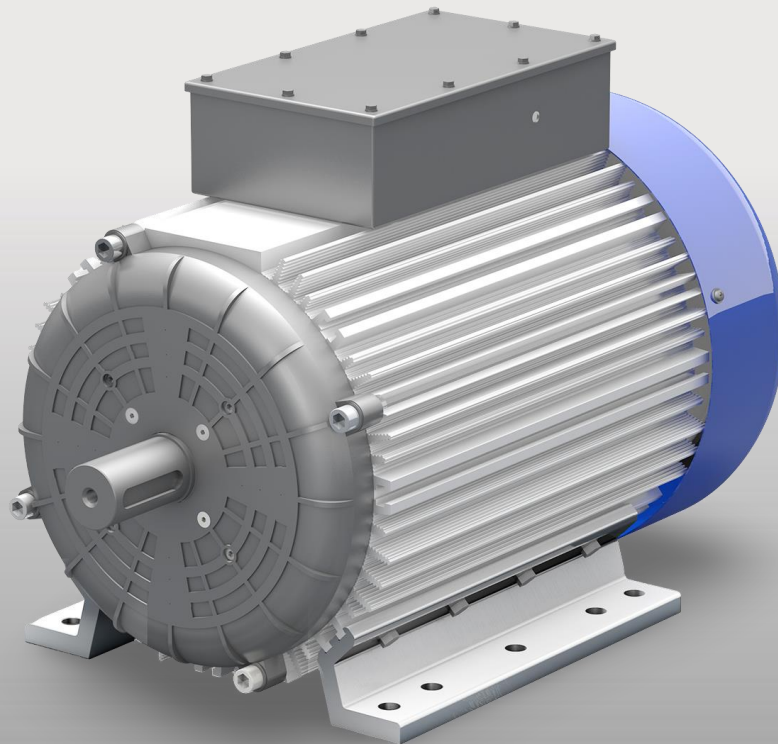


KW generators.
Powerful.
Innovative.

KWG synchronous generators
Size 132, 160, 200, 250, 280, 355



Imprint

Document type:	Operating instructions		
Document name:	KWG_Generator_Operating_Manual_V3-0_EN		
Version:	V3.0		
Language:	EN		
Number of pages:	48 Pages		
Created by:	Tim Kurz	Created on:	28.03.2024
Modified by:	Tim Kurz	Modified on:	10.06.2024

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Manufacturer address

KW-Generator GmbH
Bänglesäcker 24
73527 Schwäbisch Gmünd - Lindach
Phone +49 (0) 7171 104 17 - 0
Mail: info@kw-generator.com
Internet: www.kw-generator.com

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List of changes

Index	Modified by	Stand	Amendment
V23	Michael Kurz	01/2021	Modification: Error correction, troubleshooting adapted and BG355
V24	Michael Kurz	02/2022	Modification: Page 5 - Type key extended, Page 7 - Performance extended, Page 8 - Table updated, Page 9 - Text for terminal box extended, Page 11 - Text for tightening torque extended, Page 12 - Text for current load changed.
V25	Tim Kurz	11/2023	BG280 added
V3.0	Tim Kurz	06/2024	New layout; adaptation of texts. New versioning

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2 FOREWORD AND GENERAL INFORMATION

2.1 About these operating instructions


These operating instructions refer to the generators of the KWG-.... brushless synchronous generator series size 132, 160, 200, 250, 280, 355 and are intended to familiarize you with these generators and their intended use and to install and operate them safely, properly and efficiently.


Observing the instructions given in this operating manual helps to avoid hazards, repair costs and downtime caused by incorrect installation or operation. It also ensures high reliability and a long service life of the generator.

Keep the instructions for the generator accessible to personnel at all times at the place of use until the product is disposed of.


The persons responsible for the installation, maintenance and servicing of the generator must have read and understood this manual before installing and commissioning the system and must follow the instructions given in it. Follow the  chapter "3 Safety instructions".

Before operating the generator for the first time, operators must read and understand the following parts of the operating instructions and follow the instructions given therein:

 Chapter 2 "Foreword and general information" on page 8

 Chapter 3 "Safety instructions" on page 13

 Chapter 4 "Description" on page 19

 Chapter 6 "Functional description of the generator regulator" on page 29

 Chapter 7 "Installation and commissioning" on page 31

 Chapter 8 "Maintenance" on page 40

The generator may only be installed and used in compliance with all applicable national safety regulations and regulations on accident prevention and environmental protection.

We reserve the right to change the content of this documentation without prior notice. The illustrations do not necessarily correspond to the actual product.

The document is double-sided. The document must therefore be printed double-sided / duplex.

2.2 Display of warnings

For better differentiation, hazardous risks are identified in the instructions by the following warning signs and signal words.



DANGER

Disregarding such warnings can lead to serious injury or even death.



WARNING

Disregarding such warnings can lead to serious injury or even death.



CAUTION

Disregarding such warnings can lead to minor to moderate injuries.

ATTENTION



Indicates a potentially harmful situation that can lead to damage to the device or the surrounding area.

NOTE

This information provides you with additional advice and tips to make your work easier.

2.3 Presentation conventions

The following presentation conventions are used:

Name	Representation	Function
Instruction for action 1st level	1), 2) etc.	Prompts an action.
Instruction for action 2nd level	a), b) etc.	Designates a section in a sequence of actions.
Enumeration in safety instructions	➤	Indicates individual elements of the enumeration in safety instructions.
Enumeration	•	Indicates individual elements of the enumeration.
Emphasis	▪	Indicates important remarks.
Cross reference		Reference within this document to another chapter or to a more detailed document.
Figure reference/table		Reference to a figure or table.

2.4 Intended use of the generators

The generators are components of machines and systems intended for industrial and professional use and therefore cannot be treated as retail goods.

The generators may only be used in accordance with the information on the rating plate, the type-specific data sheet or a special approval. This relates primarily to the most important data, such as the rated speed, speed range, voltage, power and current as well as the protection class.

The generator outputs must be protected against overcurrent and short circuits by suitable fuse devices and must not be connected to other power distribution or power generation systems without express written permission.

Single-bearing generators are intended exclusively for mounting on an internal combustion engine that complies with the applicable standards, regulations and provisions.

Two-bearing generators are usually driven via belts, clutches or directly from the drive unit.

When using a belt drive, it is advisable to mount the generator in an adjustable manner, e.g. on rails. The belt tension must be adjusted accordingly. The max. radial force (☐ see Table 4) must not be exceeded.

KWG-Generator GmbH offers support for the design of the drive.

Unless otherwise specified, the generators and the attached parts have protection class IP54 and may be operated and stored outdoors.

The installation and operating location must be selected in such a way that a sufficient supply of fresh air to the inlet opening of the fan cover is always guaranteed. The rated output data of the generators is valid for intake and generator ambient temperatures < 40 °C and installation altitudes up to 1000 m above sea level. If the temperatures or installation altitudes are exceeded, a power derating applies as described below. Operation at temperatures > 60 °C is only permitted after special acceptance and approval.

For cleaning and maintenance, see ☐ chapter 8 "Maintenance" on page 40

2.4.1 Standards and regulations

The KWG generator systems comply with the DIN EN 60034 / VDE0530 regulations and are RoHS compliant.

2.5 Warranty

The generators may only be used for the applications specified here and only in accordance with the information in these operating instructions. KW-Generator GmbH accepts no liability for improper use or misuse of the generators or individual components.

No modifications may be made to the generators or individual components. Any modification, improper repair or use of unsuitable third-party parts will invalidate any warranty claims. The manufacturer accepts no liability in this case.

2.6 Guarantee

If no special guarantee arrangements have been concluded in writing for type-related applications and customers, we shall grant a guarantee in accordance with the general European provisions.

3 SAFETY INSTRUCTIONS

Always observe the safety instructions listed in this chapter when working with the generators. These are supplemented by additional specific warnings that only apply to certain actions and activities. These specific warnings are indicated at the relevant points in the manual and highlighted accordingly.



3.1 Qualification of staff

Installation, commissioning, operation, inspection, maintenance and repair work as well as the transport of the generators may only be carried out by authorized and qualified specialist personnel.

Qualified personnel are persons who, on the basis of their training, experience and instruction, as well as their knowledge of relevant standards, regulations, accident prevention regulations and operating conditions, have been authorized by the person responsible for the safety of the component/system to carry out the required activities and are able to recognize and avoid possible hazards.

3.2 General safety instructions and symbols attached to the system

The meaning of the warning symbols on the generator is explained below.

Labeling	Explanation
	<p>Warning of dangerous electrical voltage</p> <ul style="list-style-type: none">➤ means "Stop" in front of hazardous areas in which live parts are located;➤ Warning signs are used wherever there is no direct danger from electrical voltage.➤ Never touch the generator with wet hands during operation.
	<p>Warning of hot surfaces</p> <ul style="list-style-type: none">➤ Parts of the generator can be very hot during and after operation. Do not touch the generator during operation and allow it to cool down completely after use.

3.3 Safe operation - safety instructions

The following safety instructions must be observed when operating the generators.



DANGER

Non-compliance with warnings and safety instructions

Death or serious injury

- All safety and warning instructions must be followed!
- Before carrying out any work on the appliance, switch it off completely and secure it against unintentional restarting.
- The generators may only be operated with properly installed protective covers for the drive.
- Do not operate the generators in potentially explosive atmospheres.
- Never carry out visual inspections for maintenance purposes and cleaning work on the generators during operation.



CAUTION



Hot surfaces

Risk of burns

- Parts of the generator can be very hot during and after operation. Do not touch the generator during operation and allow it to cool down completely after use.

ATTENTION

Never expose the generators to jets from high-pressure cleaners. This could damage the appliance.

3.4 Safe operation - safety rules

The following safety instructions must be observed when installing and carrying out work on the generators.

3.4.1 Safety rules for working on electrical systems

Always follow the five safety rules for working on electrical systems when working on the generators:

- Unlock.
- Secure against restarting.
- Check that there is no voltage.
- Earthing and short-circuiting.
- Cover or block off neighboring live parts.

3.4.2 Safety instructions for installation, maintenance and repair



DANGER

Non-compliance with warnings and safety instructions

Death or serious injury

- All safety and warning instructions must be followed!
- Before carrying out any work on the appliance, switch it off completely and secure it against unintentional restarting.
- Work on electrical systems and generators may only be carried out by trained specialist personnel and in accordance with the applicable national regulations.
- Do not operate the generator in potentially explosive atmospheres.
- Never carry out visual inspections for maintenance purposes and cleaning work on the generators during operation.



DANGER



Dangerous electrical voltage

Death or serious injury due to electric shock

- Before working on the appliance, it must be disconnected from the power supply!
- Work on electrical systems and generators may only be carried out when they are switched off and de-energized. Switched-off drive units must be secured against unintentional restarting (including existing auxiliary circuits).
- Unauthorized persons, children and animals must not have access to the generator during and after operation.
- Earthing the neutral conductor of the generator (N, center conductor) cancels the protective measure "protective separation" and should therefore be avoided.
 - If earthing of the neutral conductor N is required, this may only be carried out by a qualified electrician in compliance with the regulations.
 - The effectiveness of the electrical protective measures must be confirmed by appropriate measurements.




WARNING



Rotating machine parts



Death or serious injury from being pulled in




- Before working on the appliance, it must be disconnected from the power supply!
- Work on electrical systems and generators may only be carried out when they are switched off and de-energized. Switched-off drive units must be secured against unintentional restarting (e.g. by removing and storing the ignition key).
- Have the generators turned off.
- Use personal protective equipment for long hair [see  chapter 3.1 "Personal protective equipment" on page 17] or a hair tie.

3.1 Personal protective equipment

Personal protective equipment is required and must be used for various activities on the device/system.

The specialist companies must provide sufficient protective equipment for their personnel and supervisors must check that it is worn.

Commandment sign	Meaning	Explanation
	Use eye protection M004	Eye protection must be used wherever biological, chemical, thermal, mechanical, optical or electrical hazards occur that can enter the eyes and damage them in a fraction of a second.
	Use foot protection M008	Safety shoes must be used wherever slippery floor coverings, falling or protruding sharp objects, obstacles of any kind, cold, wet, heat, aggressive liquids, dust and much more must be expected. Safety shoes in different categories offer acid-resistant, waterproof, nail penetration-resistant, slip-resistant or heat-resistant soles. Steel toecaps protect the toe area from broken bones, bruises and contusions.

Commandment sign	Meaning	Explanation
	Use hand protection M009	<p>Safety gloves must be used wherever injuries caused by stabs, cuts, burns or hypothermia as well as other harmful effects, such as substances that can permanently damage the skin and above all severely damage the hands.</p> <p>Under no circumstances should safety gloves be used when working on rotating parts such as drills etc.</p>
	Use protective clothing M010	<p>Protective clothing must be used wherever special work tasks have to be carried out in extreme working conditions and the body may be damaged.</p> <p>Depending on the design, they can protect the wearer from heat, cold, moisture, vapors, radiation, electrical energy, flames, sparks, flammable liquids and chemical substances.</p> <p>High visibility vests, on the other hand, help to ensure that you are not overlooked.</p>
	Use head protection M014	<p>A safety helmet must be worn wherever falling, swinging, toppling or flying objects are likely to hit your head and cause injury.</p> <p>Long hair can cause serious accidents if it is caught by machines or machine parts. Hoods, scarves, caps or close-meshed hairnets are therefore required in appropriate work areas.</p>

4 DESCRIPTION

4.1 General structure

The generators consist of an internal pole main machine with a salient pole rotor and an external pole exciter machine for transmitting the excitation power. A rotating rectifier set mounted on the exciter pole wheel is used to convert the current coming from the exciter pole wheel. The housing consists of the stator, the end shields, the extruded housing with the extruded feet and a cover to cover the fan wheel on the B side. The terminal box / cable conduit can be mounted at 90° or, depending on the type, at 45°. There are functional screw and fastening channels on the outside of the housing.

ATTENTION

The screw and fastening channels are only for mounting the generator feet, end shields and KWG accessories.

The channels may not be used for other attachments without written approval.

The encapsulated generator regulator is in the terminal box cover, but can also be mounted separately as an external component.

4.2 Type designations and serial numbers

Each generator has a unique type designation and individual serial numbers. These are described in the following chapter.

NOTE

Please have the relevant serial number and type designation of the generator in question to hand if you have any queries or wish to order spare parts.

4.2.1 Type plate on the generator

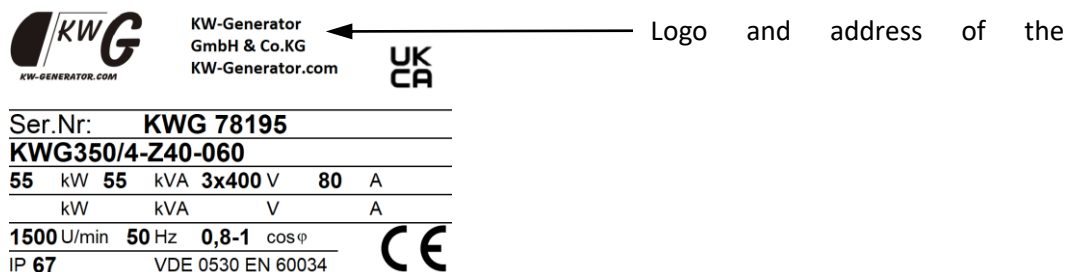


Illustration 1 Example of a generator nameplate

The serial number can look like this: **KWG2565**

KWG-175/4-Z10-011

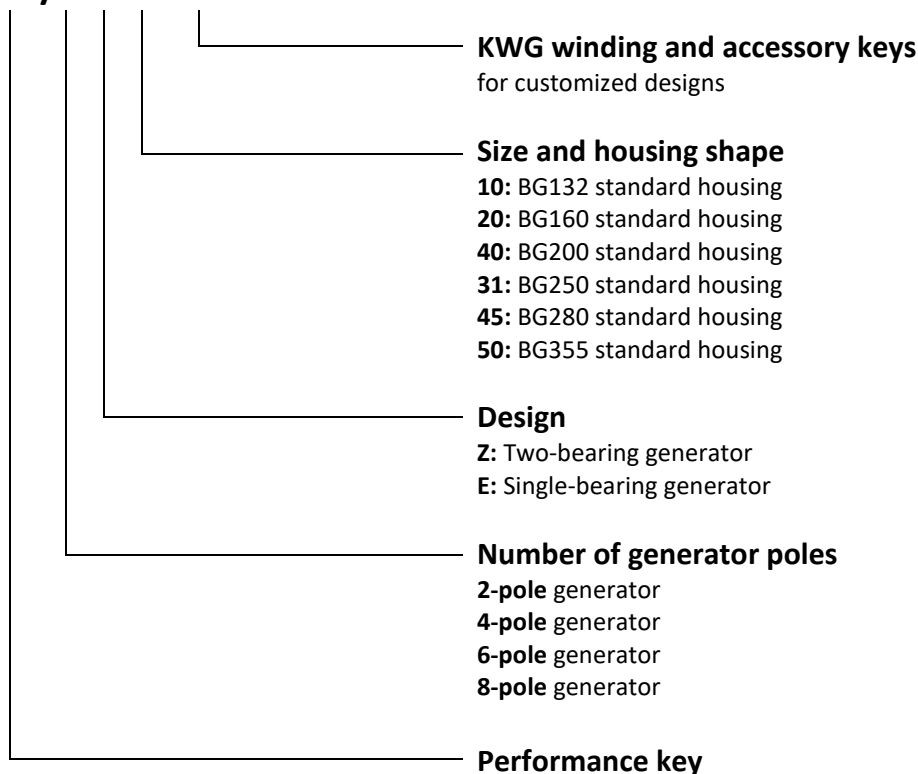


Table 1 Structure of the generator type designation (type code)

4.3 Technical data

In the following table you will find an overview of the available generators and their general technical data.

If no other data is listed in the type-specific data sheet, the data of Table 2 are valid.

	BG132	BG160	BG200	BG250	BG280	BG355
Number of poles	2					
	4					
	6					
	8					
Speed	3000 min ⁻¹ for 2-pole ¹⁾ 1500 min ⁻¹ with 4-pole ¹⁾ 1000 min ⁻¹ with 6-pole ¹⁾ 750 min ⁻¹ with 8 poles ¹⁾					
Overspeed	see DIN EN 60034 (IEC 60034)					
Voltages (50 Hz)	115, 230, 400 V ¹⁾					
Frequency	50 Hz / 60 Hz ¹⁾					
Power range (50 Hz)	up to 550 kVA ¹⁾					
Direction of rotation	Two-bearing version left/right-handed, single-bearing version right-handed only					
Power factor	cos ϕ = 0.8 - 1.0					
Efficiency (3-phase winding)	approx. 90% at 80% load ⁴⁾					
Efficiency (1-phase winding)	approx. 85% at 75% load ⁴⁾					
Unbalanced load	1/3 of the total rated load of the generator					
Coolant temperature	40 °C; can be used up to 60 °C with power reduction ¹⁾					
Protection class	IP 54 ²⁾					
Thermal class	F/H					
Air humidity	Continuous operation: 85% at 25 °C, short-term: 100% up to max. 35 °C ³⁾					
Weight (mass)	35 - 105 kg	130 - 210 kg	230 - 270 kg	300 - 500 kg	620 - 900 kg	800 - 1,800 kg

Table 2 Technical data

¹⁾ Deviating by agreement

²⁾ Higher degrees of protection by arrangement

³⁾ Ambient conditions for transportation and storage see Table 8

⁴⁾ Depending on type

4.3.1 Resistance values of standard 3-phase generators

	Main development Stator L1-N (Phase-N) [Ohm]	Main development Stator L1-L2 (phase- phase) [Ohm]	Main development Rotor 2F1-2F2 [Ohm]	Exciter winding Rotor (phase-phase) [Ohm]	Exciter winding Stator F1-F2 [Ohm]
KWG-090/2-x10-xxx	0,97	1,94	7,2	1,35	28
KWG-110/2-x10-xxx	0,69 (0,171)	1,39 (0,332)	7,65	1,35	28
KWG-145/2-x10-xxx	0,47	0,94	8,82	1,35	28
KWG-190/2-x10-xxx	0,22	0,57	10,07	1,35	28
KWG-230/2-x10-xxx	0,16	0,32	11,75	1,9	14
KWG-300/2-x10-xxx	0,11	0,22	14,20	1,9	14
KWG-175/4-x10-xxx	0,49	1,0	8,3	1,72	14
KWG-240/4-x10-xxx	0,09	0,3	10,76	1,65	14
KWG-180/2-x20-xxx	0,2	0,24	7,62	0,35	10
KWG-250/2-x20-xxx	0,08	0,15	7,55	0,3	10
KWG-360/2-x20-xxx	0,42	0,82	8,87	0,40	10
KWG-200/4-x20-xxx	0,16	0,31	1,70	0,3	10
KWG-270/4-x20-xxx	0,10	0,20	2,11	0,3	10
KWG-370/4-x20-xxx	0,077	0,15	2,69	0,32	10
KWG-250/4-x40-xxx	0,1	0,19	2,44	0,32	10
KWG-350/4-x40-xxx	0,042	0,081	3,00	0,32	10
KWG-270/4-x31-xxx	0,034	0,065	3,17	0,46	14,5
KWG-320/4-x31-xxx	0,028	0,056	3,8	0,46	14,5
KWG-450/4-x31-xxx	0,026	0,052	4,3	0,46	14,5
KWG-325/4-x45-xxx	0,017	0,034	2,58	0,27	15,5
KWG-460/4-x45-xxx	0,010	0,020	3,3	0,27	15,5
KWG-235/4-x50-xxx	0,0095	0,019	0,9	0,095	14,5
KWG-335/4-x50-xxx	0,0057	0,011	1,15	0,095	14,5
KWG-430/4-x50-xxx	0,0044	0,0088	1,28	0,095	14,5
KWG-560/4-x50-xxx	0,0026	0,0052	1,55	0,095	14,5

Table 3: Resistance values of standard 3-phase generators

- The resistance value Z_{u-N} depends on the type and is approx. $\frac{1}{2}$ of the resistance L1-N. The same applies to Z_v and Z_w .
- Balancing quality of the rotor: Class 2.5 to IEC 34-12 / for 2-bearing generators balanced with half feather key.
- Ventilation: self surface ventilated by co-rotating fan on the B-side.
- Excitation device: with electronic controller, self-excited.
- Setpoint adjustment: Type-dependent, with internal trimmer.
- Static voltage tolerance: $< \pm 1 \%$ of U_{Nenn} and a speed drop of 5% of n_N (📖 see standard IEC8528).
- Dynamic voltage change: $< 25 \%$ at rated load connection and disconnection (📖 see IEC8528 standard).
- Settling time: 0.1 to 0.5 s depending on application and generator type (📖 see IEC8528 standard).
- Continuous short-circuit current: $> 3 \times I_{Nenn}$ three-phase; $> 6 \times I_{Nenn}$ single-phase for 3 to 5 s.
- Unbalanced load: capable of unbalanced load, see type-specific generator data sheet.
- Damper rods in the rotor: standard.
- Distortion factor: $< 5 \%$ U-N for standard windings.
- Short-term overload capacity: 50% for 2 min.
- Overtemperature in the alternator: depending on the type, the temperature is measured with an integrated sensor in the alternator or the temperature is determined via the resistance of the winding.
- If a temperature threshold is exceeded, the output power is automatically and continuously reduced. Excess temperature in the generator controller: Each KWG controller measures the controller temperature with an integrated sensor in the controller. If a temperature threshold is exceeded, the excitation power is automatically reduced continuously.
- Underspeeds: possible without restriction.
- Bearing: Deep groove ball bearing on drive side as locating bearing and on fan side as non-locating bearing, permanently lubricated bearings in sealed C3 design Max. bearing service life: 20,000 hours when ambient conditions are maintained.
- max. radial shaft load on the center of the shaft end📖 see Table 4:

	BG132	BG160	BG200	BG250	BG280	BG355
2-pole (max. values)	3.500 N	6.500 N	---	---	---	---
4-pole (max. values)	4.000 N		8.500 N	11.000 N	16.400 N	by arrangement

Table 4max. permissible radial shaft load

4.3.2 Terminal box

The terminal box is normally located on the back of the housing and contains the connections for the stator winding and all connections required for generator operation and monitoring. Several metric or PG threads can be provided for the customer connection. On the customer side, the cable glands must comply with the respective IP classification.

4.3.3 Direction of rotation and rotating field

In accordance with DIN EN 60034-8, the temporal phase sequence corresponds to the terminal sequence U-V-W when the direction of rotation is clockwise (viewed clockwise to the shaft end). Left-hand drive rotation with phase sequence U-V-W is possible.

4.3.4 Behavior at underspeed

There is no need to worry about underspeeds on the alternator. The generator controller limits the excitation current to the maximum permissible current with simultaneous multiple temperature monitoring. Depending on the ambient conditions, the rated output power is still displayed up to 5%¹⁾ underspeed. For genset applications, an additional power control is integrated to protect against motor torque overload.

¹⁾ Depends on type and parameters.

4.3.5 Behavior at overspeed

ATTENTION

The maximum permissible speed must not be exceeded, as this would result in mechanical destruction of the rotor due to the high centrifugal forces.

Explanation:

Overspeed causes the rotor to touch the stator, resulting in total destruction of the alternator. Furthermore, the generator governor can no longer maintain the specified step response times in the event of overspeed. This continues until the remanence voltage of the generator exceeds the rated voltage and can result in damage to the generator or connected devices.

4.4 Design examples of generators

The most common designs are listed below.

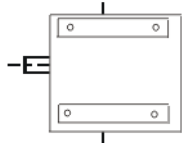
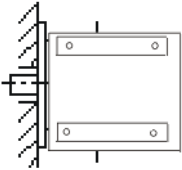
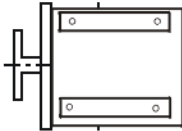
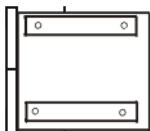
Icon	Design	Description
	IM B3 (B3)	Two-bearing design with bottom-mounted feet and a cylindrical shaft end
	IM B34 (B3/B14)	Two-bearing design with bottom-mounted feet and flange connection on the A end shield and one cylindrical shaft end
	IM 1202	Single-bearing version with SAE clutch disk
	SAE J609	Single-bearing design with tapered shaft

Table 5: Design examples of generators

4.5 Overview of protection classes (IP code)

NOTE

Here is an excerpt from the EN 60529 standard (degrees of protection provided by enclosures (IP code)).

Further information on the protection classes can be found in the current version of the EN 60529 standard.

Protection against contact and foreign bodies:

1. code number	Designation - Explanation
0	Not protected.
1	Protected against solid foreign objects 50 mm in diameter and larger: The object probe (50 mm sphere) must not penetrate fully.
2	Protected against solid foreign bodies 12.5mm diameter and larger: The object probe (12.5mm sphere) must not penetrate fully. <u>Note:</u> Typically the ventilation slots in a PC power supply housing,...
3	Protected against solid foreign bodies 2.5mm diameter: The object probe (2.5mm sphere) must not penetrate at all.
4	Protected against solid foreign bodies 1mm and larger: The object probe (1 mm sphere) must not penetrate at all.
5	Dust-protected: Ingress of dust is not completely prevented, but dust must not penetrate in such quantities that the operation of the appliance or safety is impaired.
6	Dustproof: No ingress of dust with a negative pressure of 20 mbar in the housing.

Table 6 Protection classes - 1st digit: Protection against contact and foreign bodies

Protection from water:

2. code number	Designation - Explanation
0	No protection.
1	Protected against dripping water: Vertically falling drops must not have any harmful effects.
2	Protected against dripping water when the housing is tilted up to 15°: Vertically falling drops must not have any harmful effects if the housing is inclined by an angle of up to 15° on either side of the vertical.
3	Protected against water spray: Water sprayed at an angle of up to 60° on either side of the vertical must not have any harmful effects.
4	Protected against splash water: Water splashing against the housing from any direction must not have any harmful effects.
5	Protected against water jets: Water directed as a jet against the housing from any direction must not have any harmful effects. <u>Note:</u> Corresponds to approx. 12.5 liters/minute (garden hose). Test period approx. 5 minutes. (Data without guarantee.).
6	Protected against strong water jets: Water that is directed against the housing as a strong jet from any direction must not have any harmful effects.
7	Protected against the effects of temporary immersion in water: Water must not enter in a quantity that causes harmful effects when the enclosure is temporarily submerged in water under standardized pressure and time conditions.
8	Protected against the effects of permanent immersion in water: Water shall not enter in such quantity as to cause harmful effects when the enclosure is continuously immersed in water under conditions agreed between the manufacturer and the user. However, the conditions must be more severe than for code number 7.

Table 7: Protection classes - 2nd digit: Protection against water

5 TRANSPORTATION AND STORAGE



WARNING

Danger from falling objects

Death or serious injury

- To lift the generator, only use the eyebolts / stops provided and suitable for this purpose.

The generator is delivered bolted onto a pallet ready for installation. The components are sealed with a protective film to protect them from water and dirt.

It is recommended that the generator is carefully checked for transportation damage on arrival at its destination. Any visible damage must be reported immediately to the transportation company involved and to KW-Generator GmbH.

To lift and move the generator, only use the lifting eyes / stops provided for this purpose. The lifting eyes / stops are only designed for lifting the generator. It is not permitted to use them to lift the entire generator set. Ensure that all devices and aids used for lifting the generator are designed for the weight of the generator and that all safety precautions have been taken for transportation.

The weights of the various generators can be found at  chapter 4.3.

The ball bearings do not require maintenance during the storage period. Turning the shaft manually from time to time prevents contact corrosion and hardening of the grease.

ATTENTION

Components may be damaged by moisture.

- Ensure that all covers are properly closed during transportation and storage.
- If the generator is not put into operation immediately, it must be stored in a protected, clean, dry and vibration-free location.

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

Table 8 Storage and transportation conditions

6 FUNCTIONAL DESCRIPTION OF THE GENERATOR REGULATOR

A KWG generator regulator must be used for safe operation of the KWG generator. The voltage regulator is matched to the respective generator type for safe and stable operation. The system is stable in all operating positions and ensures compliance with the guidelines and the requirements of the application. Adjustments can only be made at KWG, as all parameters are digitally stored in the controller software.

Operating modes such as overload, underspeed, no-load operation, single-phase load and loads with $\cos \phi < 1$ are automatically detected by the generator controller and responded to accordingly.

ATTENTION

Damage due to heating.

- It is not advisable to operate the generator unnecessarily at underspeed, as this operating mode requires more exciter power due to the principle and heats up the exciter system and the entire generator unnecessarily.

The generator regulator is connected to the generator via AMP-MATE-N-LOK connectors.

6.1 Using the potentiometers

It is possible to adjust the output voltage (type-specific) on the generator controller using TR1.

- Turning clockwise increases the output voltage.
- Turning counterclockwise reduces the output voltage.

KWG generator regulators regulate the output voltage to average value formation (AVG) or to the true effective value (TRUE-RMS). For this reason, it is important that the generator voltage is measured with a TRUE-RMS / AVG measuring device during calibration.

6.2 Thermal protection

All KWG generator regulators are temperature-protected. The temperature in the generator controller is measured. The threshold value for this is parameter-dependent. If the temperature exceeds this threshold, the output power is reduced until the temperature remains constant.

6.3 Interface options

For the interface options of the controller, see the corresponding controller operating instructions.

6.4 Inductive/capacitive load

The KWG generator systems are designed as standard for inductive and capacitive loads of 0.8 - 1.

For non-ohmic loads in excess of this, corresponding derating tables must be requested from KWG.

6.5 Interface to the KWG-Isowatcher

In addition to the stand-alone operating mode, the KWG iso monitor offers the option of communication via CAN bus as well as direct communication with the KWG generator controller.

6.6 Operation with insulation monitor

ATTENTION

Damage due to insulation damage.


- It must be ensured that the insulation monitor is operational and functional and that the correct type of network (IT network) has been selected.
- DIN EN 61557-8 must be observed.

The effectiveness of the test device (iso detector) must be checked by an internal or external test button to ensure that it is functioning correctly and complies with the requirements. The effectiveness of the test device (iso-monitor) must usually be checked every working day.

7 INSTALLATION AND COMMISSIONING

This chapter describes the installation and initial commissioning of the generator.

The generator may only be installed by authorized and qualified specialist personnel.

Before installing and commissioning the generator, carefully read the  chapter 3 "Safety instructions".

7.1 Preparatory measures

Carry out the following work and checks before installation:




WARNING

Danger from self-starting machines

Death or serious injury

- Do not start the generator until you have ensured that the system is disconnected by the main switch or other disconnection devices.

- Remove the protective film and transport locks.
- Check whether the data specified on the type plate of the generator corresponds to the system data.
- Check that all nuts and bolts on the generator are tight and that the mechanical structure is correct.
- Check whether there is sufficient cooling air at the installation location and whether it is ensured that the generator does not draw in hot air or is not blown in from the side by other unit fans with hot air.
- Ensure that the system is secured against access by unauthorized persons and animals and is equipped with the necessary safety devices in accordance with the statutory regulations.
- Ensure that there is sufficient space for maintenance and inspection work ( see chapter 8 - Maintenance) is provided. KWG offers technical support regarding the installation situation.
- For single-bearing generators, check that the tightening torque of the clutch disks is correct and that the cone of the generator and the drive shaft are clean and undamaged.
- Ensure that the connections on the terminal board are made correctly.
- Carry out a measurement to check that the connections are not reversed and that there are no short circuits between the generator and external switches.
- wait until the genset has reached its rated speed before switching on the system.

The sum of all connected extension cables must not exceed the following lengths:

- max. 250 m with conductor cross-section 2.5 mm²
- max. 100 m with conductor cross-section 1.5 mm²
- Other lengths and cross-sections on request.

To ensure safe operation of three-phase generators, the current drawn for the electrical equipment should be distributed as evenly as possible over the three phase conductors.

ATTENTION

Damage due to overload.

- Ensure that the maximum current specified for each socket is not exceeded.

Both end shields are equipped with a water drainage hole that may be sealed with a sealing screw at the factory. If the water drainage hole is required, it is essential to check whether it is located on the underside of the generator.

ATTENTION

Damage and failure of the generator due to water.

- Ensure that the water drainage hole is always at the bottom of generators that are installed at an angle so that condensation and penetrating water can always drain away completely.
- If necessary, turn the end shield opposite the housing.

7.2 Align

ATTENTION

Damage due to incorrect alignment.

- Align the generator correctly to avoid vibrations, bearing damage, damage to the drive unit, damage to the adapter unit (coupling) and unnecessary noise emissions.

When using single-bearing generators, the dimensions of the connection housing/connection flange and flywheel/shaft cone of the drive motor must be checked. In addition, the dimensions of the flange and the coupling disk/shaft cone of the generator must be checked.

7.3 Tightening torques

Please observe the following tightening torques.
For tightening torques for terminal boards, see the following table

Application	Thread size					
	M5	M6	M8	M10	M12	M16
electrical connections:						
Fastening with light load	5	6	12	30	36	*)
Fastenings of normal load (terminal box cover, ...)	5	8	14	24	39	*)
Fastening high loads (feet, flanges, ...)	6,5	11	25	45	75	120

Table 9 Tightening torques for terminal boards

*) Sizes by agreement

7.4 Insulation test

NOTE

Further information on insulation testing can be found in the current version of the DIN EN 60034 standard.

In accordance with standard DIN EN 60034-1 (chapter: Testing the withstand voltage), the alternator is tested at KWG during the final test.

The entire system must comply with the EN 60204 standard.

7.5 Electrical connection and terminal board

7.5.1 Generators with terminal board connection

ATTENTION

Damage due to improper screwing.

- Make sure that the ring cable lugs are positioned as shown in Illustration 2 must be connected as shown. Improper screw connection can lead to overheating and fire due to excessive contact resistance.

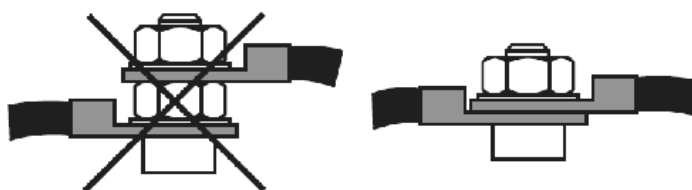


Illustration 2 Proper assembly of ring fork shoes

The bolt size on the terminal board depends on the type.
Assignment of the terminal board:

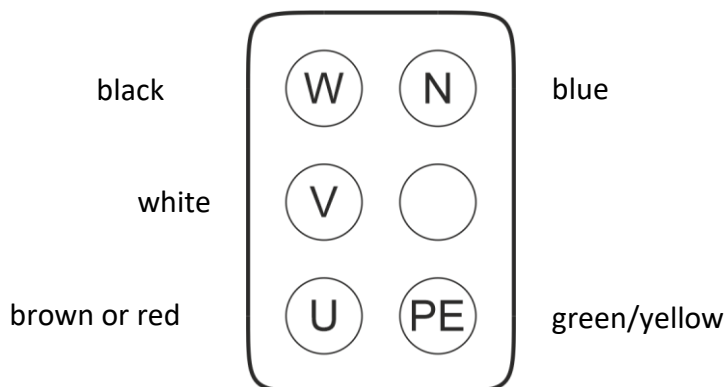


Illustration 3 Assignment of the terminal board

7.5.2 Current carrying capacity and tightening torque of the KWG terminal board

The design of the terminal boards is calculated by KWG for the respective generator type. The following table shows the maximum current load of each bolt of the terminal board. These must not be exceeded.

Clipboard	Max. Current load [A]	Nut tightening torque [Nm]
M4 - 6-pin	16	1,5
M5 - 6-pole	25	3
M6 - 6-pole	63	5
M8 - 6-pole	100	9
M10 - 6pole	160	20
M12 - 6-pole	250 (315) ¹⁾	25
M16 - 6-pole	315 (400) ¹⁾	30
M20 - 6-pole	400 (630) ¹⁾	52

Table 10 Current carrying capacity and tightening torques

¹⁾ Depending on material

7.5.3 Generators without terminal board connection

The cable design is usually with strands in a flexible corrugated conduit. Separation of the corrugated conduit and the strands from the generator is only possible with KWG. The system connection is customer-specific, but usually with ring cable lugs.

7.6 Connection of the generator controller

NOTE

The illustrations shown in the current chapter are symbolic images.

7.6.1 Generator with three-phase winding and DVR regulator

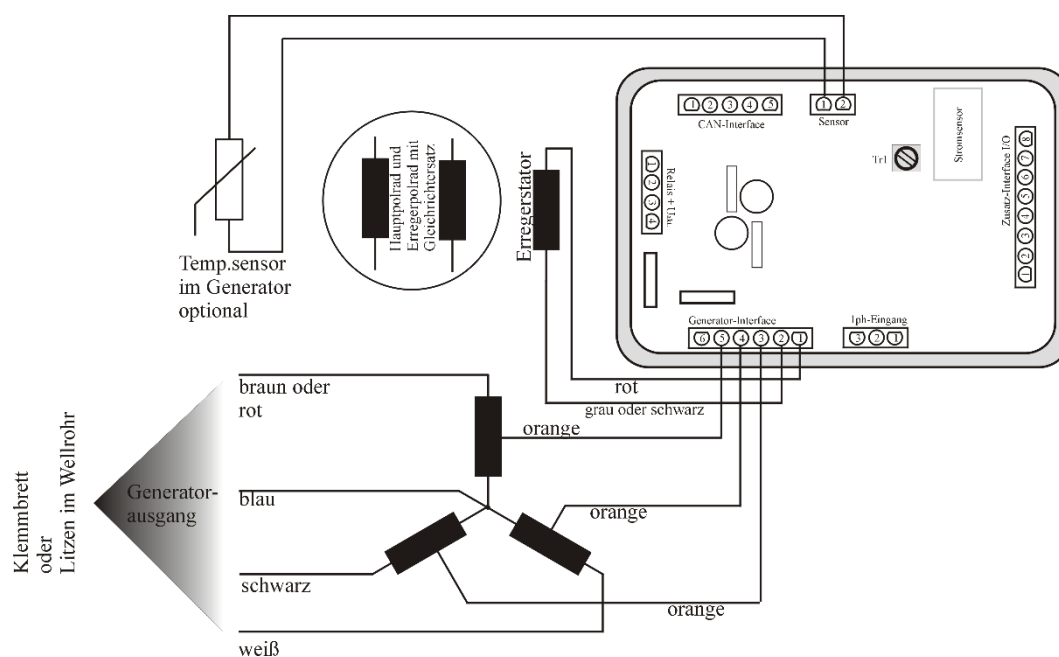


Illustration 4 Connection: Generator with three-phase winding and DVR regulator

7.6.2 Generator with three-phase winding and SCB / SVR regulator

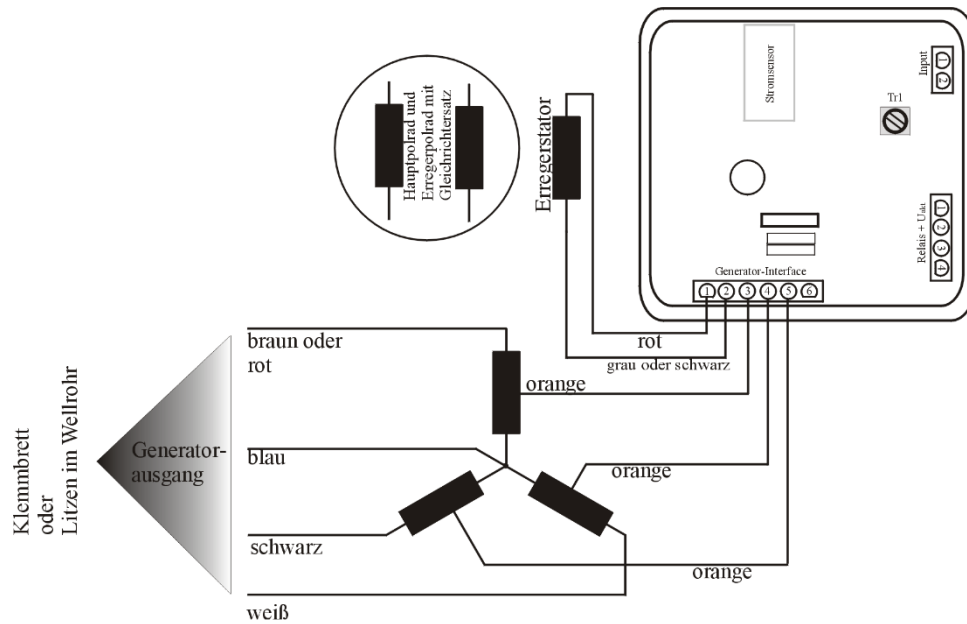


Illustration 5 Connection: Generator with three-phase winding and SCB / SVR regulator

7.6.3 Generator with single-phase winding and DVR regulator

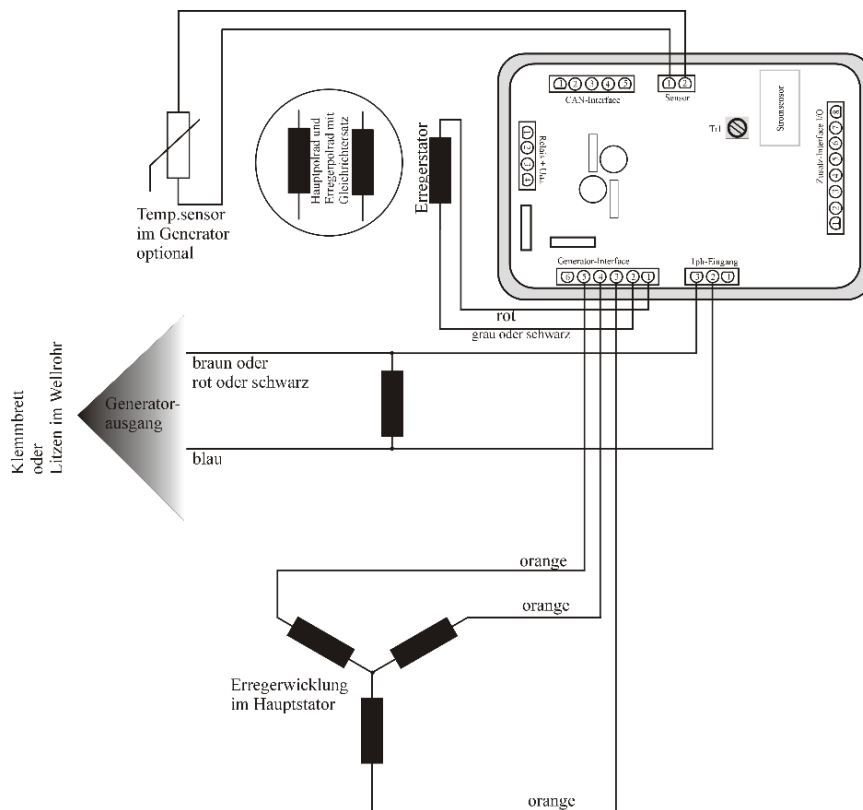


Illustration 6 Connection: Generator with single-phase winding and DVR regulator

7.6.4 Generator with single-phase winding and SCB / SVR regulator

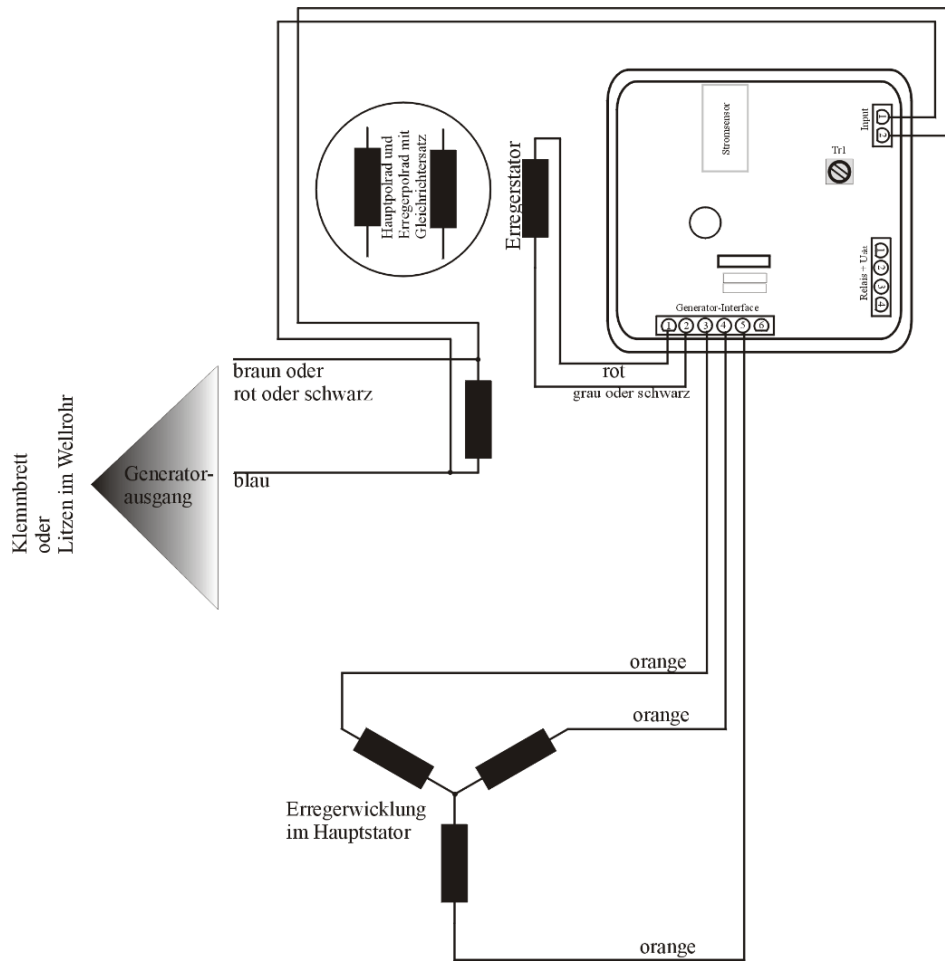


Illustration 7Connection: Generator with single-phase winding and SCB / SVR regulator

7.6.5 Generator regulator pin assignment

DVR controller	
Generator interface	1 = F1 2 = F2 3 = CLOSED 4 = ZV 5 = ZW 6 = N (necessary depending on application)
CAN interface	1 = LOW 2 = HIGH 3 = GND 4 = +9 to +30V 5 = nc
Sense input	1 = nc 2 = Sensor N 3 = Sensor U
Relay interface	1 = Rel1 2 = Rel2 3 = nc 4 = nc
Sensor	1 = NTC 2 = NTC
Additional I/O interface	1 = +10V Ref-Out 20mA max. 2 = GND 3 = Analog in 4 = nc 5 = Digital in+ 6 = Digital in- 7 = Digital out - 8 = Digital out+

Table 11: Pin assignment: DVR controller

SCB / SVR controller	
Generator interface	1 = F1 2 = F2 3 = CLOSED 4 = ZV 5 = ZW 6 = nc
INPUT	1 = Sensor cable 2 = Sensor cable
Relay interface	1 = Rel1 2 = Rel2 3 = Mag- 4 = Mag+

Table 12: Pin assignment: SCB / SVR controller

8 MAINTENANCE



DANGER



Dangerous electrical voltage

Death or serious injury due to electric shock

- Visual inspections and cleaning work on the generator for maintenance purposes must never be carried out during operation.



CAUTION



Hot surfaces

Risk of burns

- Parts of the generator can be very hot during and after operation. Do not touch the generator during operation and allow it to cool down completely after use.
- Wear safety gloves.

ATTENTION

Damage to components due to water ingress possible.

- Never expose the generator to jets from high-pressure cleaners.

Maintenance work must be carried out regularly and on time to ensure reliable operation of the generator.


All generator components are basically maintenance-free. Damage and defects to the generator must be rectified immediately by authorized and qualified specialist personnel, regardless of the maintenance intervals. The generator must not be put into operation until defects have been rectified. Repair work may only be carried out by trained specialist personnel. The generator must be checked regularly for excessive soiling and cleaned if necessary.

It may be necessary to carry out checks on the drive system in accordance with the specifications and regulations of the respective drive/system manufacturer. This also includes fitted protective covers.

Observe the maintenance instructions of the drive or system manufacturer. The generator may only be opened by the manufacturer or an authorized body. It does not contain any parts that can be replaced or repaired by the user.

Damage and defects to the generator system must be rectified immediately. The system must not be put into operation until the defects have been rectified.

Maintenance and repair work on the generator may only be carried out by authorized and qualified personnel.

Before installing and commissioning the generator, carefully read the  chapter "3 Safety instructions".

8.1 Maintenance schedule

The following maintenance work must be carried out in good time by the relevant persons.


Interval	Maintenance work	Executing person
working day	<ul style="list-style-type: none"> • Check the generator system for unusual noises by listening. • Check insulation monitoring (option) for correct function ( see chapter 7.4 - "Insulation test"). • Visual inspection for defects in the connection cable. 	Users
weekly	<ul style="list-style-type: none"> • Visually check for dirt or damage and clean if necessary. • Check cooling air openings for dirt and blockages and clean if necessary. 	Users
every 5000 operating hours	<ul style="list-style-type: none"> • Check the ball bearing by listening and replace if necessary (unusual running noises). 	Qualified specialist

Table 13 Maintenance schedule

9 TROUBLESHOOTING



DANGER



Dangerous electrical voltage

Death or serious injury due to electric shock

- All troubleshooting/repair work on the generator system may only be carried out by a qualified electrician.

Malfunction	Possible cause	Remedy
Output voltage is not correct	<ul style="list-style-type: none"> • Trimmer on controller not calibrated • The measuring device used is not suitable for this purpose. 	<ul style="list-style-type: none"> • Set the trimmer to regulator and measure the output voltage with the correct measuring instrument. 📖 see chapter 9.1 - Advanced troubleshooting
Output voltage fluctuates	<ul style="list-style-type: none"> • Regulator not suitable for generator type • Drive system extremely unstable 	<ul style="list-style-type: none"> • Replace the controller with the correct one. • Bring the drive system to a stable state.
No output voltage	<ul style="list-style-type: none"> • Connected fuse has disconnected • 3-phase short circuit of the output phases • Generator or regulator is defective 	<ul style="list-style-type: none"> • Replace or reactivate the fuse. • Eliminate the output short circuit. 📖 see chapter 9.1 - Advanced troubleshooting
Generator gets too hot	<ul style="list-style-type: none"> • Generator environment too hot • Intake air too hot • Fan cover is reduced in size due to foreign objects • Generator is in abnormal operating state • Generator is overloaded • Generator is extremely dirty 	<ul style="list-style-type: none"> • Check ambient conditions and air intake. • Measure the temperature at the alternator or read out the alternator temperature with a diagnostic device and contact KWG. • Clean the generator.
Generator makes noise	<ul style="list-style-type: none"> • Foreign objects in the fan cowl • Defective ball bearing • Single-phase overload • Drive unit not working correctly 	<ul style="list-style-type: none"> • Remove foreign bodies. • Have the ball bearing checked by a specialist. • Measure the phase currents with an ammeter and eliminate the overload if necessary. • Replace the V-belt or adjust it to the correct tension. • Check the drive for running noises.

Malfunction	Possible cause	Remedy
Mechanical damage to the generator	<ul style="list-style-type: none"> • Damage to the generator detected during maintenance work 	<ul style="list-style-type: none"> • Contact KWG and, if necessary, show the damage with a photo. • Shut down the generator until clarification to prevent further consequential damage.


Table 14 Typical causes of faults and possible remedial measures

For further troubleshooting measures, please contact KW-Generator GmbH or request the relevant documents from them.

9.1 Advanced troubleshooting

9.1.1 Error: no or too low output voltage

- 1) Is an excessively large piece of electrical equipment connected to the output? In any case, no electrical equipment should be connected during the inspection.
- 2) Check whether the generator is rotating at nominal speed. Most regulators are equipped with an f/U characteristic curve. This means that at a frequency of less than 48 Hz, the voltage begins to decrease in a defined ramp.
- 3) Check that the alternator or alternator regulator is not too hot. If necessary, allow it to cool down briefly and then check the output voltage. If the cause was increased heat, it may be due to overload, single-phase overload, excessive soiling of the alternator, inlet of the ventilation hood soiled or not free or external influence, e.g. exhaust or exhaust manifold close to the alternator or regulator.
- 4) If the output voltage is less than approx. 4 V (U-N), the generator lacks remanence. This can happen if the generator slowly comes to a standstill with a motor load. It is very rare for the remanence to be lost.

To eliminate the problem, see document  "External excitation".



DANGER

Non-compliance with warnings and safety instructions

Death or serious injury

- The generator must be shut down for the following steps 5 to 8!
- All safety and warning instructions must be followed!
- Before carrying out any work on the appliance, switch it off completely and secure it against unintentional restarting.

- 5) If the output voltage is approx. 4V - 50V (U-N), either the regulator or the generator may be damaged.

Remove the regulator from the generator. Unplug the cable for this purpose. Is there any visible damage?

With the regulator disconnected, the generator can be tested as follows: (cold values)

Check resistance values. See page 8 (Resistance values of standard 3-phase generators).

- 6) The winding tap or the excitation winding for single-phase generators Zv-Zw is connected to the 6-pin AMP plug with stranded wires in yellow or orange.

The resistance value Zu-N depends on the type and is approx. $\frac{1}{2}$ of the resistance L1-N.

The main winding is usually placed on a clipboard.

As a rule, the low-resistance value cannot be determined precisely with a multimeter. The symmetry of the resistance values, for example, can also be compared with each other.


- 7) Carry out insulation measurement with a special measuring device (DC500V).

Attention: a qualified electrician is required for this.

- 8) If the generator appears to be OK in all the steps described above, contact KWG.

10 REPAIR

The user is not permitted to carry out any repair or maintenance work on the generator components. This type of work may only be carried out by authorized and qualified specialist personnel. We strongly recommend removing the generator for this work and sending it to KW-Generator GmbH.

To carry out repair work on the generator, follow the  chapter 3 "Safety instructions".

11 DECOMMISSIONING, UNINSTALLATION



DANGER



Dangerous electrical voltage

Death or serious injury due to electric shock

- Before working on the appliance, it must be disconnected from the power supply and de-energized!
- Work on electrical systems and generators may only be carried out when they are switched off and de-energized. Switched-off drive units must be secured against unintentional restarting (including existing auxiliary circuits).



WARNING

Danger from self-starting machines

Death or serious injury

- Before removing the machine, it must be ensured that the unit cannot be started automatically or manually.



WARNING

Danger from falling objects

Death or serious injury

- To lift the generator, use only the eyebolts / stops intended for this purpose and suitable lifting equipment and means of transportation.

The connecting power cables and other cables to the generator terminal box must be disconnected.

Before the bolts on the machine base can be loosened, the generator must be secured against slipping and falling. For the disassembly of generators with SAE flange and disk, SAE flange and coupling as well as single-bearing generators with conical shaft, the necessary instructions must be obtained from KWG.

12 WASTE DISPOSAL

Observe the applicable legal regulations when disposing of or recycling generator systems that are no longer functional. If necessary, commission a disposal company. Further information can be obtained from the responsible environmental authorities or from KW-Generator GmbH as well as from the type-specific data sheet.

Designation	Material
Generator housing	Aluminum
Fan cover	Iron/steel
Fan wheel	Polypropylene
Rotor/shaft	Iron/steel
Windings/insulation	Copper, cured impregnating resins
Circuit boards/electronic components	Disposal as electronic waste

Table 15 Disposal

13 SPARE PARTS

Please contact KW-Generator GmbH directly for spare parts due to the possible wide range of variants.