ELECTRIC DRIVES

FOR EVERY DEMAND

Medium-speed synchronous generators

www.vem-group.com

Catalogue 2016

Medium-speed synchronous generators

Contents

Introduction

Synchronous machines have always played a major role in our product range at VEM. We at our Sachsenwerk plant have decades of experience in manufacturing high-voltage machines combined with state-of-the-art expertise in:

- Electromagnetic and structural design
- High-voltage insulation
- Innovative cooling technology
- Programmable logic control systems
- Rationalised cost-efficient production methods

All of these benefits you will find in our new range of medium-speed three-phase high-voltage generators. We planned and designed this generator range to ensure the following characteristics:

- High efficiency
- Long service life
- Low installation and commissioning costs
- Low maintenance
- Low noise emissions

Our synchronous generators are manufactured at the VEM Dresden location's Sachsenwerk plant, and shipped from there to customers across the globe as stationary installations on land or at sea, on ships and oil platforms.
We serve a wide variety of application areas:

- Continuous power in insular systems and parallel power generation
- Emergency power
- Peak load operation

Our generators may be driven by diesel or gas motors, or water, gas or steam turbines.

Note:
We constantly improve on our products. Versions, technical specifications and images are subject to change, and are only binding on written confirmation by the supplier.
Motors shown in this brochure are examples for information only, and may include accessories only available at additional cost.

Product overview

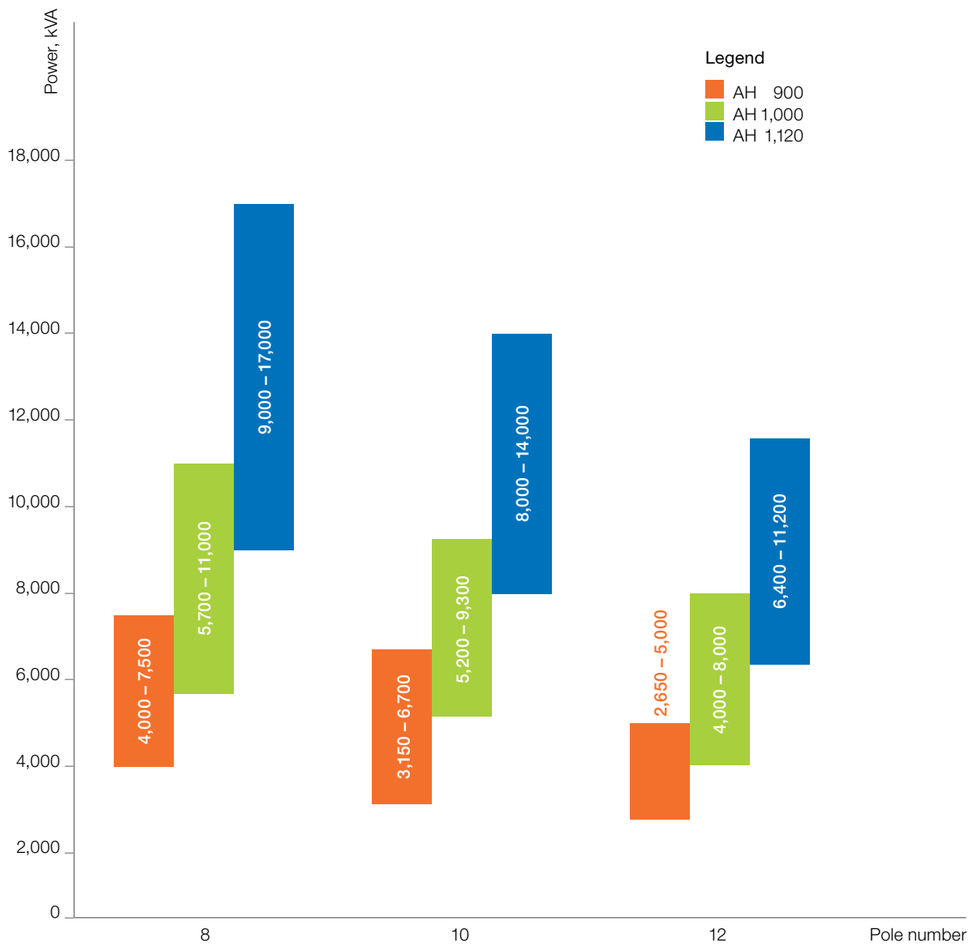
Product overview

Our new medium-speed three-phase high-voltage generators in salient pole design are available at 900 mm to 1,120 mm shaft height with eight to twelve poles.
Other numbers of poles upon request.

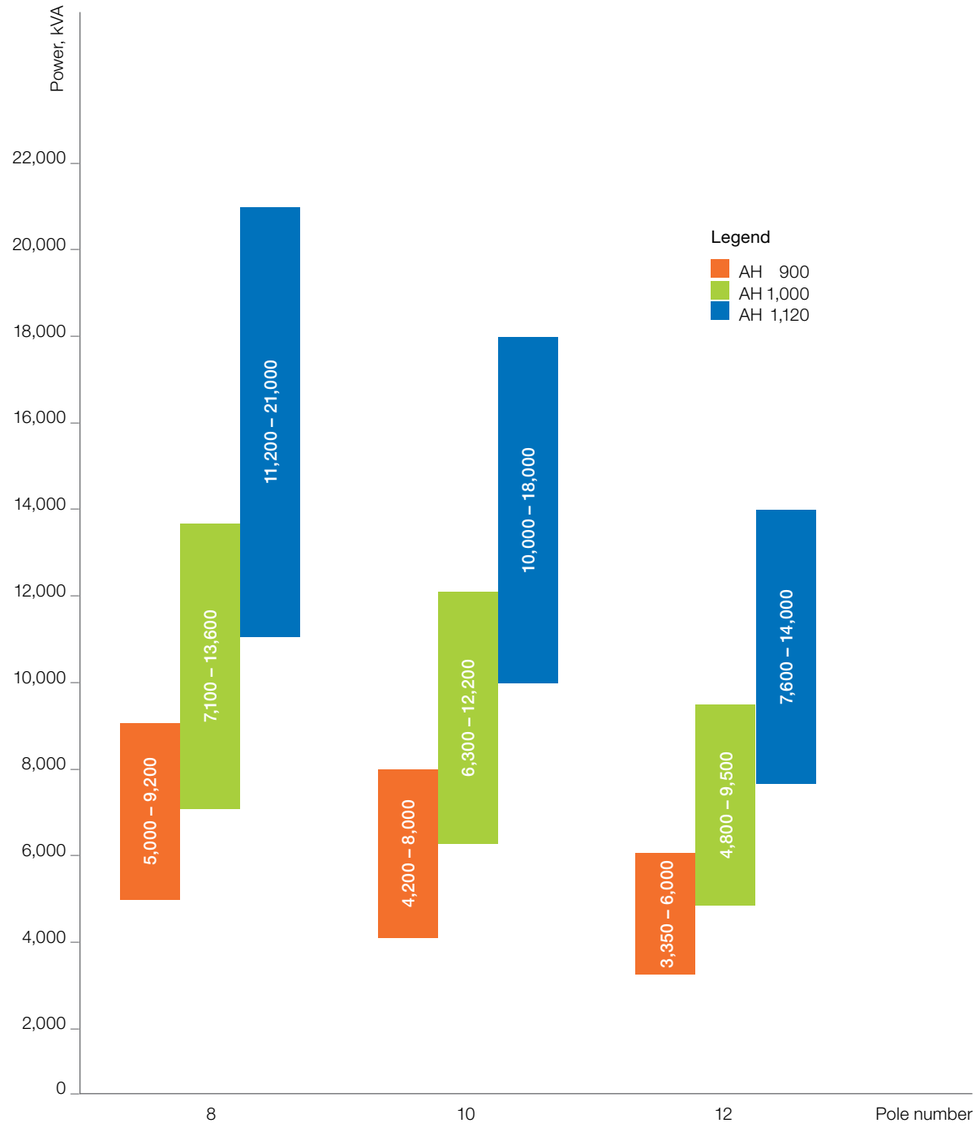
Standard design

Voltage:	6.3 (6.6) kV and 10.5 (11.0) kV
Frequency:	50 Hz or 60 Hz
Power factor cos φ:	0.8 ü
Thermal class:	155 (F) utilisation based on 155 (F)

Diesel generators 6.3 and 10.5 kV, 50 Hz, cos φ 0.8, F/F



Diesel generators 6.6 and 11 kV, 60 Hz, cos φ 0.8, F/B



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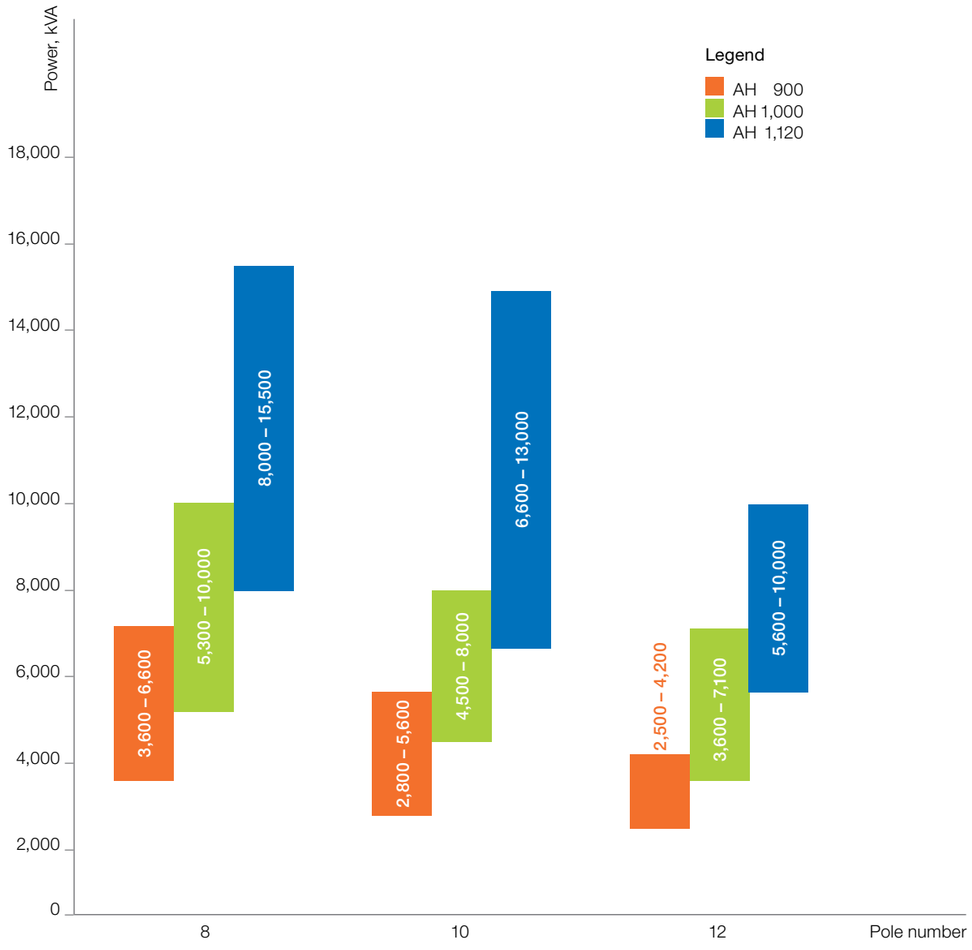
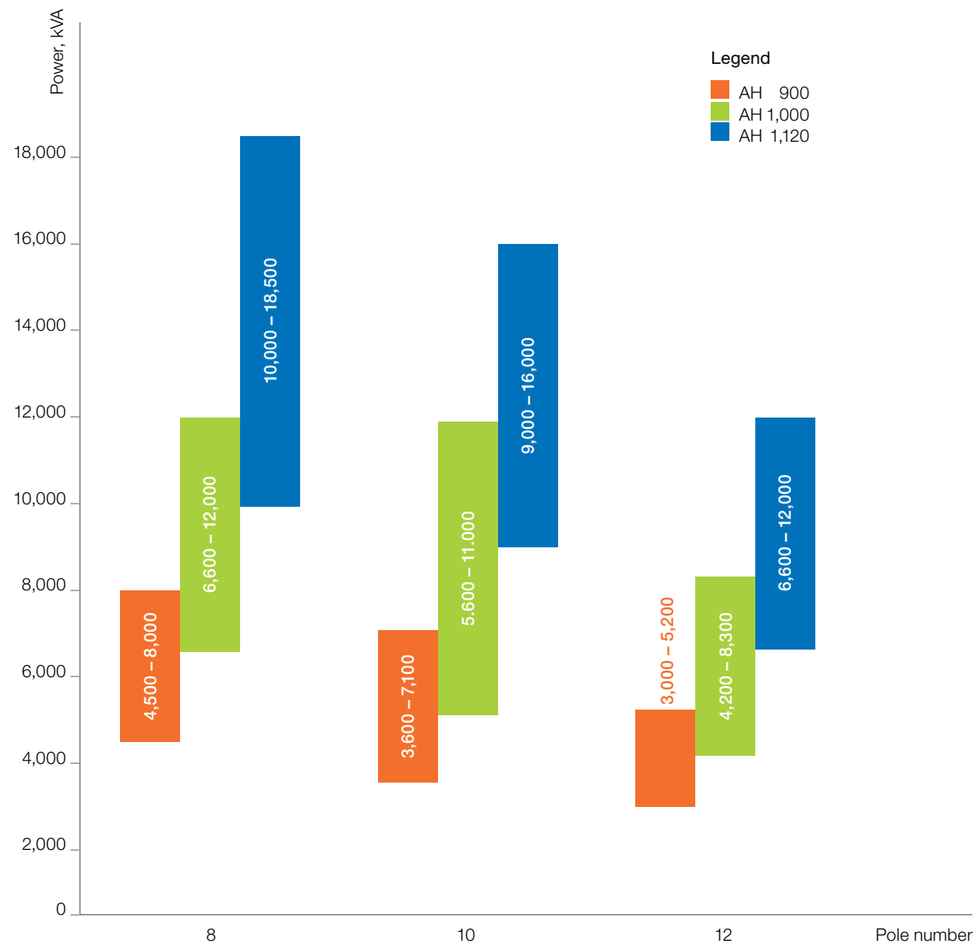
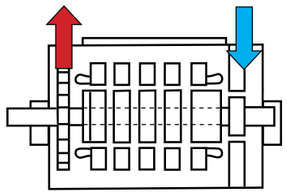
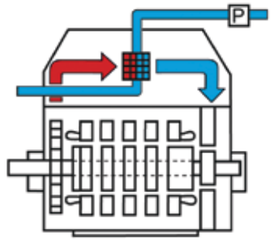
Diesel generators 6.3 and 10.5 kV, 50 Hz, cos φ 0.8, F/B



Diesel generators 6.6 and 11 kV, 60 Hz, cos φ 0.8, F/B



IP codes and cooling

IP code:	IP 23	IP 44
Cooling type:	IC 0 A1	IC 8 A1 W7
		

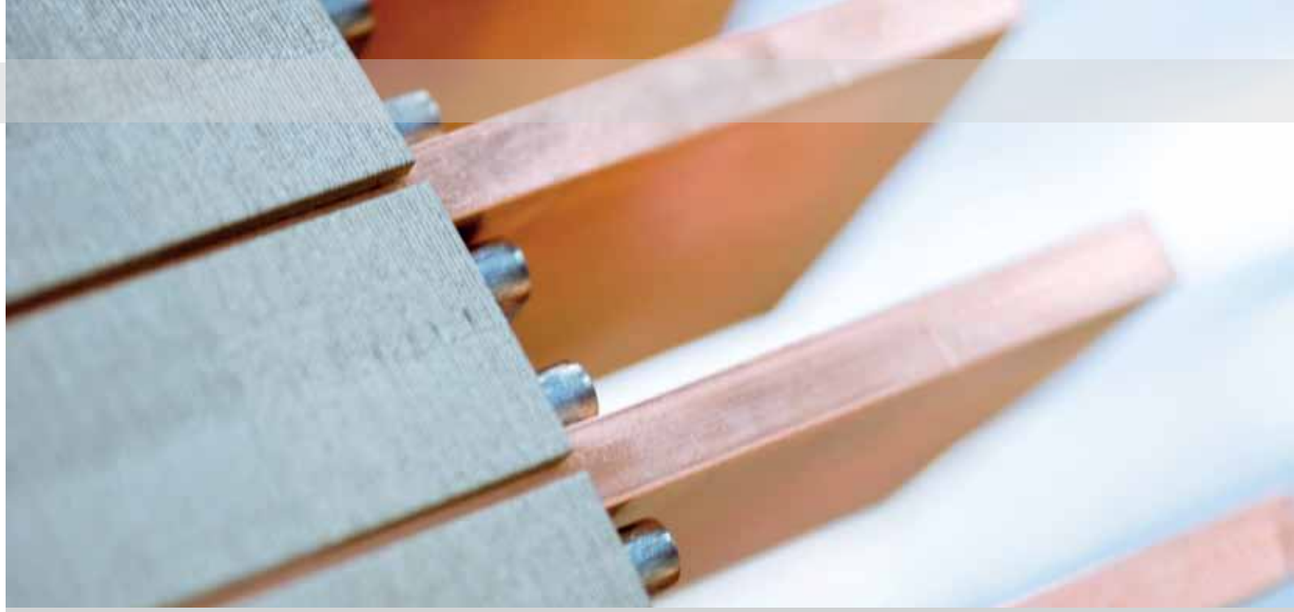
Design versions

Our brushless synchronous generators are usually supplied in the following versions:

- IM B20 (IM 1101)
- IM B3 (IM 1001)
- IM B25 (IM 2401)
- IM B16 (IM 1305)

Technical design

Matching electrical output power with the motor's mechanical power and potential overload requirements depending on intake temperature and local installation height plays an important role in selecting a generator. Additional details such as IP code compliance, cooling type, design, bearings and foundations, and an ideal choice of excitation system and impact on mains stability and quality naturally also play a role in optimising a generator to local conditions. Our project planning department at VEM provides answers to these questions as well as assistance in selecting the right generator.



Type identification
Standards and regulations

Type identification

Type identification from our Sachsenwerk plant consist of letters and digits.

Letters Positions 1–5
Digits 10–11
Letters Positions 12-13

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	D	R	A	S	Y	9	0	2	0	- 8		W	S	

1 **Current type**
D three-phase current

2 **Machine type**
G Synchronous generator w/ slip ring
R Synchronous generator w/o slip ring

3 **Cooling, IP code**
A Self-ventilation (IP 23; IP 24)
K Circulation cooling (IP 44)
IP 54 on request

4 and 5 **Design type**
(encoded)
Intended use and bearings,
Deviating voltage and frequency,
Explosion protection, design, etc.

6 and 7 **Shaft height**
(encoded)

8 and 9 **Laminated core length**
(encoded)

10 and 11 **No. of poles, speed**

12 to 14 **Additional letter**
Code letters for special winding designs,
pole types and revision level

Standards and regulations

Our motors comply with all relevant international standards, as well as the current DIN standards and VDE regulations, for standard versions esp. IEC 60034 - DIN EN 60034 (VDE 0530) with the following parts:

Part 1 Rating and performance
IEC 60034-1 – DIN EN 60034-1 (VDE 0530-1)

Part 2 Standard methods for determining losses and efficiency from tests
IEC 60034-2- …(several parts) – DIN EN 60034-2- ... (VDE 0530-2- …)

Part 4 Methods for determining synchronous machine quantities from tests
IEC 60034-1 – DIN EN 60034-4 (VDE 0530-4)

Part 5 Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification
IEC 60034-5 – DIN EN 60034-5 (VDE 0530-5)

Part 6 Methods of cooling (IC Code)
IEC 60034-6 – DIN EN 60034-6 (VDE 0530-6)

Part 7 Classification of types of constructions and mounting arrangements (IM Code)
IEC 60034-7 – DIN EN 60034-7 (VDE 0530-7)

Part 8 Terminal markings and direction of rotation
IEC 60034-8 – DIN EN 60034-8 (VDE 0530-8)

Part 9 Noise limits
IEC 60034-9 – DIN EN 60034-9 (VDE 0530-9)

Part 14 Mechanical vibration of certain machines with shaft heights 56 mm and higher – Measurement, evaluation and limits of vibration severity
IEC 60034-14 – DIN EN 60034-14 (VDE 0530-14)

Part 15 Impulse voltage withstand levels of form-wound stator coils for rotating AC machines
IEC 60034-15 – DIN EN 60034-15 (VDE 0530-15)

Part 18 Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters – Qualification and quality control tests
IEC 60034-18- … (several parts) – DIN EN 60034-18- … (VDE 0530-18- …)

Part 27 Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines
DIN CLC/TS 60034-27; VDE V 0530-27

Part 29 Equivalent loading and superposition techniques – Indirect testing to determine temperature rise
IEC 60034-29 – DIN EN 60034-29 (VDE 0530-29)

as well as

ISO 10816- … – DIN ISO 10816- … Evaluation of machine vibration by measurements on non-rotating parts (several parts)

ISO 21940-32 – DIN ISO 21940-32 Shaft and fitment key convention

ISO 1940- … – DIN ISO 1940- … Balance quality requirements of rigid rotors... (several parts)

We supply to other standards on request such as pending IEC standards and regulations of all major marine classification societies.

Features and operating performance

Voltage and frequency

The generators in this range are available in basic designs for rated voltages 6.3 and 10.5 kV for 50 Hz, and 6.6 and 10 kV for 60 Hz. The range for set-point controller amounts to ± 5 % of rated voltage UN. Values in deviation from these nominal voltages and set-point range are available on request.

Voltage waveform

Open-circuit line voltage with corresponding winding design is practically sinusoidal. The total harmonic distortion (THD) lies below the limit set [1].

Stator winding circuit

The stator winding is connected in star configuration.
The neutral point is designed to be open for protection and instrument transformer installation.

Overload capacity

Our synchronous generators are designed for an overload of 1.5 times rated current for a period of 120 s, and can be operated for one in six hours at 1.1 times rated current taking overload capacity of internal combustion motors into account. The exciter unit is generously dimensioned for dynamic processes. An excitation system ceiling voltage of approximately 2.3-fold for dynamic events is available.

Short-circuit behaviour

Sudden short-circuit current
The peak value for sudden short-circuit current in a short-circuited three-phase generator magnetised to rated voltage is substantially lower than the

$\hat{I}_S \leq 21 \cdot I_N$ limit according to [1].

Sustained short-circuit current
The auxiliary generator winding and excitation system are matched in such a way as to generate a necessary short circuit current of approximately 3 x I_N for t ≤ 5 s on a three-phase terminal short circuit.

Unbalanced load

A generously dimensioned damper cage allows for unbalanced load. Our synchronous generators are suitable for permanent unbalanced load of $I_2/I_N \leq 10$ % (inverse current/rated current). However, we recommend aiming towards a balanced load for optimal operation.

Dynamic voltage behaviour

Sudden load changes result in voltage changes (ΔU), which are mainly determined by transient generator dimensions and external connection conditions such as
- Output on connection
- cos φ during connection
- Generator at open circuit or on load

Connections on load of around I_N and cos φ ≤ 0.4 will likely lead to transient voltage drops of ΔU 15–25 %. Transient generator voltage behaviour depends on the time constant in the main generator, exciter and control system. A generously dimensioned excitation system ensures short settling times. The transient voltage settling time is around 600 ms depending on the number of poles and generator output. The generator first reaches the voltage tolerance range after about 300 ms, and remains within the static voltage tolerance range specified after settling.

Power plant properties and system feedback

The generator, excitation system and voltage controller are perfectly matched to meet the necessary legal requirements for power plants and permissible system feedback for supplying power to the national grid.

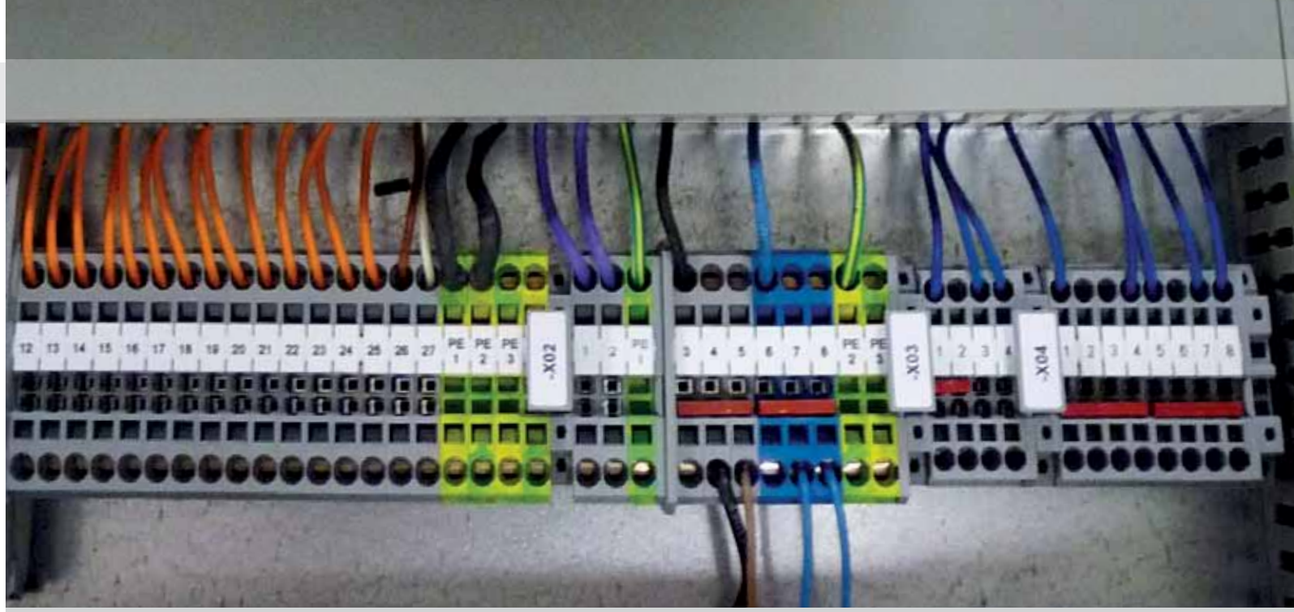
The requirements and limits on connection to the medium, high and very high-voltage grid in Germany are mainly defined in [5] and [6] with compliance documented by a unit certificate according to [7]. This unit certificate must be issued by an accredited certification body with the necessary measurements carried out by a testing laboratory accredited in accordance with EN 17025.

We provide support for the certification process on request. This may involve providing a configured simulation model of the electrical system consisting of generator, excitation system and voltage controller [8]; we can also carry out some of the tests and validations for the simulation model required by [9] according to [8] using our own testing facilities. These include harmonic measurements, reactive power supply and some of the measurements involved in low-voltage ride through (LVRT) testing before delivery, which greatly reduces the time and effort that you as our customer will need for commissioning.

Marine classification

Depending on the classification regulations, the limits on permissible winding temperatures are somewhat lower than in [1]. This might require corresponding derating.

Overload requirements/permissible temperature rise				
Classification regulation	Coolant temperature [°C]	Permissible stator winding heating 155 (H) [K]	Overload and duration	S/S_N
IEC 60034-1 – DIN EN 60034-1	40	105	50 % 30 s	1.0
DNV GL	45	95	50 % 2 min	0.95
Bureau Veritas	50	90	50 % 2 min	0.925
Lloyd's Register of Shipping	45	90	50 % 15 s	0.95
RINA	50	90	50 % 2 min	0.925
American Bureau of Shipping	50	90	-	0.925



Regulation

4

Brushless excitation system

A uniform excitation principle is used across the entire output range. By default, an auxiliary winding supplies the exciter unit (Figure 1) to separate it from the voltage level of the main generator. A separately installed permanent-magnet pilot exciter may optionally replace the auxiliary winding supply to the exciter unit (Figure 2).

A three-phase external pole exciter built into the N-side supplies the excitation current to the pole winding of the main generator, ensuring more than sufficient power for all operating conditions while maintaining continuous short-circuit current. The rectified auxiliary voltage from the auxiliary winding or auxiliary exciter is supplied to the controller, which then supplies the necessary excitation current to the exciter depending on operating state.

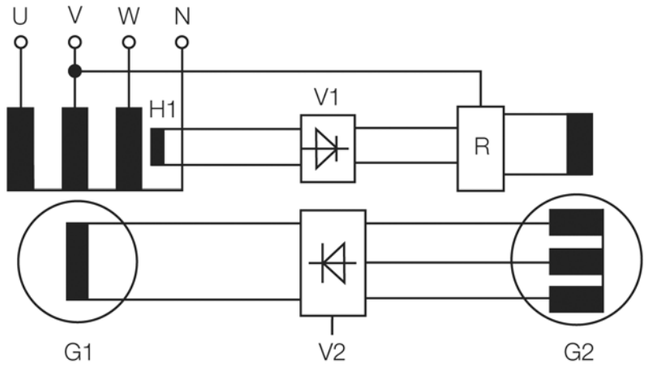


Figure 1: Block diagram: brushless excitation system with auxiliary winding

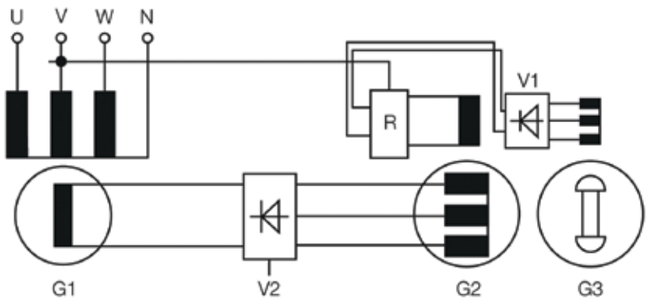


Figure 2: Block diagram: brushless excitation system with permanent magnet generator

Excitation system with digital controller

The brushless excitation system with an AC exciter, rotating rectifier bridge, and over-voltage protection circuitry is designed according to established principles.
Over-sizing ensures that all operating points are kept within the stable generator power graph as well as overloads, fulfilling all dynamic requirements that apply.

A specifically developed digital exciter box provides excitation regulation and control.

The digital controller provides the following basic functions to the operator:
- Voltage regulation (± 0.5 %)
- Remote set-point adjustment by external contacts
- Reactive droop
- Frequency-dependent voltage division
- Excitation current limit
- Automatic remanent voltage build-up
- Automatic de-excitation on shut-down
- Fast de-excitation
- Excitation error messaging
- Plug-in configuration and diagnostics

Optional additional functions:
- Generator current limit
- Reactive power or cos φ control
- Internal or external reactive power specification
- Reactive power limitation
- Mode selection by external contacts
- Rotating diode defect messaging

Exciter and generator currents are limited using a time-dependent threshold to take both the dynamics and the permissible generator heating into account.

The exciter is installed in a cabinet for wall mounting, and is equipped with an interface for convenient configuration and diagnostics via notebook. The configuration notebook is available as an option.

The excitation system may also be extended by the following functions without requiring mechanical changes:
- Battery excitation
- Load-angle limit
- Line compensation
- Switchable active power stabilisation

The exciter is certified for the following marine classifications:
Lloyd's Register
Bureau Veritas
Rina

The system is connected via cable connection to the terminal strip in the machine's auxiliary terminal box.

The excitation system may optionally be extended to the generator control cabinet, which may include the following functions:

- Brushless rotor earth fault and rotor measurement recording
- Generator protection with the following functions (not-exhaustive):
  - ANSI 87 - Generator differential protection
  - ANSI 64G - Stator earth fault protection
  - ANSI 32R - Reverse power protection
  - ANSI 40 - Under-excitation protection
  - ANSI 46 - Unbalanced load protection (two-stage)
  - ANSI 51 - Over-current protection with under-voltage preservation
  - ANSI 51V - Inverse time overcurrent protection
  - ANSI 59 - Over-voltage protection
  - ANSI 27 - Under-voltage protection
  - ANSI 81 - Frequency protection
  - ANSI 59 - Over-excitation protection
  - ANSI 40 - Under-excitation protection
  - ANSI 64R (1–3 Hz) - Rotor earth fault protection 1–3 Hz
  - ANSI 50BF - Breaker failure protection
- Generator synchronisation (several synchronising points)

The unit is mounted into a standing cabinet.

Structural design

Structural design

Our three-phase synchronous generators mainly consist of the following assemblies: stator, rotor, bearing shields, friction bearings, an exciter and ventilation hood.

Stator

The stator consists of a welded construction with the stator laminated core shrunken in. The stator core assembly consists of insulated dynamo core segments axially clamped on by extrusion billets.
The three-phase two-layer winding lies in the open slots in the laminated core. The preformed coils consist of flat copper wire with mica sheet insulation. The main insulation consists of low-binder mica-glass cloth tape. Low-impedance corona shielding on the slot part and high-impedance corona shielding on the slot end to prevent corona discharges.
The fully insulated coils are secured using slot closures in the slots. The circuit connections are brazed on.
The stator winding is vacuum pressure-impregnated using epoxy resin (insulation VEMoDUR®-VPI-155).


Stator

Rotor

The rotor consists of a forged shaft, shrunk-on rotor yoke with poles, and the exciter rotor.
Directly wound laminate cores with salient poles or directly wound individual poles mounted onto the rotor yoke may be used depending on generator size. The field coils consist of copper wire with vitreous enamel insulation. Vacuum-pressure impregnation and field-coil supports arranged in the gaps between the poles ensure the required resistance to stress caused by centrifugal forces. A damper winding consisting of copper rods soldered to the damper segments is mounted onto the heads of the poles.
All rotors are dimensioned for 60 Hz operation. The rotor core is pressed on using pressure plates connected to the shaft.


Rotor

Bearing shields

The bearing shields are designed as welded pot bearing shields. The centrings between the end plates and stator eliminate the need for air gap checks, even after dismantling. Radially mounted guides ensure precise tangential positioning of the bearing shields against the stator housing after dismantling.

Friction bearing

The friction bearings are designed as side flange-mounted bearings screwed to the centring on the bearing shield, and are fitted with a horizontally split casing, a split bearing shell with cast bearing metal, an oil ring and various seals. The bearings comply with IP 44 in the basic version. Additional seals may be used for compliance with higher levels of protection (IP 55).
The friction bearings are normally designed as floating bearings, and do not take axial loads. They may be supplied in various designs depending on the specific requirements, including ring oil lubrication, winding oil lubrication, hydrostatic shaft lifting, water cooling, insulated and as a fixed bearing. Any necessary lubrication fittings are available on request.


Friction bearing

Exciter

The exciter is designed as an external pole machine.
The exciter is mounted within the generator. The rotor and the rotating rectifier bridge in the exciter are mounted onto a common hub on the generator shaft.

Ventilation hood

The ventilation hood design depends on ventilation type.

The inlet and outlet air grilles are arranged on the D and N sides on the left and right in the ventilation hood for ventilation type IC 0 A1 with draft ventilation. Generators in this design comply with IP 23.

The air-water heat exchanger is mounted into the ventilation hood in ventilation type IC 8 A1 W7 with air-water cooling. Generators in this design comply with IP 54. Air-water heat exchangers may be designed as double-pipe coolers on request.

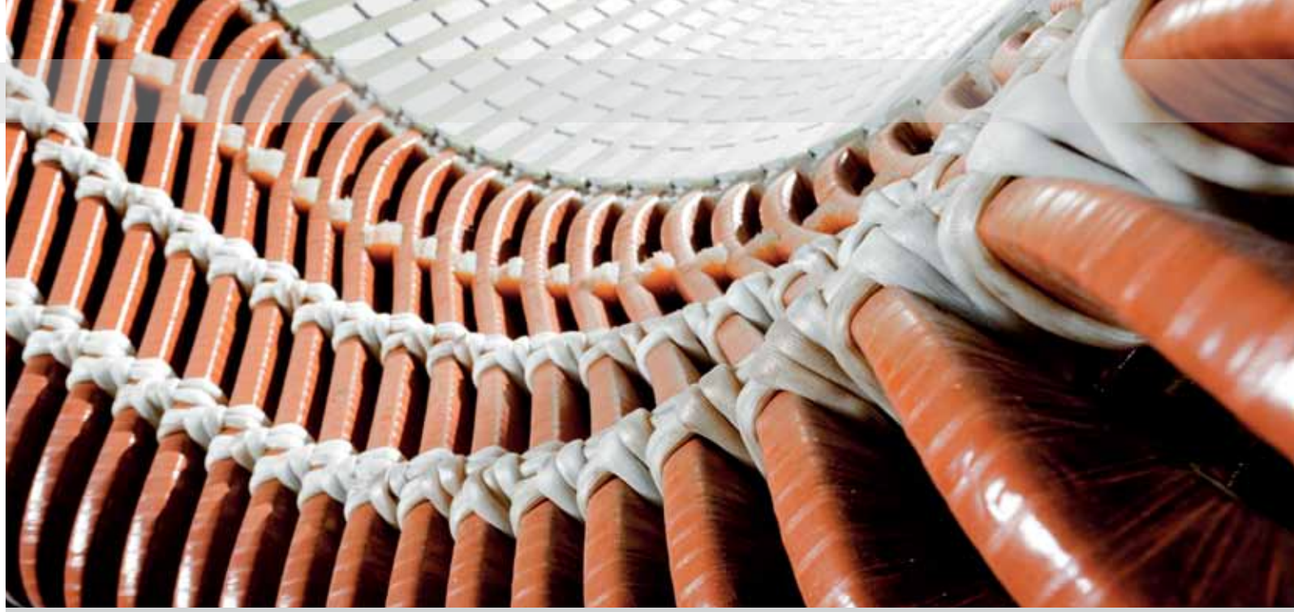
The main and auxiliary ventilation terminals as well as current and voltage transformers are located in the ventilation hood in all ventilation types. The main connection cable may lead into the hood from the left or right, and from above or below. The auxiliary power cable leads in from the N side from above or below. All entry plates are not drilled. Bolted cable fastenings or packing frames are also available on request.


Ventilation hood

Monitoring

The generator is monitored as follows:
- 3 PT 100 in the stator winding + 3 in reserve
- 1 double PT 100 per bearing shell
- The monitor cable may be connected from the terminals using the four-wire technique.

More monitoring elements may be added on request, such as a PT 100 for cooling air, leakage protection, oil level indicator, oil sump thermometer and shaft vibration monitoring.



VEMoDUR insulation system

VEMoDUR insulation system

Winding insulation quality plays a major role in operational reliability in electrical machines. VEM Sachsenwerk GmbH's insulation system have always featured technical solutions that meet international standards in quality parameters while ensuring high levels of reliability and long lifetimes.

We use the VPI technique in every area of high-voltage equipment insulation; we developed VEMoDUR®-VPI-155 at our Sachsenwerk plant and tested it according to [2].

This insulation system has come to be a reference system for future comparative functional assessment according to [3] after decades of operating experience.

The insulation system's components consisting of winding and main insulation with high proportions of mica and epoxy resin are perfectly matched to one another. Our insulation systems are subject to permanent monitoring during the impregnation process for parameters such as:

· Resin viscosity
· Impregnation and curing temperature
· Pressure dwell times
· Low and high pressure
· PD level measurements

The insulation hardens in a rotational hardening process.

VEMoDUR plant at VEM

The VPI process ensures high mechanical strength especially in the windings, and excellent electrical resistance especially in high flash-over voltages, while reliably ensuring rated impulse voltages according to [4] in any generator.

The insulation system features a high resistance to humidity – that is, the winding is insensitive to humidity and corrosive gases.

Routine tests include intermediate and final electrical testing on insulation strength including sudden and partial discharge testing, which may be separately agreed and performed on request.

Driers

Quality assurance
Documentation
Shipping, Packaging and installation
Service

7

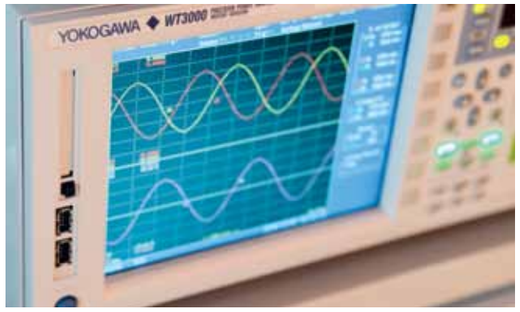
Quality assurance

Consistently high product quality, high customer satisfaction levels and sustainable processes are part of our company policy, and central to our working approach in theory and practice.

We at VEM Sachsenwerk GmbH have an integrated quality management system certified according to the International Railway Industry Standard (IRIS) Revision 02 as well as DIN EN ISO 9001:2008 and DIN EN ISO 14001:2009.

Our Quality Assurance department monitors the entire production process beginning with development, goods inward inspection and production processes up to final testing and delivery. We have around fifty experts in disciplines such as 3D measurement.

We subject every machine to a final internal inspection at our own testing facilities after manufacture. The particular machine's test scope will depend on the standards and regulations that apply, as well as on customer specifications and internal regulations from a variety of departments.
We distinguish between routine tests applied as standard according to IEC 60034-1 – DIN EN 60034-1, and extended type tests. Depending on project type, the tests are supervised for acceptance by classification organisations, monitoring institutions and independent third-party watchdogs, and you as our customer also have the option of performing your own acceptance test.



Our state-of-the-art testing facilities for large machines are dimensioned for up to 6 MW continuous load over a wide speed range. A variable-frequency power supply with voltages ranging from 400 V to 15 kV allows for optimisation to testing requirements for a variety of machine types.Our extensive measurement equipment supports specific tests including thermography, structure-borne noise measurement, and partial discharge diagnosis.

The results of our tests are documented in a test protocol or test report. Each machine is released for delivery together with a 3,1 certificate according to EN 10204 as part of the documentation, which includes a clear summary of key test findings.

Documentation

Unless otherwise agreed, the operation and maintenance manual includes the documents listed below:

- Safety precautions
- EC declaration of incorporation
- Description and specifications
- Motor dimension drawing
- Cable connection dimension drawing
- Wiring diagrams
- Installation and assembly
- Commissioning
- Operation
- Maintenance
- Servicing
- Spare parts list
- Test certificate and log book
- Additional operating manuals (options, third-party suppliers)

Any additional documentation scope must be contractually agreed. The documentation is provided in two copies on delivery of the product. The documentation is available in all European Community languages.

Additional copies, expanded documentation scope, and translations into other languages will be charged separately.

Shipping, packaging, assembly

The type of packaging will depend on the structural machine design and the agreed transport and storage conditions.

We comply with any type of packaging requirement according to the HPE packaging guidelines. Our contractors pack the goods on site or at VEM.

Goods may be shipped assembled or in parts depending on weights and measures as well as contract terms.

We have long-standing arrangements with specialised companies for oversize shipments. We recommend that you have the required installation and commissioning services performed by our expert staff.

Any work to be performed or commissioned by the customer to a third party must be documented accordingly.

Failure to provide such documentation will result in loss of manufacturer liability and guarantee.

Service

Please contact our Customer Services department for queries regarding delivery. Our team supports operators of high-quality machines and systems with a wide range of services.

Testing centre services and contract manufacturing
Our powerful state-of-the-art testing technology allows us as a manufacturer-independent contractor to supply a full range of testing services such as routine, type and system testing. We also perform special tests on new products on request. Our company has the necessary qualified staff and extensive experience in testing requirements of various acceptance testing organisations inside and outside Germany.
Detailed test plans are available on request.

Mechanical calculations for condition and fault diagnostics
Awareness on the current state of technical systems as well as possible equipment failure before lasting damage is caused increases equipment lifetime while avoiding costly downtime and lengthy repairs. VEM draws up and evaluates vibration analyses that take your specific operating situation into account alongside the actual machines to be tested.

Assembly and start-up
Installation, commissioning, repairs and inspections on heavy industrial machines require extensive experience and sensitivity. It takes very experienced professionals to deal with the increasing complexity of machines and equipment as well as the local situation and the tight deadlines involved. Our field installation team has repeatedly proven our aptitude for satisfying these requirements the world over.
We develop project schedules together with our customers, acting locally with qualified staff in installing equipment or providing engineering supervision and support up to successful commissioning. Our detailed reports and measurement protocols document the quality of our services.

Technical services
We provide support for material faults within the statute of limitations, and also offer selected service modules to keep your equipment constantly available after commissioning. We provide property-related service agreements to define the nature and scope of our services.
Our team works closely with internal departments such as Planning and Design. We can advise you on all aspects of operating the machine and related peripherals.

On-call service
You can reach us from 8 AM to 5 PM CET/CEST on Mondays to Fridays except on public holidays. Further on-call availability is available by agreement.

Maintenance
We have experienced staff available for preparing service and maintenance plans. We are pleased to offer the necessary services for your drives.

Inspection
Inspections include the current electrical and mechanical condition of your drives.
We determine causes for conspicuous wear for appropriate counteraction, and recommend spare parts as necessary. We also provide guarantee extension agreements as long as your machines are properly operated and maintained.

Repairs
We also provide high-quality repair and revamp services for electrical machines as a cost-effective alternative to new machine purchases; these services are usually carried out at our plant.

Training
We train customer staff locally or at our plant.

Spare parts
Please contact our expert team for any technical and commercial queries you might have about spare parts and inventory. A stock of spare parts on site will help us provide prompt service in the event of damage. We would be pleased to draw up an appropriate recommendation. We will also keep your reserve parts on store in Dresden on request.

General notes

Unless expressly stated otherwise, our machines are manufactured and supplied as follows:

- Manufacturing with the VEMoDUR insulation system
- Coating according to the Sachsenwerk SW-N 170-004 standard based on DIN EN ISO 12944/31-8, DIN 55928 Parts 8 and 9 and other applicable standards.
- The direction of rotation of the machine is clockwise as viewed from the drive end (DE). The terminal box is located on the right.
- The cooler is located on the machine and the water connection is mounted on the left as viewed from the drive end (DE).
- The water radiator has no water supply monitoring up to connection flange.
- No cable gland
- PT 100 for winding and bearing in 2-wire circuit without trigger; 2, 3 and 4-wire versions from terminal box connection.
- Mechanical vibrations comply with limits in IEC 60034-14 – DIN EN 60034-14 as documented in the VEM testing facility.
- Vibration monitoring without evaluation unit.
- VEM requires the use of an insulated coupling.

Technical datas and dimensions

8

Generators 6.3 kV, 50 Hz

cos φ = 0.8 (+), utilisation F/F
Type DRKSX … with air-water heat exchanger (IC 8 A1 W7), water temperature 38 °C, IP 44
Type DRASX … open-circuit air cooling (IC 0 A1), air intake temperature 45 °C, IP 23

	Apparent power	Active power	Mech. power	Norminal power	Speed	Efficiency			Reactances			Time constants		
Type	S_n	P_n	P_{mech}	I_n	n	η 4/4	η 3/4	η 2/4	xd	xd'	xd''	T'do	T'd	T''d
	[kVA]	[kW]	[kW]	[A]	[min⁻¹]	[%]	[%]	[%]	[%]	[%]	[%]	[s]	[s]	[ms]
8-pole version														
DR.SX 9020-8WS	4000	3200	3293	367	750	97.18	97.05	96.49	132	27	16	3.30	0.66	22
DR.SX 9022-8WS	4500	3600	3701	412	750	97.26	97.13	96.56	129	26	16	3.34	0.66	21
DR.SX 9025-8WS	5000	4000	4106	458	750	97.41	97.27	96.69	130	25	15	3.49	0.68	21
DR.SX 9028-8WS	5700	4560	4678	522	750	97.47	97.39	96.93	150	28	17	3.75	0.71	21
DR.SX 9032-8WS	6600	5280	5411	605	750	97.57	97.48	97.01	146	27	16	3.81	0.71	21
DR.SX 9036-8WS	7500	6000	6144	687	750	97.65	97.59	97.17	162	30	17	3.99	0.73	21
DR.SX 1022-8WS	5700	4560	4677	522	750	97.50	97.33	96.73	137	28	17	3.98	0.80	29
DR.SX 1025-8WS	7000	5600	5737	642	750	97.61	97.49	97.00	144	29	17	4.09	0.81	29
DR.SX 1028-8WS	8000	6400	6549	733	750	97.73	97.64	97.20	163	32	18	4.37	0.85	29
DR.SX 1032-8WS	9000	7200	7363	825	750	97.79	97.65	97.15	144	28	16	4.33	0.83	28
DR.SX 1036-8WS	10000	8000	8174	916	750	97.87	97.74	97.24	150	28	16	4.54	0.85	28
DR.SX 1040-8WS	11000	8800	8988	1008	750	97.91	97.77	97.27	148	27	16	4.62	0.86	28
DR.SX 1125-8WS	9000	7200	7369	825	750	97.71	97.51	96.90	131	27	17	5.29	1.09	37
DR.SX 1128-8WS	10000	8000	8178	916	750	97.82	97.63	97.05	140	28	17	5.63	1.13	37
DR.SX 1132-8WS	11200	8960	9152	1026	750	97.90	97.73	97.18	151	29	17	5.98	1.17	36
DR.SX 1136-8WS	13000	10400	10619	1191	750	97.94	97.80	97.32	159	30	18	6.18	1.18	36
DR.SX 1140-8WS	15000	12000	12240	1375	750	98.04	97.90	97.42	158	30	17	6.24	1.18	36
DR.SX 1145-8WS	17000	13600	13866	1558	750	98.08	97.94	97.45	152	28	16	6.30	1.18	35
10-pole version														
DR.SX 9020-10WS	3150	2520	2604	289	600	96.76	96.69	96.13	107	23	14	3.43	0.73	21
DR.SX 9022-10WS	3600	2880	2971	330	600	96.94	96.84	96.26	103	22	14	3.37	0.72	21
DR.SX 9025-10WS	4200	3360	3458	385	600	97.17	97.11	96.64	125	26	15	3.76	0.77	21
DR.SX 9028-10WS	4750	3800	3905	435	600	97.30	97.26	96.83	136	27	16	3.99	0.80	21
DR.SX 9032-10WS	5600	4480	4606	513	600	97.26	97.18	96.68	109	22	14	3.63	0.74	20
DR.SX 9036-10WS	6700	5360	5503	614	600	97.41	97.33	96.83	118	23	14	4.00	0.79	20
DR.SX 1022-10WS	5200	4160	4281	477	600	97.17	97.06	96.47	108	23	15	3.74	0.77	27
DR.SX 1025-10WS	6000	4800	4932	550	600	97.33	97.25	96.73	122	25	15	4.07	0.82	27
DR.SX 1028-10WS	6800	5440	5581	623	600	97.47	97.38	96.88	128	25	15	4.28	0.84	27
DR.SX 1032-10WS	7500	6000	6151	687	600	97.55	97.44	96.93	128	25	15	4.48	0.86	27
DR.SX 1036-10WS	8600	6880	7051	788	600	97.58	97.47	96.95	121	23	14	4.41	0.84	26
DR.SX 1040-10WS	9300	7440	7625	852	600	97.57	97.44	96.89	113	22	13	4.38	0.83	26
DR.SX 1125-10WS	8000	6400	6563	733	600	97.52	97.35	96.75	122	26	15	4.38	0.94	36
DR.SX 1128-10WS	9000	7200	7382	825	600	97.54	97.33	96.69	105	22	13	4.22	0.90	35
DR.SX 1132-10WS	10000	8000	8190	916	600	97.68	97.49	96.89	118	24	14	4.66	0.96	35
DR.SX 1136-10WS	11200	8960	9165	1026	600	97.76	97.58	97.02	125	25	14	4.88	0.99	35
DR.SX 1140-10WS	12500	10000	10224	1146	600	97.81	97.64	97.07	124	25	14	4.95	0.99	35
DR.SX 1145-10WS	14000	11200	11444	1283	600	97.87	97.68	97.12	123	24	13	5.07	1.00	34
12-pole version														
DR.SX 9020-12WS	2650	2120	2201	243	500	96.33	96.23	95.56	91	25	15	2.26	0.63	21
DR.SX 9022-12WS	2850	2280	2367	261	500	96.34	96.20	95.47	84	23	14	2.25	0.62	21
DR.SX 9025-12WS	3250	2600	2693	298	500	96.56	96.40	95.69	87	24	14	2.36	0.64	21
DR.SX 9028-12WS	3800	3040	3143	348	500	96.71	96.68	96.19	105	28	16	2.57	0.69	21
DR.SX 9032-12WS	4250	3400	3513	389	500	96.77	96.70	96.16	98	26	14	2.58	0.68	21
DR.SX 9036-12WS	5000	4000	4123	458	500	97.02	96.97	96.48	114	30	16	2.73	0.71	21
DR.SX 1022-12WS	4000	3200	3303	367	500	96.87	96.81	96.24	104	28	16	2.97	0.80	28
DR.SX 1025-12WS	4500	3600	3707	412	500	97.12	97.07	96.59	122	32	17	3.32	0.86	28
DR.SX 1028-12WS	5200	4160	4285	477	500	97.09	97.02	96.48	104	27	16	3.13	0.82	28
DR.SX 1032-12WS	6000	4800	4934	550	500	97.28	97.23	96.75	119	30	17	3.39	0.87	28
DR.SX 1036-12WS	7000	5600	5752	642	500	97.36	97.33	96.91	127	32	17	3.50	0.88	28
DR.SX 1040-12WS	8000	6400	6575	733	500	97.34	97.33	96.92	123	31	17	3.46	0.87	28
DR.SX 1125-12WS	6400	5120	5264	587	500	97.26	97.16	96.62	118	28	17	3.24	0.78	36
DR.SX 1128-12WS	7200	5760	5914	660	500	97.39	97.30	96.79	124	29	17	3.40	0.80	36
DR.SX 1132-12WS	8000	6400	6563	733	500	97.51	97.41	96.91	129	30	17	3.56	0.82	35
DR.SX 1136-12WS	9000	7200	7380	825	500	97.56	97.45	96.96	128	29	17	3.62	0.82	35
DR.SX 1140-12WS	10000	8000	8202	916	500	97.54	97.41	96.87	116	26	15	3.56	0.81	35
DR.SX 1145-12WS	11200	8960	9175	1026	500	97.66	97.56	97.09	131	29	16	3.79	0.84	35

Generators for rated voltage 10.5 kV upon request.

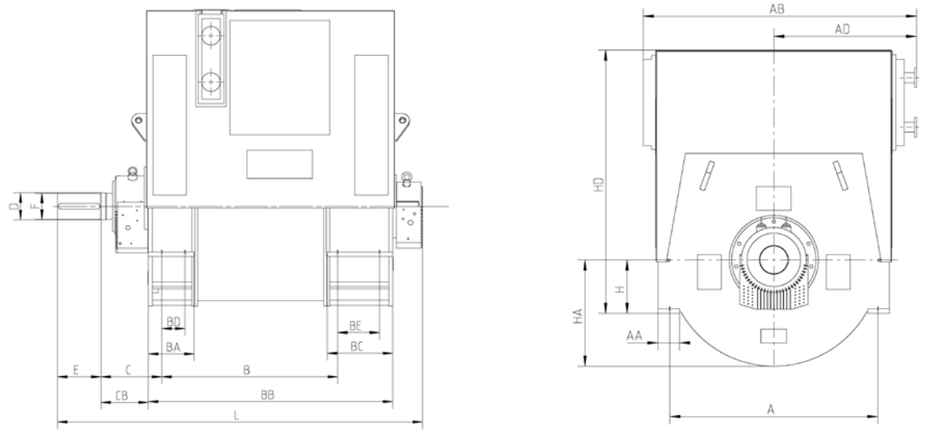
Generators 6.6 kV, 60 Hz

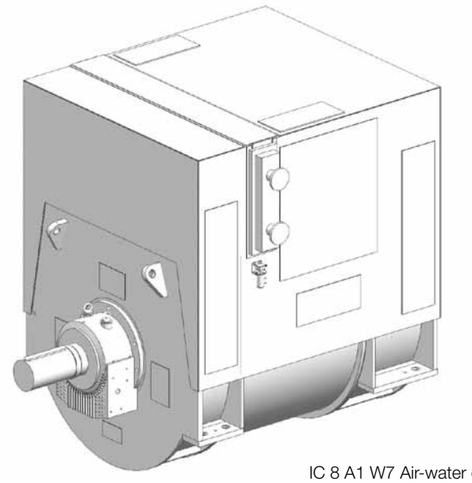
cos φ = 0.8 (+), utilisation F/F
Type DRKSX … with air-water heat exchanger (IC 8 A1 W7), water temperature 38 °C, IP 44
Type DRASX … open-circuit air cooling (IC 0 A1), air intake temperature 45 °C, IP 23

	Apparent power	Active power	Mech. power	Norminal power	Speed	Efficiency			Reactances			Time constants		
Type	S_n	P_n	P_{mech}	I_n	n	η 4/4	η 3/4	η 2/4	xd	xd'	xd''	T'do	T'd	T''d
	[kVA]	[kW]	[kW]	[A]	[min⁻¹]	[%]	[%]	[%]	[%]	[%]	[%]	[s]	[s]	[ms]
8-pole version														
DR.SX 9020-8WS	5000	4000	4114	437	900	97.22	97.03	96.35	130	27	16	3.20	0.65	22
DR.SX 9022-8WS	5600	4480	4600	490	900	97.39	97.22	96.61	142	28	17	3.39	0.67	22
DR.SX 9025-8WS	6300	5040	5172	551	900	97.45	97.27	96.67	140	27	16	3.50	0.68	21
DR.SX 9028-8WS	7100	5680	5821	621	900	97.57	97.43	96.88	153	28	17	3.73	0.70	21
DR.SX 9032-8WS	8100	6480	6635	709	900	97.66	97.47	96.87	137	26	15	3.71	0.69	21
DR.SX 9036-8WS	9200	7360	7533	805	900	97.70	97.54	97.00	146	27	16	3.85	0.71	21
DR.SX 1022-8WS	7100	5680	5823	621	900	97.55	97.33	96.67	143	29	17	3.98	0.81	29
DR.SX 1025-8WS	8500	6800	6965	744	900	97.63	97.43	96.80	137	27	16	3.97	0.80	29
DR.SX 1028-8WS	9500	7600	7775	831	900	97.75	97.56	97.00	148	29	17	4.25	0.83	29
DR.SX 1032-8WS	10500	8400	8586	919	900	97.83	97.65	97.10	157	30	17	4.50	0.86	29
DR.SX 1036-8WS	12000	9600	9808	1050	900	97.88	97.72	97.19	163	31	17	4.64	0.87	28
DR.SX 1040-8WS	13600	10880	11108	1190	900	97.95	97.78	97.24	160	30	17	4.68	0.87	28
DR.SX 1125-8WS	11200	8960	9174	980	900	97.67	97.40	96.65	116	24	15	4.89	1.03	36
DR.SX 1128-8WS	12500	10000	10230	1093	900	97.75	97.48	96.75	118	24	15	5.15	1.06	36
DR.SX 1132-8WS	14000	11200	11445	1225	900	97.86	97.58	96.86	120	24	15	5.41	1.08	36
DR.SX 1136-8WS	16000	12800	13075	1400	900	97.90	97.62	96.90	114	23	14	5.38	1.07	35
DR.SX 1140-8WS	18500	14800	15097	1618	900	98.03	97.85	97.28	163	31	17	6.25	1.18	35
DR.SX 1145-8WS	21000	16800	17139	1837	900	98.02	97.83	97.27	148	28	16	6.19	1.17	35
10-pole version														
DR.SX 9020-10WS	4200	3360	3461	367	720	97.07	97.01	96.50	113	24	15	3.34	0.72	21
DR.SX 9022-10WS	4800	3840	3951	420	720	97.18	97.15	96.69	121	26	16	3.47	0.73	21
DR.SX 9025-10WS	5500	4400	4522	481	720	97.30	97.26	96.78	115	24	15	3.47	0.73	20
DR.SX 9028-10WS	6300	5040	5175	551	720	97.40	97.37	96.93	120	25	15	3.60	0.74	20
DR.SX 9032-10WS	7000	5600	5742	612	720	97.52	97.45	97.00	122	25	15	3.77	0.76	20
DR.SX 9036-10WS	8000	6400	6561	700	720	97.54	97.48	97.01	114	23	14	3.67	0.75	20
DR.SX 1022-10WS	6300	5040	5180	551	720	97.29	97.15	96.54	128	26	16	4.05	0.82	27
DR.SX 1025-10WS	7200	5760	5914	630	720	97.40	97.28	96.72	137	27	17	4.31	0.85	27
DR.SX 1028-10WS	8200	6560	6729	717	720	97.49	97.36	96.81	137	27	16	4.42	0.86	27
DR.SX 1032-10WS	9500	7600	7789	831	720	97.57	97.44	96.91	136	26	16	4.50	0.86	27
DR.SX 1036-10WS	11000	8800	9018	962	720	97.58	97.44	96.88	120	23	15	4.25	0.82	26
DR.SX 1040-10WS	12200	9760	9994	1067	720	97.66	97.52	97.00	127	24	15	4.45	0.84	26
DR.SX 1125-10WS	10000	8000	8202	875	720	97.54	97.31	96.64	119	26	15	4.26	0.92	36
DR.SX 1128-10WS	11000	8800	9012	962	720	97.65	97.44	96.78	127	27	15	4.57	0.96	36
DR.SX 1132-10WS	12500	10000	10230	1093	720	97.75	97.56	96.96	140	29	16	4.88	1.00	35
DR.SX 1136-10WS	14000	11200	11450	1225	720	97.82	97.63	97.04	142	29	16	5.04	1.01	35
DR.SX 1140-10WS	16000	12800	13079	1400	720	97.87	97.69	97.11	140	28	15	5.05	1.01	35
DR.SX 1145-10WS	18000	14400	14706	1575	720	97.92	97.71	97.12	132	26	14	5.08	1.00	35
12-pole version														
DR.SX 9020-12WS	3350	2680	2772	293	600	96.67	96.55	95.90	105	29	17	2.35	0.65	21
DR.SX 9022-12WS	3750	3000	3103	328	600	96.68	96.55	95.87	98	27	16	2.32	0.64	21
DR.SX 9025-12WS	4250	3400	3514	372	600	96.75	96.61	95.91	96	26	15	2.37	0.65	21
DR.SX 9028-12WS	4750	3800	3922	416	600	96.89	96.81	96.24	107	29	16	2.55	0.68	21
DR.SX 9032-12WS	5300	4240	4375	464	600	96.92	96.74	96.02	92	25	14	2.47	0.66	20
DR.SX 9036-12WS	6000	4800	4945	525	600	97.06	96.89	96.23	99	26	14	2.58	0.68	20
DR.SX 1022-12WS	4800	3840	3961	420	600	96.94	96.80	96.09	97	26	15	2.86	0.77	28
DR.SX 1025-12WS	5600	4480	4608	490	600	97.22	97.09	96.49	115	30	17	3.18	0.84	28
DR.SX 1028-12WS	6300	5040	5187	551	600	97.16	97.03	96.39	101	27	15	3.06	0.81	28
DR.SX 1032-12WS	7500	6000	6165	656	600	97.33	97.22	96.65	112	29	16	3.24	0.84	28
DR.SX 1036-12WS	8500	6800	6980	744	600	97.42	97.33	96.82	122	31	17	3.42	0.87	28
DR.SX 1040-12WS	9500	7600	7794	831	600	97.51	97.41	96.90	123	31	17	3.48	0.88	28
DR.SX 1125-12WS	7600	6080	6252	665	600	97.25	97.10	96.48	112	27	16	3.18	0.77	36
DR.SX 1128-12WS	8750	7000	7188	765	600	97.39	97.24	96.65	115	27	16	3.28	0.78	35
DR.SX 1132-12WS	10000	8000	8206	875	600	97.49	97.32	96.71	117	27	16	3.38	0.79	35
DR.SX 1136-12WS	11200	8960	9183	980	600	97.57	97.41	96.84	120	27	16	3.49	0.80	35
DR.SX 1140-12WS	12500	10000	10243	1093	600	97.63	97.44	96.82	113	26	15	3.45	0.79	35
DR.SX 1145-12WS	14000	11200	11459	1225	600	97.74	97.56	97.00	125	28	16	3.69	0.83	35

Generators for rated voltage 11 kV upon request.

Dimension tables for generators in version IC 8 A1 W7; IP 44; IM B3



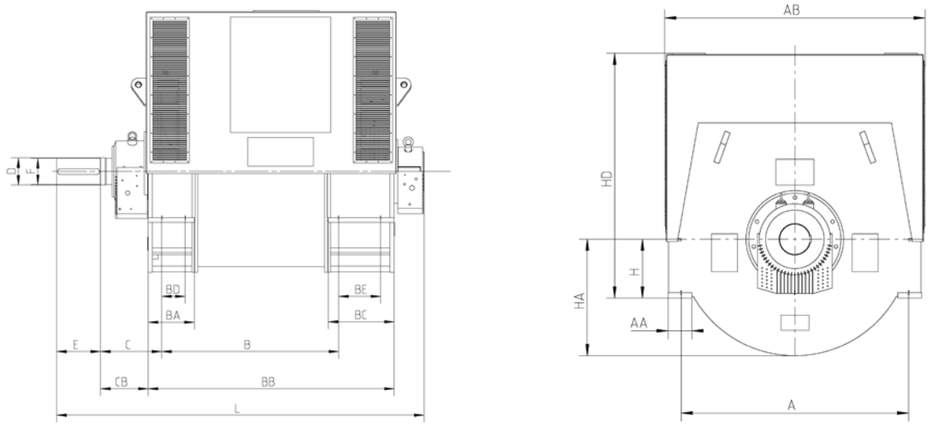


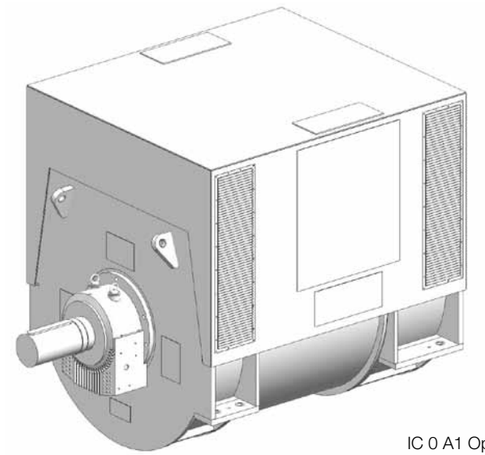
IC 8 A1 W7 Air-water cooling

	Total mass	Rotor mass	Mass moment of inertia	Dimensions mm																		
Type	kg	kg	kgm²	A	AA	AB	AD	B	BA	BB	BC	BD	BE	C	CB	D	E	F	H	HA	HD	L
8-pole version																						
DRKS. 9020-8WS	18380	6330	960	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9022-8WS	19060	6690	1020	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9025-8WS	20100	7230	1120	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9028-8WS	21820	8040	1230	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 9032-8WS	23180	8760	1370	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 9036-8WS	24530	9480	1500	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 1022-8WS	24280	8910	1550	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1025-8WS	25640	9580	1710	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1028-8WS	27000	10260	1860	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1032-8WS	29560	11440	2070	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1036-8WS	31330	12350	2270	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1040-8WS	33100	13250	2470	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1125-8WS	30880	12060	2770	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1128-8WS	32560	12930	3020	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1132-8WS	34740	14100	3350	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1136-8WS	37650	15560	3690	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
DRKS. 1140-8WS	39830	16720	4020	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
DRKS. 1145-8WS	42610	18180	4440	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
10-pole version																						
DRKS. 9020-10WS	18260	6600	1040	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9022-10WS	18930	6980	1110	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9025-10WS	19950	7540	1230	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9028-10WS	21650	8380	1340	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 9032-10WS	22980	9130	1490	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 9036-10WS	24310	9890	1640	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 1022-10WS	23600	9080	1620	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1025-10WS	24890	9780	1780	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1028-10WS	26190	10490	1940	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1032-10WS	28670	11710	2160	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1036-10WS	30350	12660	2380	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1040-10WS	32040	13600	2590	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1125-10WS	29580	12180	2850	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1128-10WS	31140	13090	3110	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1132-10WS	33190	14300	3460	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1136-10WS	35950	15800	3810	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
DRKS. 1140-10WS	38000	17020	4160	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
DRKS. 1145-10WS	40590	18530	4600	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380

	Total mass	Rotor mass	Mass moment of inertia	Dimensions mm																		
Type	kg	kg	kgm²	A	AA	AB	AD	B	BA	BB	BC	BD	BE	C	CB	D	E	F	H	HA	HD	L
12-pole version																						
DRKS. 9020-12WS	18390	6870	1120	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9022-12WS	19070	7260	1200	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9025-12WS	20110	7850	1330	1950	180	2540	1330	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2665	3490
DRKS. 9028-12WS	21830	8720	1450	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 9032-12WS	23180	9510	1620	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 9036-12WS	24540	10300	1780	1950	180	2540	1330	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2665	3820
DRKS. 1022-12WS	23590	9250	1680	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1025-12WS	24900	9980	1850	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1028-12WS	26220	10720	2020	2160	200	2760	1440	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2915	3620
DRKS. 1032-12WS	28720	11980	2260	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1036-12WS	30430	12960	2490	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1040-12WS	32140	13950	2720	2160	200	2760	1440	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2915	4040
DRKS. 1125-12WS	29450	12300	2920	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1128-12WS	31040	13240	3190	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1132-12WS	33110	14500	3560	2400	200	2980	1552	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	3245	3930
DRKS. 1136-12WS	35910	16050	3940	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
DRKS. 1140-12WS	37980	17310	4300	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380
DRKS. 1145-12WS	40600	18880	4760	2400	200	2980	1552	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	3245	4380

Dimension tables for generators in version IC 0 A1; IP 23; IM B3





IC 0 A1 Open-circuit cooling

	Total mass	Rotor mass	Mass moment of inertia	Dimensions mm																	
Type	kg	kg	kgm²	A	AA	AB	B	BA	BB	BC	BD	BE	C	CB	D	E	F	H	HA	HD	L
8-pole version																					
DRAS. 9020-8WS	17900	6330	960	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9022-8WS	18580	6690	1020	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9025-8WS	19620	7230	1120	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9028-8WS	21330	8040	1230	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 9032-8WS	22690	8760	1370	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 9036-8WS	24040	9480	1500	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 1022-8WS	23610	8910	1550	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1025-8WS	24980	9580	1710	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1028-8WS	26340	10260	1860	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1032-8WS	28890	11440	2070	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1036-8WS	30660	12350	2270	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1040-8WS	32420	13250	2470	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1125-8WS	30040	12060	2770	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1128-8WS	31720	12930	3020	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1132-8WS	33900	14100	3350	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1136-8WS	36790	15560	3690	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
DRAS. 1140-8WS	38970	16720	4020	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
DRAS. 1145-8WS	41740	18180	4440	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
10-pole version																					
DRAS. 9020-10WS	17780	6600	1040	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9022-10WS	18450	6980	1110	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9025-10WS	19470	7540	1230	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9028-10WS	21160	8380	1340	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 9032-10WS	22490	9130	1490	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 9036-10WS	23820	9890	1640	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 1022-10WS	22940	9080	1620	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1025-10WS	24230	9780	1780	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1028-10WS	25530	10490	1940	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1032-10WS	27990	11710	2160	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1036-10WS	29680	12660	2380	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1040-10WS	31360	13600	2590	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1125-10WS	28730	12180	2850	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1128-10WS	30300	13090	3110	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1132-10WS	32350	14300	3460	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1136-10WS	35090	15800	3810	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
DRAS. 1140-10WS	37140	17020	4160	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
DRAS. 1145-10WS	39720	18530	4600	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380

	Total mass	Rotor mass	Mass moment of inertia	Dimensions mm																	
Type	kg	kg	kgm²	A	AA	AB	B	BA	BB	BC	BD	BE	C	CB	D	E	F	H	HA	HD	L
12-pole version																					
DRAS. 9020-12WS	17910	6870	1120	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9022-12WS	18590	7260	1200	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9025-12WS	19630	7850	1330	1950	180	2180	1480	550	2320	840	260	550	560	415	240	410	250	615	985	2280	3490
DRAS. 9028-12WS	21340	8720	1450	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 9032-12WS	22690	9510	1620	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 9036-12WS	24050	10300	1780	1950	180	2180	1810	550	2650	840	260	550	560	415	240	410	250	615	985	2280	3820
DRAS. 1022-12WS	22930	9250	1680	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1025-12WS	24240	9980	1850	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1028-12WS	25550	10720	2020	2160	200	2400	1620	575	2410	790	285	500	625	480	240	410	250	615	1090	2380	3620
DRAS. 1032-12WS	28040	11980	2260	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1036-12WS	29750	12960	2490	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1040-12WS	31460	13950	2720	2160	200	2400	1980	575	2770	790	285	500	625	480	280	470	290	615	1090	2380	4040
DRAS. 1125-12WS	28610	12300	2920	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1128-12WS	30200	13240	3190	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1132-12WS	32270	14500	3560	2400	200	2620	1785	610	2585	800	320	510	685	540	280	410	290	615	1205	2480	3930
DRAS. 1136-12WS	35050	16050	3940	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
DRAS. 1140-12WS	37120	17310	4300	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380
DRAS. 1145-12WS	39740	18880	4760	2400	200	2620	2175	610	2975	800	320	510	685	540	320	470	330	615	1205	2480	4380

Legend

[1] IEC 60034-1 – DIN EN 60034-1

[2] IEC 60034-18 – DIN EN 60034-18

[3] VEM publication: *Dauerwärmebeständigkeit des Isoliersystems VEMoDUR-VPI-155*
(Long-term thermal resistance in the VEMoDUR-VPI-155 insulation system)

[4] IEC 60034-15 – DIN EN 60034-15 (VDE 0530-15)

[5] BDEW – Technical guideline for power-generation plants in the medium-voltage grid,
Richtlinie für Anschluss und Parallelbetrieb von Erzeugungsanlagen am Mittelspannungsnetz
(Guidelines for connection and parallel operation of production systems in the medium-voltage grid)

[6] Transmission Code 2007, *Netz- und Systemregeln der deutschen Übertragungsnetzbetreiber*
(Grid code for German power transmission companies)

[7] FGW – Technical Guideline for production units and equipment,
Part 8: *Zertifizierung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen am Mittel-, Hoch- und Höchstspannungsnetz*
(Certification of electrical properties in power-generation units and plants in the medium, high and very high-voltage grid)

[8] FGW – Technical Guideline for production units and equipment,
Part 4: *Anforderungen an Modellierung und Validierung von Simulationsmodellen der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen*
(Requirements for modelling and validating simulation models for electrical properties in power-generation units and plants)

[9] FGW – Technical Guideline for production units and equipment,
Part 3: *Bestimmung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen am Mittel-, Hoch- und Höchstspannungsnetz*
(Determination of electrical properties of generating units and plants in the medium, high and very high-voltage grid)

Notizen

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