-4CON-M16/0,5 SCO 	4-pole M12 circular plug connector, female 	1	Out	Brown	
		2	S1	White	
		3	GND	Blue	
		4	+12 V	Black	
		Pin 1 and Pin 3 are bridged inside the <i>HMI</i> to supply the external LED.			

Variant no. 2 (2 inputs)

Socket on <i>HMI</i>	Plug on connection cable	Pin assignment			
		Pin	Function	Color	Wiring
4-pole M12 circular plug connector, male SACC-E-MS-4CON-M16/0,5 SCO 	4-pole M12 circular plug connector, female 	1	S2	Brown	
		2	S1	White	
		3	GND	Blue	
		4	+12 V	Black	

**Note:** Further variants with a higher number of contacts are available on request.



## 3.5 Generator with control electronics

### 3.5.1 Overview

Figure 5:  
Generator with control  
electronics (schematic  
representation)

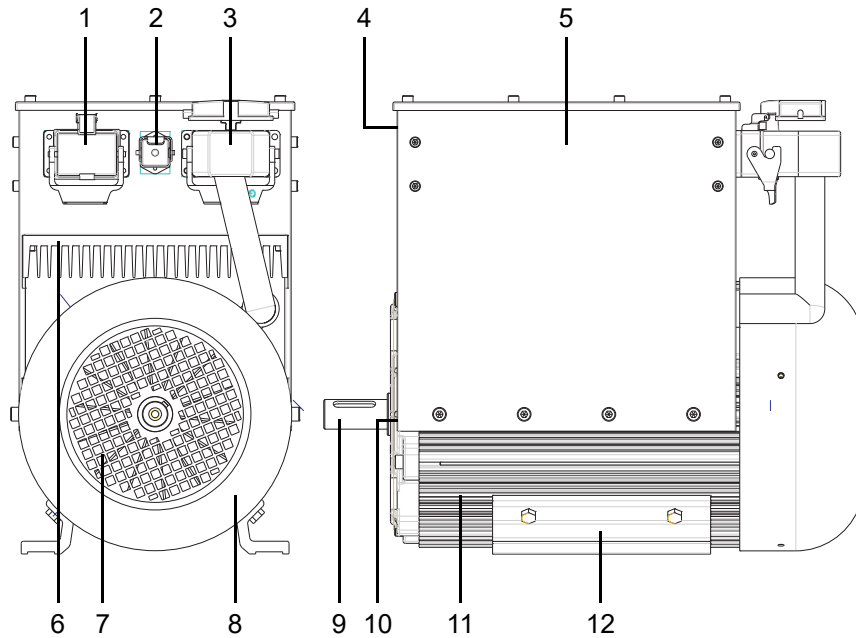


Table 4:  
Generator components

No.	Designation
1	Connector for magnet plate.
2	Connector for <i>HMI</i> control unit (symbolic).
3	Connector for generator cable (shown plugged in).
4	Type plate of the controller box.
5	Controller box with control electronics and generator governor in solid casting.
6	Cooling element for cooling the control electronics.
7	Cooling air intake with protective grid.
8	Fan cover for covering the fan impeller.
9	Drive shaft.
10	Type plate of generator.
11	Cooling profiles.
12	Mounting base with variable mounting dimensions.

### 3.5.2 Description

The electronically controlled brushless synchronous generators are maintenance-free, highly reliable and durable, and designed for continuous operation.

The low-noise generator housing is splash-proof according to IP54 specifications and provides a highly effective ventilation. Cooling is provided by a fan impeller fitted at the rear, which draws in the cooling air at the rear and blows it towards the front through the cooling profiles running along the generator housing.

The generators offer a reinforced bearing system and can be connected to all common drive systems thanks to different adapter flanges.

Two generator bases with variable mounting dimensions are used to bolt the generator either directly to the base or to rails, thus making it movable (depending on the drive type).

The controller box attached to the generator holds both, the power electronic equipment for controlling the voltages and currents for the magnet plate and the control electronics for the generator itself. For better protection against water damages and vibrations, the electronics inside the controller box is casted completely.

By means of the CAN interface, the electronic generator governor can be integrated in existing engine management systems. The control electronics does not need a separate power supply, as it is supplied from the generator.

### 3.5.3 Connections on the GEMA controller box

**CAN bus and supply; connection to HMI control unit**

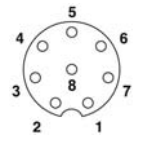
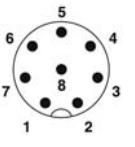
**Available variant no. 1**

Socket on GEMA controller box			Plug on connection cable		
Type: HARTING STAF 6 STI-S			Type: HARTING HAN 3A-GW-PG11 STAF 6 FE-L		
1	n. c.	-	1	n. c.	-
2	CAN0_L	Yellow	2	CAN0_L	Brown
3	CAN0_H	Blue	3	CAN0_H	Green
4	Shield_GND	Gray	4	Shield_GND	Yellow
5	+15 V	Orange	5	+15 V	White
6	GND	Gray	6	GND	Shield

**Available variant no. 2**

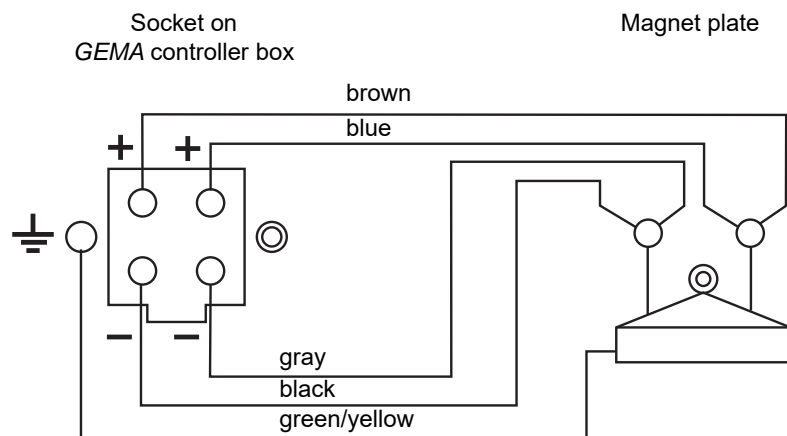
Socket on GEMA controller box			Plug on connection cable		
5-pole M12 circular plug connector, female			5-pole M12 circular plug connector, male		
Type: SACC-E-FS-5CON-M16/0,5 SCO					
1	Shield_GND	Brown	1	Shield_GND	Brown
2	CAN0_L	White	2	CAN0_L	White
3	CAN0_H	Blue	3	CAN0_H	Blue
4	GND	Black	4	GND	Black
5	+15 V	Gray	5	+15 V	Gray

Available variant no. 3

Socket on GEMA controller box			Plug on connection cable				
8-pole M12 circular plug connector, female Type: SACC-E-FS-8CON-M16/0,5 SCO			8-pole M12 circular plug connector, male				
1	Not used	White		1	Not used	White	
2	CAN0_L	Brown		2	CAN0_L	Brown	
3	CAN0_H	Green		3	CAN0_H	Green	
4	Shield_GND	Yellow		4	Shield_GND	Yellow	
5	+15 V	Gray		5	+15 V	Gray	
6	GND	Pink		6	GND	Pink	
7	Not used	Blue		7	Not used	Blue	
8	Not used	Red		8	Not used	Red	

Connector for magnet plate

Socket on GEMA controller box	Plug on connection cable
<b>GEMA 9, GEMA 15, GEMA 20:</b> HARTING HAN 6	<b>GEMA 9, GEMA 15, GEMA 20:</b> HARTING HAN 6
<b>GEMA 25, GEMA 30:</b> HARTING HAN 16	<b>GEMA 25, GEMA 30:</b> HARTING HAN 16



**NOTICE**

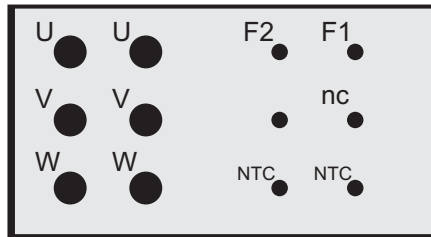
Too small conductor cross sections may cause damage of the connection cable or performance loss of the magnet plate.

- ▶ We recommend to always use the ready-made connection cables delivered by KW-Generator GmbH & Co. KG.
- ▶ When using other connection cables, make sure that the required conductor cross section is met. Please refer to section 3.7 "Technical data" on page 23.

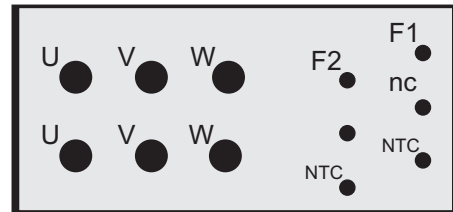
**Connector for generator**

Socket on GEMA controller box	Plug on connection cable
<b>GEMA 9, GEMA 15, GEMA 20:</b> HARTING HAN 10	<b>GEMA 9, GEMA 15, GEMA 20:</b> HARTING HAN 10
<b>GEMA 25, GEMA 30:</b> HARTING HAN 16	<b>GEMA 25, GEMA 30:</b> HARTING HAN 16

Socket on GEMA controller box for  
GEMA 9, GEMA 15, GEMA 20



Socket on GEMA controller box for  
GEMA 25, GEMA 30



### 3.6 Type designations and serial numbers

Each *GEMA* system has different unique type designations and individual serial numbers. These are described in the subsequent sections.

**Note:** For any inquiries or for ordering spare parts, please have the serial number and type designation of the corresponding *GEMA* component ready.

#### 3.6.1 Type plate on the *GEMA* generator

Each *GEMA* generator has an unique type designation and an individual serial number. Both numbers can be found on the generator's type plate.

Figure 6:  
Example of a type plate  
for a *GEMA* 9 generator

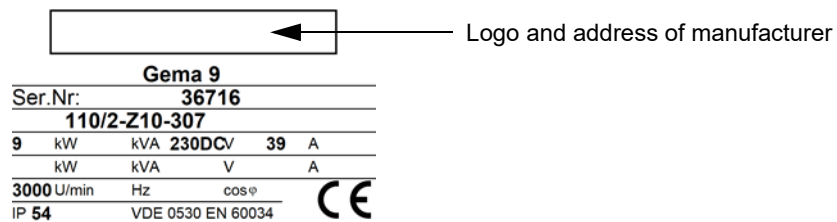
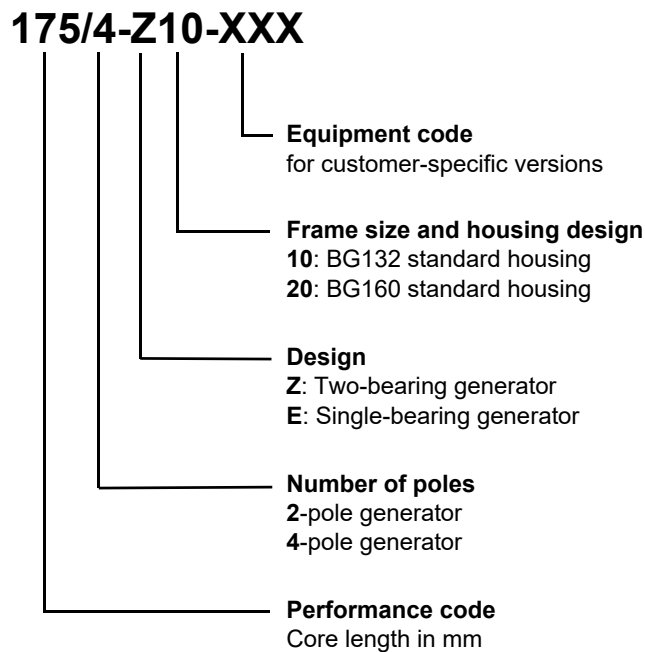


Figure 7:  
Breakdown of the  
generator type  
designation



### 3.6.2 Type plate on the *GEMA* controller box

The type plate on the *GEMA* controller box shows the designation and the serial number of the controller box as well as information about the software version of the control electronics.

Figure 8:  
Example of a type plate  
for a *GEMA* controller  
box



### 3.6.3 Type plate on the *HMI* control unit

The type plate of the *HMI* control unit is located on the top side of the housing (see figure 3 on page 12). The type plate shows the designation and the serial number of the *HMI* as well as information about the software version of the device (firmware version and set of parameters).

Figure 9:  
Example of a type plate  
for a *HMI* control unit



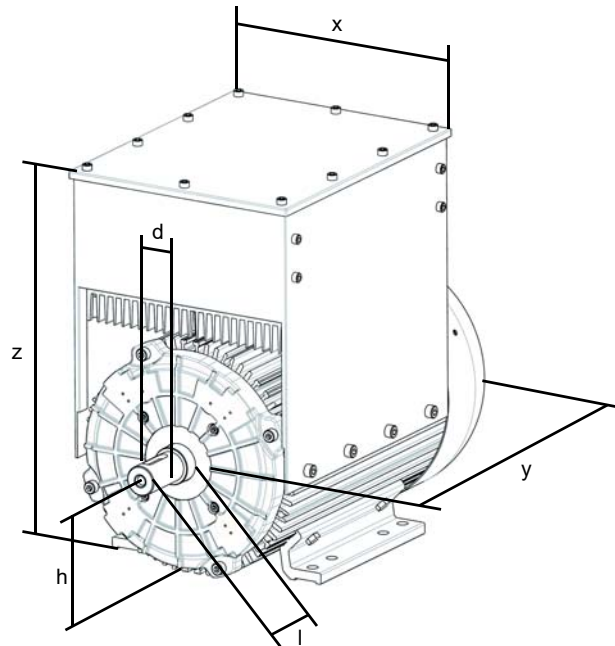
### 3.7 Technical data

The following table gives an overview on the available *GEMA* systems and their technical data

Table 5:  
Technical data of *GEMA* systems

	GEMA 9		GEMA 15		GEMA 20		GEMA 25/ GEMA 30	
	2-pole	4-pole	2-pole	4-pole	2-pole	4-pole	2-pole	4-pole
Number of poles	2-pole	4-pole	2-pole	4-pole	2-pole	4-pole	2-pole	4-pole
Nominal power On-period 100% - S1	9 kW		15 kW		20 kW		25 kW/ 30 kW	
Rated voltage	230 V							
Boost voltage	280 V							
Rated current	39 A		65 A		86 A		108 A/ 130 A	
Recommended speed (rpm)	3000	2000	3000	2000	3000	2000	3000	1800
Speed range (rpm)	2700- 3600	1800- 2500	2700- 3600	1800- 2500	2700- 3600	1800- 2500	2700- 3600	1500- 2500
Dimensions (mm)								
d x l	28 x 60	32 x 60	28 x 60	32 x 60	32 x 60		42 x 110	
h	132	132	132	132	132		160	
x	264	264	264	264	264		324	
y	425	434	450	459	525		466	
z	427	427	427	427	505		565	
Weight (mass)	75 kg		95 kg		118 kg		180 kg	
Recommended conductor cross section of the power cable to the magnet plate	5 x 4 mm <sup>2</sup>		5 x 4 mm <sup>2</sup>		5 x 6 mm <sup>2</sup>		5 x 10 mm <sup>2</sup>	

Figure 10:  
Dimensions of the  
*GEMA* system



The dimensions are listed in the table above.

## 4 Transport and storage

For delivery, the *GEMA* system is bolted onto a transport pallet ready for installation. A protective foil protects the components against water and soiling. The *HMI* and the connecting cables are enclosed.

We recommend to check the *GEMA* system carefully for transport damages on arrival at the place of destination. Any visible damages have to be reported to the involved shipping company as well as to KW-Generator GmbH & Co. KG immediately.

Use only belts with an adequate load capability for lifting and moving the generator. Ensure that all equipment and tools used for lifting the *GEMA* system are capable for the weight of the *GEMA* system, and that all safety measures for the transport are taken.

The weights of the various *GEMA* systems can be found in section 3.7 on page 23.



### WARNING

**Death or severe injury by falling objects possible.**

- ▶ Only use the eye bolts of the generator for lifting the generator itself. The eye bolts are only suitable for this purpose.

During storage, the ball bearings do not have to be maintained. Manually turning the generator shaft from time to time prevents contact corrosion and curing of the lubricating grease.

### NOTICE

**Damage of components due to penetration of moisture possible.**

When the connecting cables are unplugged, water and moisture may get into the *GEMA* system by way of the open connectors.

- ▶ Ensure that the hinged lids of the connector sockets are correctly closed for transport and storage.

If the generator is not put into operation immediately, it has to be stored clean, dry and vibration-free.

Table 6:  
Storage and transport  
conditions

Permissible temperatures:	
transport	-25 °C to +60 °C
storage	-20 °C to +50 °C
Permissible relative humidity:	
transport	95 %, non-condensing
storage	95 %, non-condensing



## 5 Installation and commissioning

This chapter provides information about installing and commissioning the *GEMA* system.

Installation of the *GEMA* system may only be performed by authorized and qualified personnel.

Read the safety precautions listed in section "Safety precautions" on page 7 prior to installing and commissioning the *GEMA* system.

### 5.1 Standard scope of delivery

The following components are contained in the standard scope of delivery of the *GEMA* system. Check the items supplied for completeness before installing the system.

**Note:** Please note that several options are available for the *GEMA* system. Thus, the number of supplied components can vary. In this chapter, only the standard scope of delivery is considered.

Standard scope of delivery of the *GEMA* system:

- *GEMA* generator with controller box
- *HMI* control unit
- Connection cable *GEMA* generator <-> *HMI* control unit
- Connection cable *GEMA* generator <-> magnet plate
- Connection cable *HMI* control unit <-> joystick

### 5.2 Preliminaries

Prior to installation, carry out the following works and checks:

- ▶ Remove the protective foils and transportation locks.
- ▶ Verify that the data specified on the type plate of the generator match the installation data.
- ▶ Ensure that all screws and nuts at the generator are tightened and that the mechanical design is correct.
- ▶ Ensure that the place of installation provides enough cooling air and that the generator will not intake any hot air.
- ▶ Ensure that the place of installation provides enough space for service and maintenance works.
- ▶ Ensure that persons without any authorization or animals have no access to the installation and that the required safety equipment is installed according to the relevant regulations.
- ▶ Ensure that the connections at the terminal plate and the magnet plate have been carried out according to the applicable regulations and that no short circuits exist between the generator and external switches.

## 5.3 Installing the *HMI* control unit

The *HMI* control unit is to be installed in sight of the operator. This allows the best view to all system data shown on the touch display as well as quick access to the control functions.

The *HMI* control unit can be mounted to an existing ferromagnetic surface on site or to a metal plate by means of two permanent magnets on the rear side of the *HMI*. The optional metal plate is available in two variations: with mounting holes or with self-adhesive back.



### CAUTION

**Bruising of fingers due to sudden appearance of attraction forces of the permanent magnets possible.**

When attaching the *HMI* control unit to the metal plate or the ferromagnetic surface, the magnetic forces of the permanent magnets may cause sudden attraction of the *HMI* control unit to the surface.

- ▶ Be careful when attaching the *HMI* control unit to the metal plate or the ferromagnetic surface.
- ▶ Hold the *HMI* control unit at its side walls in a way that the fingers cannot get under the magnets or under the back wall of the *HMI* control unit when attaching the control unit.

#### Mounting with metal plate (with mounting holes)

Proceed as follows to mount the *HMI* control unit using the metal plate:

- ▶ Mount the metal plate to the wall using four screws.
- ▶ Attach the *HMI* control unit onto the metal plate with the help of the magnets on the back wall of the *HMI* control unit.

The screw heads of the mounting screws engage in the holes on the back wall of the *HMI* control unit and thus provide additional locking of the *HMI*.

#### Mounting with metal plate (with self-adhesive back)

Proceed as follows to mount the *HMI* control unit using the self-adhesive metal plate:

- ▶ Clean the surface to which the metal plate should be stucked on. It must be free from dust and grease.
- ▶ Remove the foil on the glued side of the metal plate.
- ▶ Press the metal plate with the glued side facing down on the cleaned surface.
- ▶ The metal plate must not be stressed for at least four hours after fixing it.
- ▶ Then, attach the *HMI* control unit onto the metal plate with the help of the magnets on the back wall of the *HMI* control unit.

Figure 11:  
Dimensions of the  
HMI control unit and the  
metal plate



## 5.4 Installing the cabling

**Note:** The pin assignments of the various connection cables can be found in chapter 3 on page 9.

### 5.4.1 Factory-assembled connection cables

We recommend to always use the supplied factory-assembled connection cables delivered by KW-Generator GmbH & Co. KG. These cables have been selected according to the special requirements of the described systems and passed extensive tests. Therefore, they provide the best possible conditions for an operation free of errors or malfunctions.

The HMI <-> joystick cable and the HMI <-> GEMA generator cable as well as the cable for connecting the magnet plate (power cable) are pre-assembled and supplied with the corresponding connection plugs.

**Note:** If you do not want to use the supplied cables, please contact the service at KW-Generator GmbH & Co. KG.

#### NOTICE

**Too small conductor cross sections may cause damage of the connection cable to the magnet plate or performance loss of the magnet plate.**

- ▶ We recommend to always use the ready-made connection cables delivered by KW-Generator GmbH & Co. KG.
- ▶ When using other connection cables, make sure that the required conductor cross section is met. Please refer to section 3.7 on page 23.

### 5.4.2 Regulations for the installation of connection cables

According to the applicable mechanical requirements, the connection cables must be sufficiently fixed and provided with a suitable pull relief, if necessary.

- ▶ Never run cables across edges without applying suitable measures against mechanical damage or with direct mechanical contact to the edge.
- ▶ The total length of the connection cable between the generator and the magnet plate must not exceed 30 m. If longer connection cables are required, the conductor cross section must be adapted accordingly. In this case, please contact the service at KW-Generator GmbH & Co. KG.

## 5.5 Installing the *GEMA* generator

Proceed according to the descriptions given in this section for installing the *GEMA* generator.

Read the safety precautions listed in chapter "Safety precautions" on page 7 prior to installation.

### 5.5.1 Requirements to be met at the installation location

In principle, the *GEMA* generator can be mounted at any suitable location, for example, in the engine compartment of the excavator or at a power unit. The *GEMA* generator is splash-proof according to IP54 specifications and can therefore as well be mounted on the outside of a vehicle.

The generator should preferably be installed in a way that it cannot be exposed to the jet of high pressure cleaners.

The direction of rotation is not of importance for the functionality of the generator. It can be operated with right-hand as well as with left-hand direction of rotation.

The generator must be firmly and securely mounted on an absolutely flat base with a bearing capacity which is adequate to the generator weight. When using a belt drive, it is recommended to mount the generator adjustable. For that purpose, mounting rails can be used for example, providing the possibility of adjusting the belt tension.

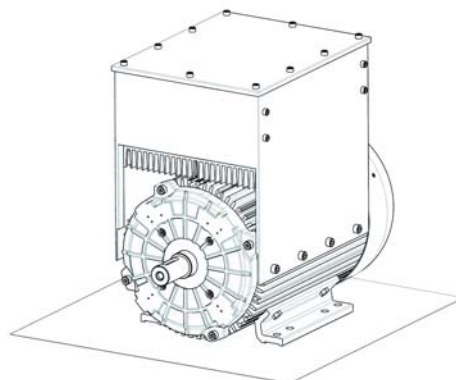
At the installation location, the required minimum clearances have to be observed, adequate ventilation has to be ensured at any time, and the temperature of the cooling air must not exceed 40 °C.

### 5.5.2 Mounting position and installation

The *GEMA* generator has to be mounted on a horizontal area standing on its generator bases, as shown in the accompanying figure.

If the generator is mounted in the normal mounting position, the attached control electronics is located on the top of the generator. On customer request, the control electronics can be mounted on the generator turned by 90°.

**Any other mounting position is forbidden!**



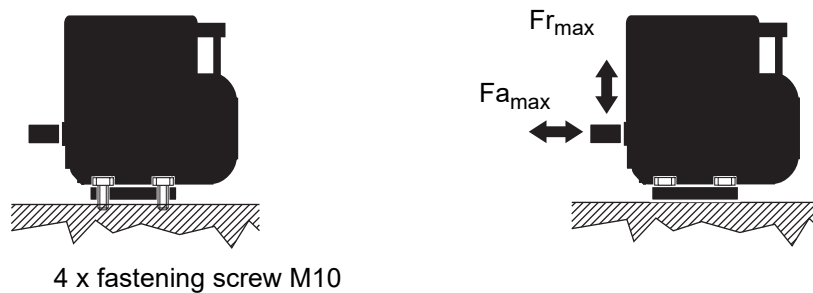
The following table gives an overview on the tightening torques (in Nm) for individual mounting purposes:

Table 7:  
Tightening torques

Application	Tightening torque for thread size				
	M5	M6	M8	M10	M12
For low mechanical load, e.g., terminal plate, electrical connections	5 Nm	6 Nm	12 Nm	30 Nm	36 Nm
For normal mechanical load, e.g., cover of terminal box	5 Nm	8 Nm	14 Nm	24 Nm	39 Nm
For high mechanical load, e.g., generator base, flange	6.5 Nm	11 Nm	25 Nm	48 Nm	83 Nm

The generator must be mounted with four screws (at least M10). The fastening must be durable as well as shock and vibration resistant. The screws must be secured against self-acting unscrewing by suitable measures, e.g. a clamp ring according to DIN 128.

Figure 12:  
Installation of the generator



Tightening torque according to specification given in table 7 on page 29.

Permissible load on the shaft:

	$F_{r_{max}}$	$F_{a_{max}}$
GEMA 9/GEMA 15 (2-pole)	3500 N	175 N
GEMA 9/GEMA 15 (4-pole) and GEMA 20 (2/4-pole)	4000 N	200 N
GEMA 25/GEMA 30 (2/4-pole)	6500 N	325 N

**Note:** The mentioned maximum radial load on the shaft ( $F_{r_{max}}$ ) relates to the middle of the shaft end.

### NOTICE

**Damage to the generator, the engine or the adapter (coupling) possible.**

Inaccurate alignment may result in vibrations, bearing damages, damages to the engine, damages to the adapter (coupling) and unwanted noise.

- ▶ Ensure a correct alignment of the generator towards the engine.
- ▶ Perform the alignment with great care and check it after completing the installation.

For single-bearing generators, the dimensions of the coupling housing/coupling flange and flywheel/shaft cone of the engine have to be checked. Additionally,

the dimensions of the flange and the coupling disc/shaft cone of the generator have to be checked.

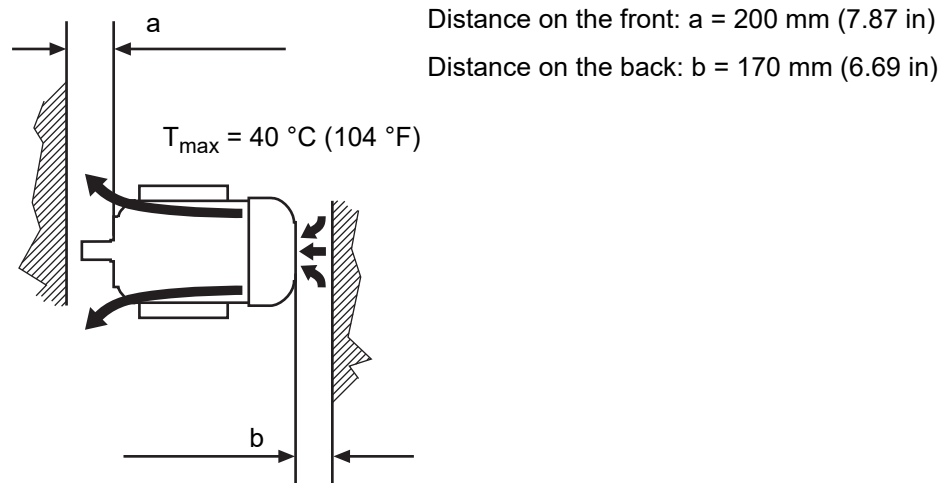
During installation, the minimum distances and regulations for cooling given in the following section must be met. The dimensions of the individual GEMA generators can be found in the technical data section (see 3.7 on page 23).

### 5.5.3 Minimum distances and cooling

In order to provide sufficient cooling, the GEMA generator needs sufficient air ventilation. The cooling air is sucked in from the rear side by the fan impeller and then blown to the front side through the cooling profiles along the housing. Adequate openings for cooling air inlet and outlet must be provided.

The following minimum distances towards parts or walls have to be observed:

Figure 13:  
Minimum distances and cooling



It is absolutely important to observe the following regulations for cooling. Risk of overheating!

The temperature of the supplied cooling air must not exceed 40 °C. If this temperature threshold is exceeded, the output power of the system is automatically reduced continuously.

Cooling air circulation must not be impaired by other air flows (e.g. directed from the side or from the front to the generator).

## 5.5.4 Installation of the belt pulley



### WARNING

**Death or severe injury due to contact with moving components possible.**

- ▶ Never touch a running belt or a rotating belt pulley.
- ▶ Never operate the *GEMA* system without suitable protective covers for the belt or the belt pulley.
- ▶ Always mount the protective covers prior to commissioning.

The belt pulley must be installed according to the specifications of the belt pulley manufacturer.

To prevent the belt pulley from twisting, it is protected on the shaft by a feathered key. The belt pulley is fastened by a screw to the front end of the shaft. This screw has to be protected against accidental loosening using a suitable lock washer.

Figure 14:  
Installation of the belt  
pulley



Threaded hole in the shaft:  
DIN 332-DS

Tightening torque:  
see table 7 on page 29

Additionally, the following notes must be observed when installing a *GEMA* system with belt drive:

- ▶ The belt pulley must be put on the drive shaft as far as possible.
- ▶ The axis of the driving shaft must be absolutely parallel to the shaft of the *GEMA* generator.
- ▶ The belt pulleys on both shafts must be flush to each other so that the belt runs absolutely straight.
- ▶ The maximum radial forces must be observed when using a belt drive.

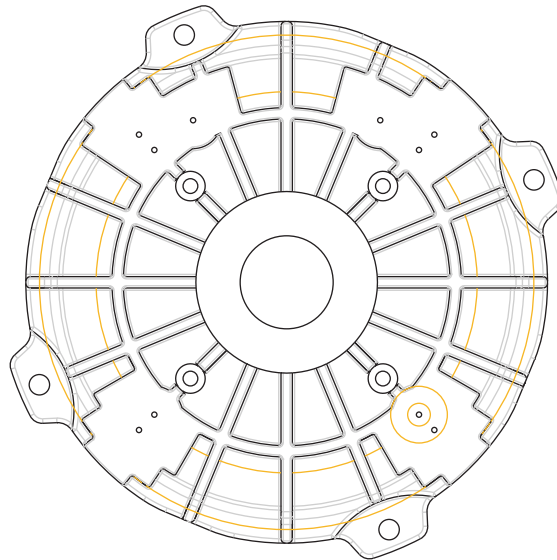
### 5.5.5 Drive types and flanges

The generator can be driven in different ways. For particular drive types, special flanges must be mounted at the generator. The available flange types are described below. If you have any questions about the flanges or special drive types, please contact KW-Generator GmbH & Co. KG.

#### V-belt drive

The most often used drive type is the belt drive. The generator is mechanically connected to the engine via a belt pulley and a belt. The belt drive is a particularly simple, inexpensive and effective type of drive. Moreover, it offers the advantage that the speeds of the engine and the generator can be optimally balanced by selecting the transmission ratio. By default, the flange for using a V-belt drive is installed on the generator. This flange can also be used for cardan drives and coupling drives.

Figure 15:  
Standard flange for  
V-belt, cardan and  
coupling drives

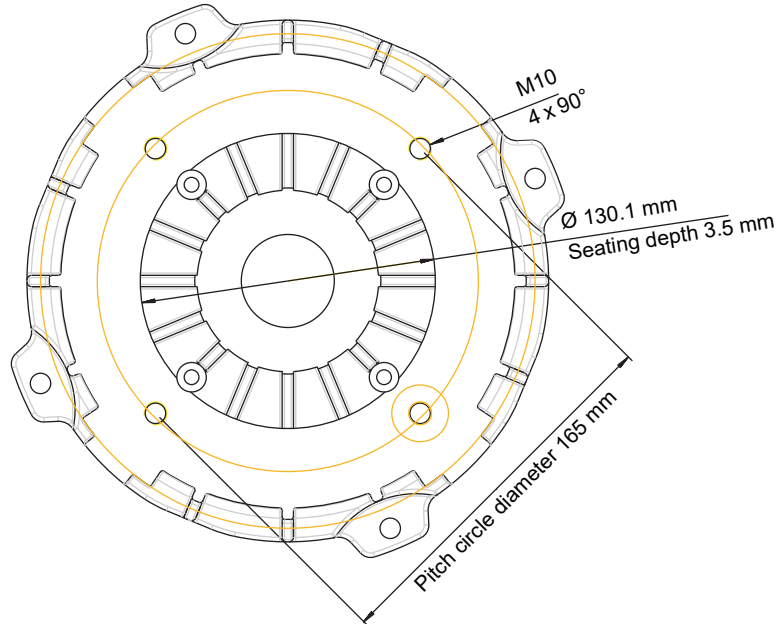




### Hydraulic drive / Europe

When using a hydraulic drive, the generator is driven by a hydraulic motor which is supplied by the hydraulic system of the vehicle.

Figure 16:  
Flange for hydraulic and  
gear drives



#### NOTICE

##### Generator damage due to penetration of water possible.

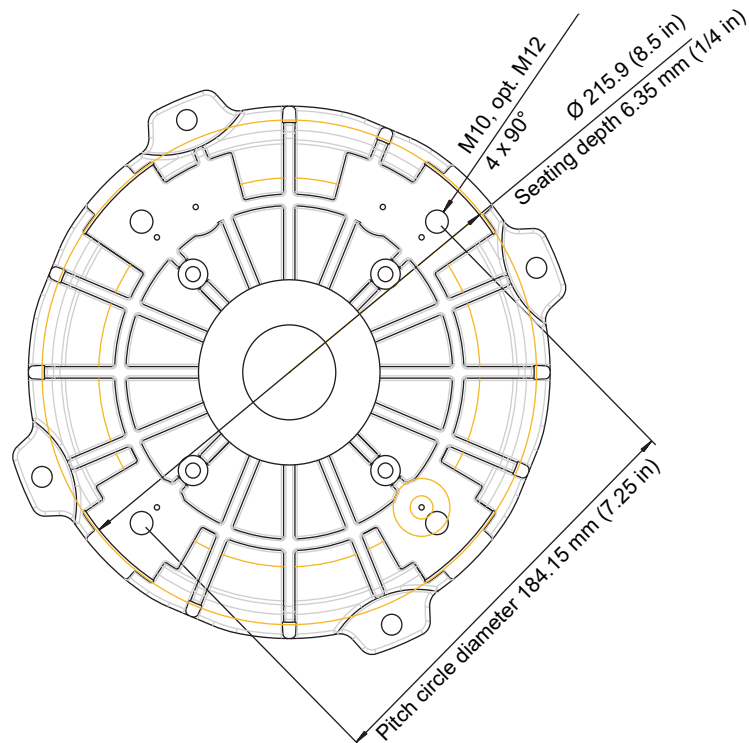
- Close all M10 threaded holes (see figure 16) that are not used for installation with sealing screws.

**Drive by direct flange mounting / hydraulic drive USA**

Using direct flange mounting, the shafts of the generator and the engine are connected by a standard "SAE" housing. Similar to the direct drive, this type also requires the engine to have an appropriate speed rating, because otherwise the generator is operated at underspeed or overspeed which may restrict the functionality of the system.

**Note:** Appropriate "SAE" housings are available as accessory. Please contact the service of KW-Generator GmbH & Co. KG.

Figure 17:  
Flange for standard  
USA and SAE housings



**NOTICE**

**Generator damage due to penetration of water possible.**

- ▶ Close all M10 threaded holes (see figure 17) that are not used for installation with sealing screws.

## 5.6 Commissioning

Perform the following checks before putting the *GEMA* system into operation for the first time. Any deficiencies found must be corrected before starting the system.

Read the safety precautions listed in chapter 2 on page 7 prior to commissioning.

1. Make sure that the *GEMA* generator is mounted correctly and firmly (see section 5.5).
2. Make sure that all protective covers of the generator drive and the drive itself are mounted correctly.
3. Make sure that all connecting cables are laid correctly and protected against damage in accordance with the mechanical requirements (see section 5.4).
4. Make sure that all connectors at the *GEMA* controller box as well as at the *HMI* control unit are properly inserted and locked.
5. Make sure that the connection cable between the *HMI* control unit and the joystick is properly inserted and locked.
6. Make sure that the *HMI* control unit is mounted properly within the field of view of the operator (see section 5.3).
7. Make sure that all safety measures for starting the engine (e.g. excavator, power unit, hydraulic unit) are met according to the applicable regulations.
8. Start the engine and wait until it has reached its rated speed intended for operation of the *GEMA* generator.
9. Compare the speed displayed on the *HMI* control unit with the permissible speed range (see section 3.7 on page 23).

**Note:** If the speed range displayed on the *HMI* control unit deviates from the permissible speed range of the generator, either the transmission ratio of the belt drive or the speed of the engine or the hydraulic drive must be adapted.

If the generator speed lies within the recommended speed range, you can start working. In this case, the *HMI* control unit displays the speed in white color. The displayed speed changes from white to yellow as soon as the recommended speed range is exceeded or underrun. Operating the *GEMA* system is described in chapter 6 on page 36.

**Note:** After commissioning, please fill in the installation and acceptance report on page 50.

In addition to the work described here, the installation has to be verified according to the guidelines and regulations of the driving system/engine manufacturer. This includes the correct attachment of protective covers. Correct execution of these works is under the responsibility of the person responsible for the entire facility.

## 6 Operation

Thanks to the fast magnetization and demagnetization cycles, the *GEMA* system offers maximum efficiency in material handling. Nevertheless, it can take several seconds before magnetization is complete in case of large magnet plates.

To achieve maximum efficiency when working with the *GEMA* system, you should only switch on the magnet plate after you have put it down on the material to be lifted. Do not switch on the magnet plate when it is still in the air. This way, a faster load lifting is possible (due to the high-speed magnetization with impulse excitation as it is used with the *GEMA* system).

Further information on the different operation modes and the behavior when switching the magnet plate on and off can be found in section 3.3 on page 10.

Read and understand the safety precautions listed in chapter 2 on page 7 prior to operating the system.

### **WARNING**

**Death or severe injury by metal parts attracted by or dropping from the magnet plate possible.**

- ▶ An energized magnet plate suspended in the air can attract or drop material inadvertently. Never switch on the magnet plate unless you need it for your work.
- ▶ The presence of persons within the swivel/work area of the magnet plate is prohibited.

### **WARNING**

**Death or severe injury due to contact with moving components possible.**

- ▶ Never operate the *GEMA* system without suitable protective covers for the drive.

### **WARNING**

**Death or severe injury due to failure of cardiac pacemakers possible.**

The magnetic fields of energized magnet plates and the permanent magnets used to mount the *HMI* control unit may affect the correct function of cardiac pacemakers.

- ▶ Persons with cardiac pacemaker must always keep sufficient safety distance to the magnet plate and the *HMI* control unit.

### **WARNING**

**Death or severe injury or damage to connectors by electric arcs possible.**

Disconnecting or plugging in connectors under load can cause electric arcs, and thus lead to burns, electric shock or damage of the connector contacts.

- ▶ Never plug in or disconnect connectors during operation.

## NOTICE

### Damage to the system by overheating possible.

- ▶ The *GEMA* system may only be operated under the ambient and cooling conditions specified in section 5.5.3 on page 30 as well as under knowledge of the technical data (see section 3.7 on page 23).

## 6.1 Switching the system on

Proceed as follows, to switch the *GEMA* system on:

1. Start the engine and wait until it has reached its rated speed intended for operation of the *GEMA* generator.
2. You can start working as soon as "CAN active" is displayed on the *HMI* control unit (see figure 4 on page 13, no. 2). Continue with section 6.2 which describes how to perform the self-test of the integrated insulation monitoring function (option).

## 6.2 Self-test of the insulation monitoring function (option)

The self-test checks whether the integrated insulation monitoring function is working correctly. Precondition: The generator must be driven.

**Note:** During the self-test for the insulation monitoring function, operation of the *HMI* control unit is only possible to a limited extent.

Proceed as follows to perform a self-test:

1. On the *HMI* control unit, press the **Nav** button in the main page of the software user interface. The navigation page is displayed.
2. Press the **System** button in the navigation page of the *HMI* control unit. The system page is displayed.
3. This page shows the resistance value currently determined by the insulation monitoring ("ISO value") and indicates whether the insulation test is currently running or not ("ISO test").
4. Press the **ISO-Test** button. The self-test starts. For the duration of the self-test, "ISO test" displays 1.
5. In the controller box, a test resistance is automatically activated, which is used to measure the value of the insulation resistance (nominal value: 23 k $\Omega$ ).
6. Check the "ISO value" field whether the measured resistance shown on the display is within the permitted range of 18 k $\Omega$  up to 28 k $\Omega$ . If this is the case, you can continue with the next step.  

If the resistance value exceeds or underruns the permitted value range, switch off the system immediately and contact the service at KW-Generator GmbH & Co. KG.
7. Press the **ESC** button to exit the system page.
8. Press the **ESC** button to exit the navigation page.
9. The *HMI* control unit now displays the main page again.
10. Choose a program, see section 6.3 on page 38.

## 6.3 Programs and their function

This section gives an overview on the preset programs and their functions. The programs have been created and optimized by KW-Generator GmbH & Co. KG and can be used for automatic sorting or for quick and clean working with different materials, for example.

Table 8:  
Overview of available programs

No.	Name	Properties	Application
1	Normal 40	<ul style="list-style-type: none"> <li>• Normal mode</li> <li>• Quick magnetization with boost voltage</li> <li>• Demagnetization with 40 % reverse magnetization</li> </ul>	Big or heavy materials
2	Normal 50	<ul style="list-style-type: none"> <li>• Normal mode</li> <li>• Quick magnetization with boost voltage</li> <li>• Demagnetization with 50 % reverse magnetization</li> </ul>	Medium-sized or medium-weight materials
3	Normal 60	<ul style="list-style-type: none"> <li>• Normal mode</li> <li>• Quick magnetization with boost voltage</li> <li>• Demagnetization with 60 % reverse magnetization</li> </ul>	Small or lightweight materials
5	TIPP II	<ul style="list-style-type: none"> <li>• Inching mode</li> <li>• Magnetization without boost voltage</li> <li>• Demagnetization without reverse magnetization</li> </ul>	Variable use for manual sorting The magnet current is defined by the duration of inching
6	Normal	<ul style="list-style-type: none"> <li>• Normal mode</li> <li>• Quick magnetization with boost voltage</li> <li>• Demagnetization with one-time reverse magnetization</li> </ul>	Very big or very heavy materials with highest working speed

### 6.3.1 Selecting a program

**Note:** An overview on the indicators and operating elements is contained in section 3.4.2 on page 13.

Proceed as follows to select a program:

1. Switch-off the magnet plate by pressing the **Mag.** key on the *HMI* control unit or the corresponding button on the joystick. The magnet plate status indication must display "OFF".
2. Press the **Program** key repeatedly until the desired program is displayed in the touch display.

The selected program is automatically activated a short time after releasing the **Program** button (indicated by the program number and program symbol displayed).

**Note:** After Program 6, Program 1 is displayed again automatically.

## 6.4 Operation in normal mode

### 6.4.1 Switching the magnet plate on and off

#### Normal mode

In normal mode, the magnet plate is energized by pressing the **Mag.** button briefly. Pressing the **Mag.** button again de-energizes the magnet plate.

#### Inching mode

In inching mode, the magnet plate is energized as long as you keep the **Mag.** button pressed. Releasing the button de-energizes the magnet plate immediately.

### 6.4.2 Changing the magnet voltage

In normal mode, the magnet voltage can be changed temporarily during operation in steps of 5 V in the range of 130 V to 230 V. Press the plus button + to increase the magnet voltage and the minus button - to decrease the voltage accordingly.

**Note:** After a restart of the *GEMA* control system, the default value for the magnet voltage is automatically applied again.

## 6.5 Advanced features of the *HMI* control unit

In addition to the main page, the software user interface of the *HMI* control unit provides several other pages with more detailed information, such as history information about the *GEMA* controller or the integrated DVR generator governor, or parameter settings. Please refer to document "KWG-3HMI User Manual" for more detailed information about these pages.

#### NOTICE

**Using programming functions may cause accidental changes on the preset programs.**

Changes performed in programming mode affect all preset programs.

► Be careful when using the programming functionality.

## 6.6 Integrated protection functions of the *GEMA* system

This section describes the internal protection functions of the *GEMA* system.

### 6.6.1 Underspeed/overspeed of the engine

The *GEMA* system provides a protection function to protect the generator from damages if the engine speed exceeds the permissible speed range. In case of underspeed or overspeed, the output power of the system is automatically reduced continuously. The *HMI* control unit indicates this by changing the color of the displayed speed value from white to yellow.

#### NOTICE

##### **Damage to the generator caused by overspeed possible.**

In case of overspeed, the integrated protection function is only able to protect the *GEMA* system electrically. The protection function does not provide protection against mechanical damages of the generator if the mechanical load limit is exceeded due to extremely high speed.

- ▶ Ensure that the engine speed does not significantly exceed the permissible range. Further information about the permissible speed range can be found in section 3.7 on page 23.

### 6.6.2 Short circuit in the magnet plate or the power cable

In case of a short circuit, the *GEMA* generator is switched off immediately. The *HMI* control unit then displays "Error: external SC" in red. This state remains until the *GEMA* system is restarted (see section 6.7 on page 42).

#### **WARNING**

##### **Death or severe injury or damage to connectors by electric arcs possible.**

Disconnecting or plugging in connectors under load can cause electric arcs, and thus lead to burns, electric shock or damage of the connector contacts.

- ▶ Never plug in or disconnect connectors during operation.

#### **CAUTION**

##### **Burns due to contact with system components possible.**

During and after operation, some components of the *GEMA* system may be very hot.

- ▶ Be careful.
- ▶ Wear protective gloves and wait until the components have cooled down, if applicable.

For localization of a short circuit, proceed as follows:

1. Stop the engine and wait until the touch display of the *HMI* control unit is completely off.
2. Disconnect the power cable plug at the *GEMA* generator while the engine is **switched off**.



3. Start the engine and switch-on the magnet plate.
  - ▶ If the error message is still displayed on the *HMI* control unit even though the power cable is disconnected, the control electronics of the *GEMA* system is defective. In this case, please contact KW-Generator GmbH & Co. KG.
  - ▶ If the "Warn. magnet plate open" message is displayed on the *HMI* control unit while the power cable is disconnected, the cause of the short circuit must be in the power cable or at the magnet plate. In this case, continue with step 4.
4. Search and repair the cause of the short circuit.
5. Plug in the power cable at the *GEMA* generator and start the engine afterwards.
6. Make sure that no error message is displayed on the *HMI* control unit.

### 6.6.3 Interruption in the magnet plate or the power cable

The *GEMA* system switches off automatically if an interruption of the power cable is detected after switching the magnet on. The *HMI* control unit then displays "Warn. magnet plate open" in yellow.

An interruption may be caused by a defect in the power cable or at the magnet plate, or by a plug-in connection that is not locked correctly. This error message is also displayed if the system is operated without a magnet plate connected.

To reset the error message, the **Mag.** button must be pressed.

### 6.6.4 Overtemperature

Cooling of the controller electronics and the generator is done by the generator fan. If the fan is defective, the air intake is blocked or the ambient temperature is too high, the system is protected against overheating by means of two different protection functions.

- Measurement of the generator temperature: In case of a too high temperature at the generator, the controller automatically reduces the output power continuously. The output power is automatically available again after cooling down.
- Measurement of the electronics temperature: In case of an overtemperature inside the controller box, the generator output is automatically switched off. The *HMI* control unit then displays "Error overtemp." in red. After cooling down, the error message is reset and the system is ready for operation again.

**Note:** In case of a temperature rise inside the controller box, the "Warn: Controller overtemp." message is displayed on the *HMI* control unit before the temperature reaches the switch-off limit. If the temperature continues to rise, the output is switched-off after a rise of another 10 °C.

## 6.6.5 Ground fault/insulation fault

The *GEMA* system is protected against ground faults of the power cable and the magnet plate (for example, caused by an age-related breakdown of windings).



### WARNING

**Death or severe injury by electric shock possible.**

- ▶ In case of a ground fault, an insulation failure occurs and the protective measure "electrical separation" is suspended. In such a case, the *GEMA* system must no longer be used.

## 6.6.6 Multiple faults in the load circuit

In case of a simultaneous occurrence of an insulation fault and an interruption in the power cable, very high voltages may occur, which are able to destroy the control electronics, the electrical connectors or the magnet.

The optional *Yellow Box* prevents damage to these components by limiting the voltage arising in case of such errors and immediately switching off the *GEMA* system.

For further information, please contact KW-Generator GmbH & Co. KG.

The status of the *Yellow Box* is displayed on the *HMI* control unit (see figure 4 on page 13, no. 10 in the figure).

## 6.7 Restart (reset) of the *GEMA* control system

In some cases a restart (reset) of the *GEMA* control system may be required (for example, in case of a short circuit in the power cable).

Proceed as follows to restart the system:

1. Stop the engine and wait until the touch display of the *HMI* control unit is completely off.
2. Restart the engine afterwards and wait until the "CAN active" state is displayed on the *HMI* control unit (see figure 4 on page 13, no. 2 in the figure). The system is then ready for operation.

## 7 Maintenance

In principle, all components of the *GEMA* system are maintenance-free. Nevertheless, the operations described in this chapter must be performed at regular intervals to ensure reliable operation of the system.

In addition to the work described here, the installation has to be verified according to the guidelines and regulations of the driving system/engine manufacturer. This includes the correct attachment of protective covers. Correct execution of these works is under the responsibility of the person responsible for the entire facility.

Any damages and defects found on the *GEMA* system must be repaired and/or corrected immediately. It is only allowed to put the system into operation after any defects have been removed.

Maintenance and repair work on the *GEMA* system may only be performed by authorized and qualified personnel.

Read and understand the safety precautions listed in chapter 2 on page 7 prior to performing any maintenance work on the *GEMA* system.

### **WARNING**

**Death or severe injury by electric shock possible.**

- ▶ Visual inspections for maintenance purposes and cleaning work on the *GEMA* system must never be performed during operation.
- ▶ Always turn off the engine first and make sure that it cannot be restarted accidentally (e.g. by removing the ignition key and keeping it safe).

### **CAUTION**

**Burns due to contact with system components possible.**

During and after operation, some components of the *GEMA* system may be very hot.

- ▶ Be careful.
- ▶ Wear protective gloves and wait until the components have cooled down, if applicable.

### **NOTICE**

**Damage to system components possible.**

- ▶ Both generator and controller box do not contain any components that can be replaced or repaired by the user. It is not allowed to perform any work or operations not described in this manual.
- ▶ Do not open or disassemble the generator or the controller box. The generator and the controller box may only be opened by the manufacturer or an agency authorized by the manufacturer.

### **NOTICE**

**Damage of system components due to penetration of water possible.**

- ▶ The *GEMA* system components must never be exposed to the jet of high-pressure cleaners.

## 7.1 Maintenance schedule

The following maintenance works must be performed in time by the appropriate persons.

Table 9:  
Maintenance schedule

Interval	Maintenance work	Person
Every working day	<ul style="list-style-type: none"> <li>• Check the generator for abnormal/unusual noise by "listening".</li> <li>• Check insulation monitoring (option) for correct function (see section 6.2 on page 37).</li> <li>• Visual inspection of the power cable for defects especially nearby the magnet plate.</li> </ul>	Operator
Weekly	<ul style="list-style-type: none"> <li>• Visual inspection for contamination or damages. Cleaning if necessary.</li> <li>• Check the cooling air openings for contamination or blocking and clean them, if necessary.</li> </ul>	Operator
Every 5000 hours of operation	Check ball bearings by "listening" and replace as necessary (in case of abnormal noise).	Qualified skilled person

## 8 Troubleshooting

Table 10:  
Typical error causes  
and remedies

Failure	Possible reason	Remedy
Generator is noisy	Foreign object inside fan cover.	Remove foreign object.
	Ball bearing is defective.	Ask skilled person to check ball bearing.
	Engine does not work correctly.	Renew V-belt or adjust belt to correct tractive force.  Check engine for running noise.
Mechanical damage at the generator.	Damages detected at the generator during maintenance works.	Contact KW-Generator GmbH & Co. KG and take picture of damage, if necessary. Until clarified, take generator out of operation to avoid further damages.
The display of the <i>HMI</i> control unit is without function.	Generator does not rotate.	Start engine.
	Generator cable or <i>HMI</i> cable is not plugged-in.	Plug in the cable.
	<i>HMI</i> cable is defective.	Replace the cable.
	<i>HMI</i> control unit is defective.	Replace the control unit.
<i>HMI</i> control unit displays "CAN active" message. Joystick is without function.	Connection cable or joystick is defective.	Check whether the system can be operated by pressing the <b>Mag.</b> button on the <i>HMI</i> control unit. If so, check or replace the connection cable to the joystick.
<i>HMI</i> control unit displays "Warn. magnet plate open" message.	Interruption in power cable or magnet plate.	Check connection cable and magnet plate for interruption and repair it, if possible.
<i>HMI</i> control unit displays "Error: overtemp" message.	Generator has been switched off by controller due to overtemperature.	Switch off the system. Wait until the generator has cooled down.
<i>HMI</i> control unit displays "YB trig" message.	The <i>Yellow Box</i> tripped due to a multiple fault.	Switch off the system. Repair the insulation fault and the interruption.
<i>HMI</i> control unit displays "Error: overvoltage" message.	Permanent overspeed of the generator or short-term peak speed above the permitted speed range.	Check the speed.
		Check the belt transmission ratio.
		Check the speed of the engine.
		Check the hydraulic circuit.

Failure	Possible reason	Remedy
System works but has not enough power. The magnet voltage is below the adjusted target value.	Engine speed is outside the valid speed range (most frequent cause).	Check engine.
	Setting for magnet voltage, power or torque to low.	Check the settings for the target values and correct, if necessary.
	Generator is too hot.	Wait until the generator has cooled down.
	Magnet plate has interturn fault.	Magnet plate current displayed on the <i>HMI</i> control unit is higher than the nominal value specified on the type plate of the magnet plate. Replace the magnet plate.
	Magnet is very hot.	Magnet plate current displayed on the <i>HMI</i> control unit is significantly lower than the nominal value specified on the type plate of the magnet plate. Replace the magnet plate.
System runs but the power is unsteady.	For belt drive systems: belt slipping.	Check and correct belt tension, if necessary.
	For hydraulic drive systems: the hydraulic motor is not capable to hold the speed (most frequent cause).	Check the hydraulic circuit.

For further troubleshooting instructions, please contact KW-Generator GmbH & Co. KG and/or request the corresponding documents there.

## 9 Reconditioning

Users cannot perform any repair or reconditioning work on the components of the *GEMA* system. Such work may only be performed by duly authorized and adequately qualified personnel. We strongly recommend to remove the *GEMA* system and to send it to KW-Generator GmbH & Co. KG.

The safety precautions listed in chapter 2 on page 7 apply for performing reconditioning work on the *GEMA* system.

## 10 Disconnection, deinstallation, disposal

Disconnection and deinstallation of the *GEMA* system has to be performed in accordance with the descriptions in chapter 5 on page 25.

*GEMA* systems which are still functional have to be packed and stored as described in chapter 4 on page 24.

Generator systems which are no longer functional have to be disposed or supplied for recycling in accordance with the legal requirements. Engage a disposal company, if necessary. For more detailed information refer to the relevant environmental protection authority or to KW-Generator GmbH & Co. KG.

Table 11:  
Waste disposal  
information

Designation	Material
<i>GEMA</i> generator housing	Aluminum
Fan cover	Iron/steel
Fan impeller	Polypropylene
Rotor and shaft	Iron/steel
Windings and insulation	Copper, cured impregnation resins
Printed circuit board and electronic components	Electronics scrap
<i>HMI</i> housing	ASA (acrylonitrile-styrene-acrylate copolymer)



## 11 Spare parts

A large number of possible variations is available for the system. Therefore, please directly contact KW-Generator GmbH & Co. KG for spare parts.

# 12 Installation and acceptance report

The installation of the *GEMA* system and the verification of its correct function must be confirmed by the responsible person by completely filling in the installation and acceptance report on this page.

**Installation place:**     Excavator     Aggregate     Magnet plate  
 Others:

**Manufacturer:**

**Type:**

**Installed system:**     GEMA 9/2     GEMA 9/4     GEMA 15/2     GEMA 15/4  
 GEMA 20/2     GEMA 20/4     GEMA 25/4     GEMA 30/2  
 GEMA 30/4     Others:

**Peculiarities of design:**

**Serial numbers:**    GEMA generator:  
                                  GEMA controller box:  
                                  HMI:

**Program version:**    Generator governor:  
                                  GEMA control electronics:  
                                  HMI:

**Yellow Box:**     Installed     Not installed

**Accessories** (e.g., cable sets, tension pulley, belt pulley):

**Installed magnet plate:**

Manufacturer:

Type:

Power:

Cable connector:

**HMI cable:**    Connector type:    Cable length:

**Power cable:**    Type:    Cross section:    Cable length:

**HMI version:**     Magnet on bottom  
 Magnet on the left     Magnet on the right

**Position of joystick connector:**

**Accessories:**     Metal plate for *HMI*    Position:

**Function test (conditions):**    Speed:    Power:  
    Voltage:    Current:

Installed by:

Function test by:

Acceptance by:

Remarks on installation and commissioning: