Industrial Motors

Commercial & Appliance Motors

Automation

Digital & Systems

Energy

Transmission & Distribution

Coatings

Synchronous Condensers

A **flexible, efficient and complete** solution

Driving efficiency and sustainability

WEG's synchronous condensers are rotating electrical machines which have been specifically developed to provide voltage support to electrical networks, and to increase the network inertia and short-circuit power capacity. Our synchronous condensers provide reliable and efficient solutions for improving stability and voltage regulation in electrical power grids.

With the retirement of large thermal power plants and the increase in renewable energy technologies such as wind and solar power, the instability of transmission networks becomes a challenge which WEG's synchronous condensers help to address. In addition to providing smooth, step-less, and highly responsive voltage regulation, WEG's synchronous condensers also provide greater short circuit power capacity and increase grid inertia. When variations in the reactive power (VAr) on a grid are not balanced, the results can include voltage instability, system isolation (islanding), voltage collapse and, in extreme cases, cascading failures like the Northeast blackout of 2003 in US. The need for synchronous condensers on electricity grids can be caused by a range of factors, such as retirement of large power generation plants, failures in transmission lines, increasing peak demands, high concentration of wind power generation or other power generation with unstable characteristics, and others.

Providing or absorbing reactive power dynamically and smoothly and without the need for switching, offering inertia and short-circuit power to the system, synchronous condensers are becoming more commonly used to ensure the electrical power quality, stability, and reliability on transmission networks. Using state-of-the-art design tools and first-class manufacturing processes, WEG provides rotating synchronous condensers tailored to our customer's needs and built to support compliance with transmission grid codes as they continue to change along with our changing use of power generation resources.

Why use Synchronous Condensers?

Synchronous condensers result in considerable economic and operational advantages due to its operating characteristics. The main advantages are:

Flexibility of power system operation

Increased flexibility of power system operation in all load conditions. Synchronous condensers provide fast injection of reactive power to limit voltage drops and fast absorption of reactive power to limit voltage rises.

Voltage stabilization

Provides smooth, step-less, and highly responsive voltage regulation with no switching required.

Increase in the system inertia

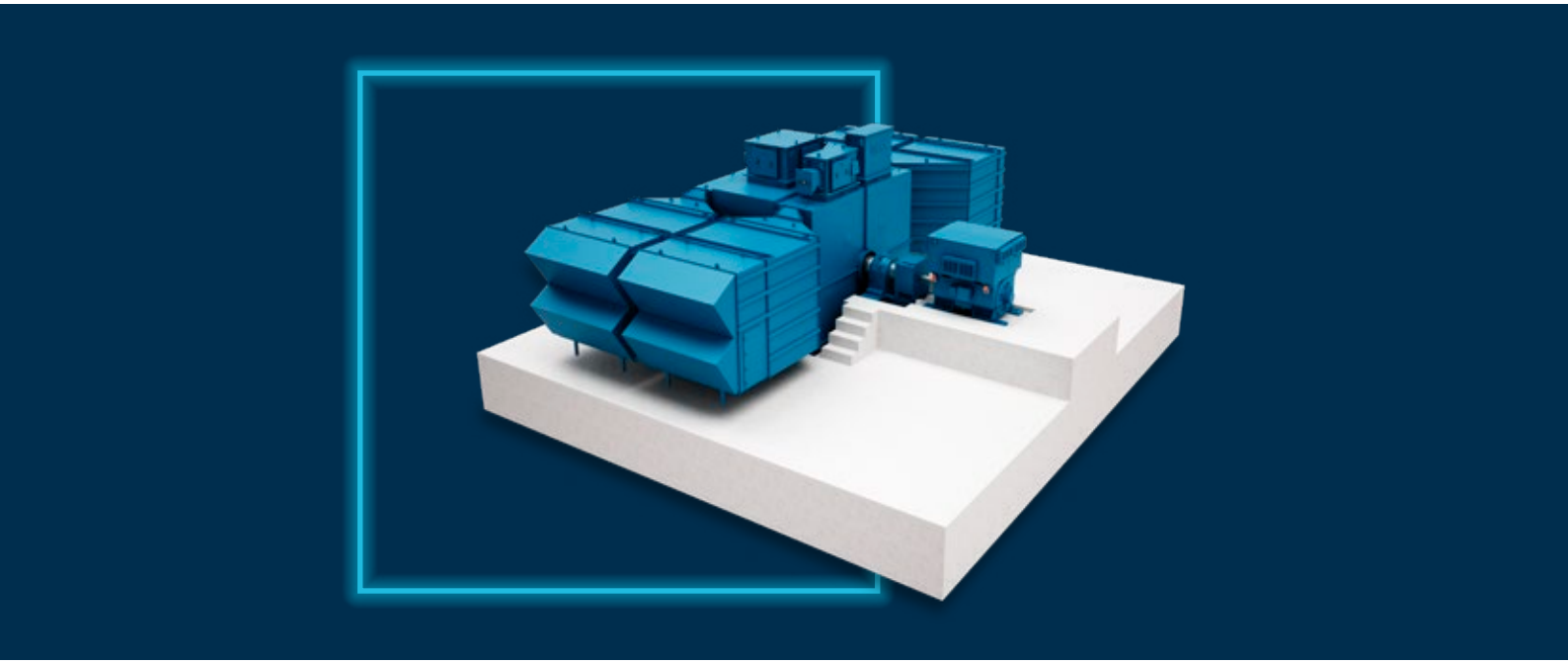
Increased network inertia helps to limit the network's rate of change of frequency and helps support low-voltage ride through requirements.

Voltage level adjustment

Compensates for voltage drops over long transmission lines, resulting in improved transmission capacity and efficiency.

Reactive compensation

Provides reactive power compensation without introduction of significant transients, resonances, or harmonics to the grid.



Why use Synchronous Condensers?

Space optimization
Optimal use of physical installation space.

Optimize power generation
Can allow other generators on the network to provide more active power by removing the burden of reactive power support: at wind and solar farms, this can raise the rated plant capacity.

Simplified operation
Avoids constant variation in taps of step-up transformers.

Reduces the number of maneuvers
Reduces the number of maneuvers with reactors or transmission line switching when necessary to correct the voltage value of the electrical system.

Grid reliability
Increases grid reliability: due to the ease of voltage adjustment with a synchronous condenser, it is possible to avoid a series of other operations necessary to achieve the same effect which require more time, more equipment, and more device communication; consequently, more risk.

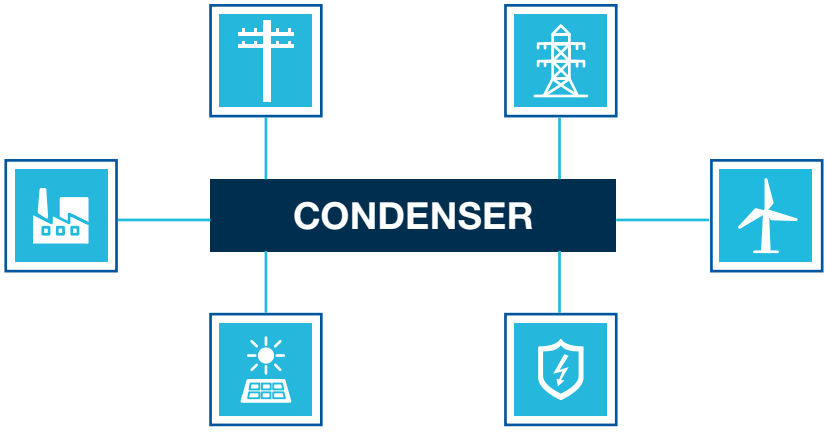
Aplications

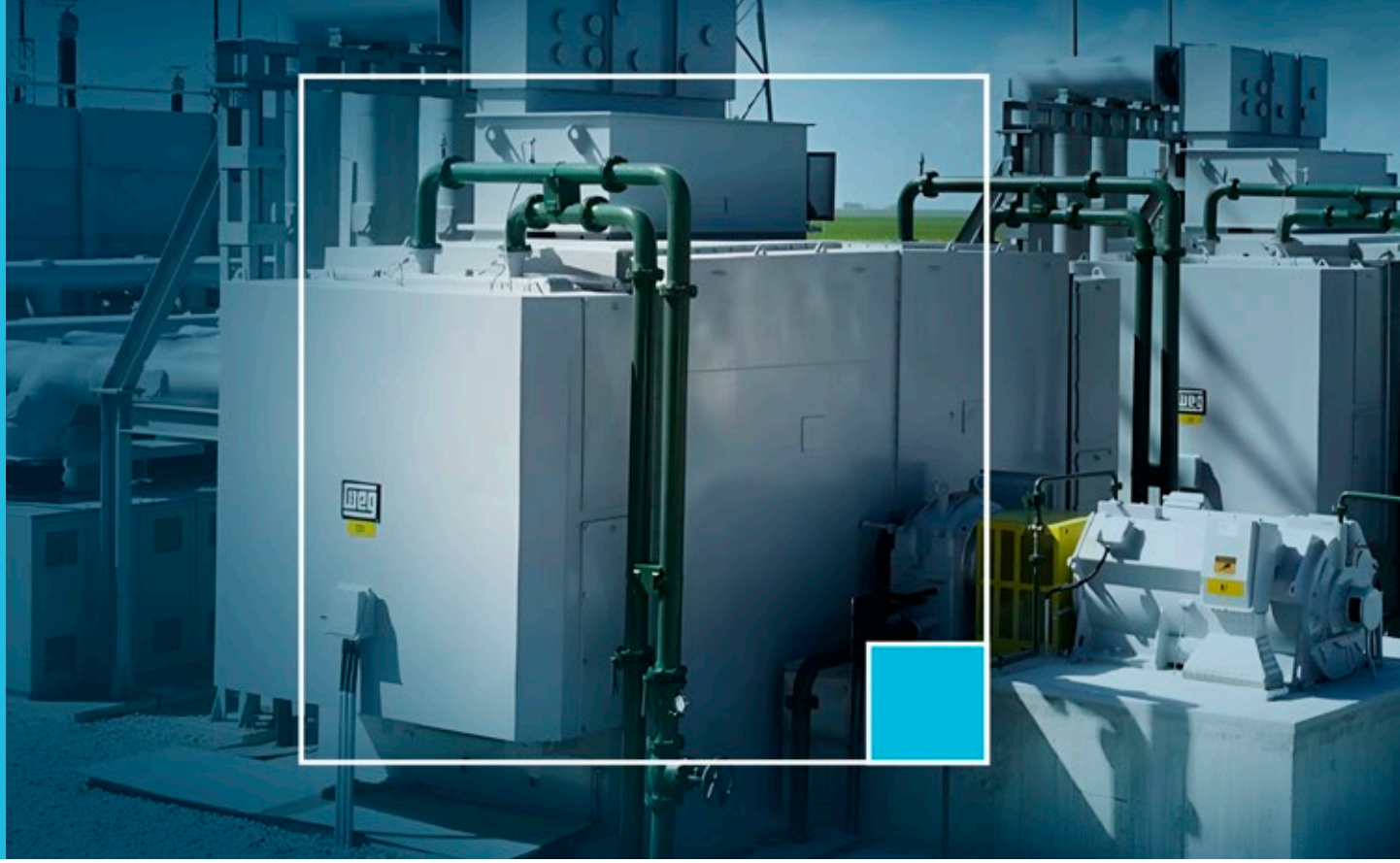
WEG's synchronous condensers are most commonly used in power generation and transmission systems, as well as in industrial plants that requires grid stability.

Long transmission lines, when unenergized or carrying reduced loads, tend to experience voltage rises towards consumers due to the lines' capacitive effect. When transmission lines are charged, they tend to experience voltage drops as the lines run further from generation sources due to the effects of mutual induction and of a typically inductive network load.

Wind and solar farms, which typically have low reactive power generation characteristics and limited short-circuit power capacity, require a synchronous condenser to be close to the generating units in order to facilitate the transmission of the generated energy to consumers. The synchronous condenser, through excitation control, maintains the balance of the power system, absorbing or providing reactive power as necessary and maintaining the voltage of the network within the recommended standards for system operation and for optimal of energy flow.

Grids with low short-circuit power capacity and high instability are optimized with synchronous condensers, due to their intrinsic characteristics of adding short-circuit power capacity and network inertia to the connection point.





Technical characteristics

- Power range: up to ±150,000 kVAr - 15,000 V - 60 Hz
  up to ±120,000 kVAr - 15,000 V - 50 Hz
- Degrees of protection: IP23/IP24W up to IP44/IP55
- Constructive forms: IM1001 or IM1005 (B3), IM7311 (D5), IM7315 (D6)
- Cooling method: TEWAC, TEAAC, WPII

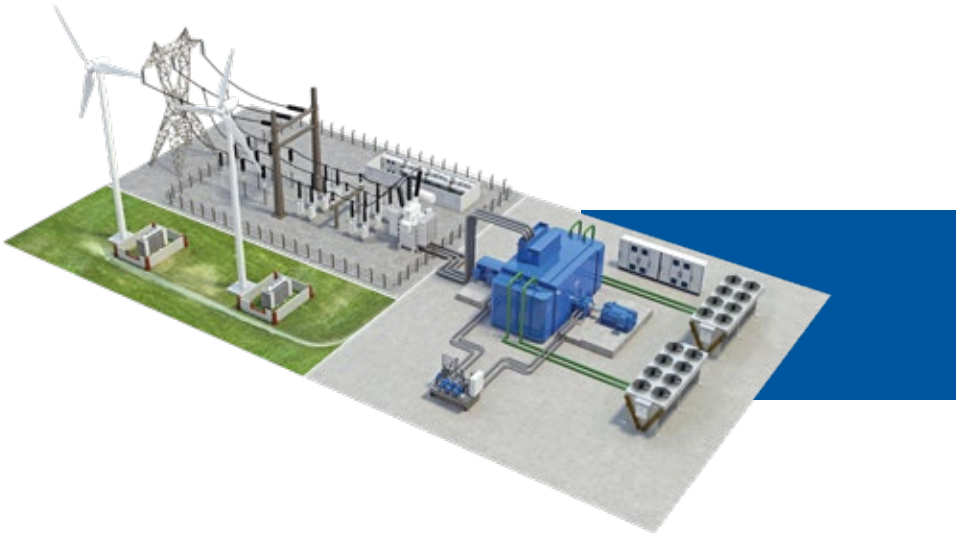
Standards and certifications

WEG's synchronous condensers are designed to the appropriate standards, such as IEC, NEMA, IEEE and ABNT, among others. To meet the needs of the most demanding world markets, WEG has a quality system certified by the Bureau Veritas Quality Institute, per the requirements of ISO 9001 and ISO 14001.

Complete solution

WEG provides the complete solution for synchronous condenser systems:

- Synchronous condenser
- Control, protection, synchronization and exicitation system
- Step-up and auxiliary transformers
- Condenser starting system (pony motor)
- Cooling system
- Lubrication oil system
- Other equipment as needed



Types of excitation

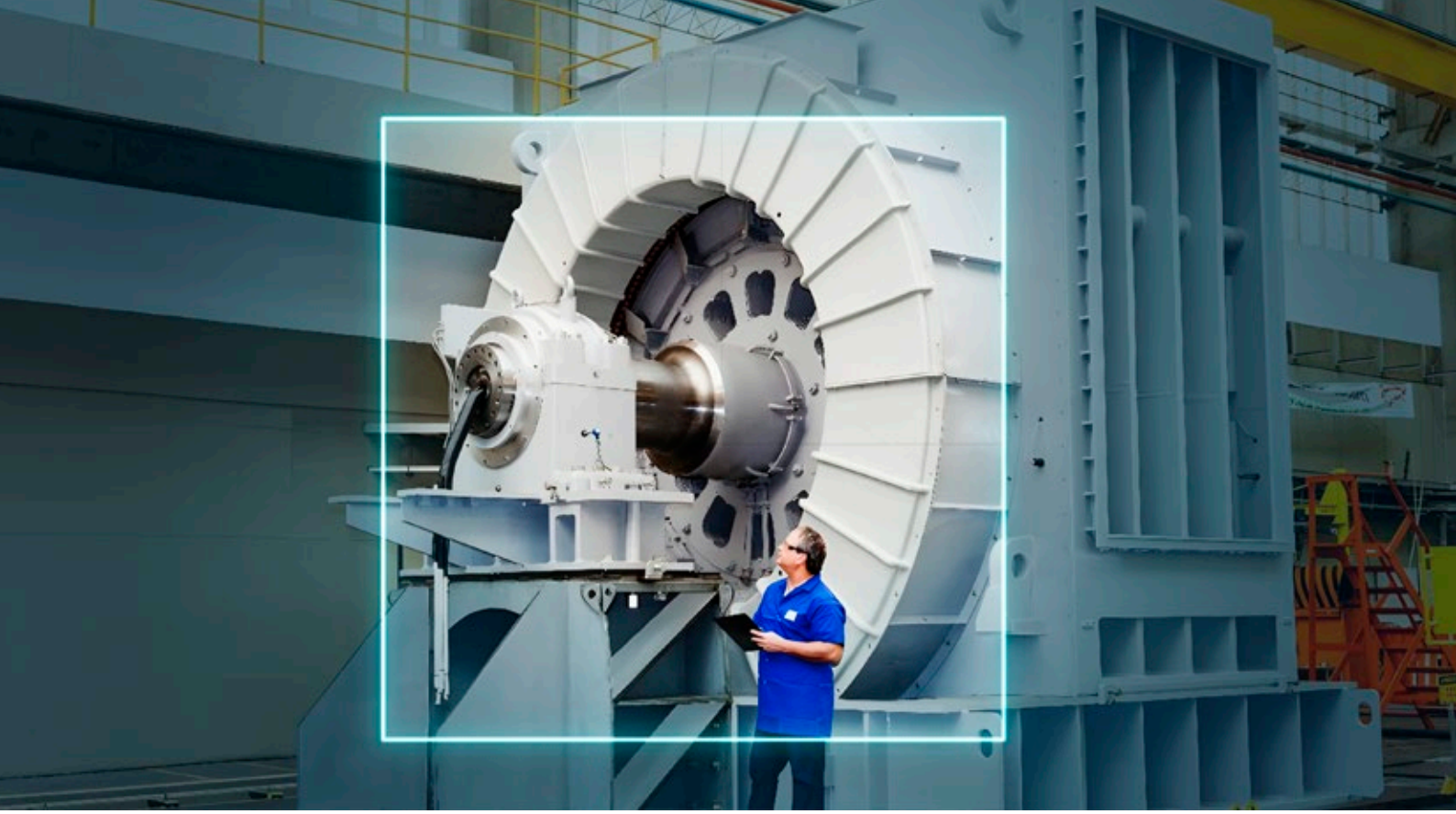
Synchronous condensers require a direct current source to power the field winding (rotor winding), which is usually supplied through a static exciter (with brushes) or a brushless exciter.

Static exciter (with brushes)

WEG's static exciters are comprised of an arrangement of collector rings and brushes, which supply the synchronous condenser's field winding. DC power for the field winding is sourced from a static AC/DC converter and the excitation system controller.
This system allows positive and negative field excitation of the synchronous condenser, as is often required, thus allowing operation of the condenser across its capability curve.

Brushless exciter

WEG's brushless excitation system includes a rotating exciter, typically mounted at the rear of the condenser, which is powered by the excitation control system's AC/DC controller. The exciter's rotor supplies the field winding with DC power through a rotating diode wheel.



Constructive characteristics

Bearings

WEG synchronous condensers are supplied with sleeve bearings that can be designed with forced lubrication or self-lubrication. The bearings can be specified with a jacking oil system to be used during the condenser start-up and shut-down conditions in order to prevent bearing damage.

Condenser starting system

WEG typically provides a correctly sized three-phase induction motor, fed by a matching variable frequency drive, which is coupled to the shaft of the synchronous condenser to provide smooth condenser starting with minimum impact to the power supply.
The auxiliary motor and respective frequency drive can also be designed to stop the synchronous condenser by regenerative braking, returning energy to the power grid during machine shutdown.
WEG also provides other types of condenser starting systems based on customer preferences.

Cooling method and ingress protection

Most often, WEG provides synchronous condensers which are:

- IC01: open, air cooled with protection degree IP23/ IP24W
- IC81W: totally enclosed, with water-to-air heat exchanger with protection degree IP44/IP55
- IC611: air-to-air heat exchanger, with protection degree IP44/IP55

WEG will supply the cooling system that best meets our customer's needs. Beyond the above basic configurations, this includes forced ventilation systems, ducted air inlets and/or outlets, and other cooling configurations as necessary to ensure optimum system performance considering the characteristics of the application and the environment where the condenser will be installed.

The scope of WEG Group solutions
is not limited to products and solutions
presented in this catalogue.
To see our portfolio, contact us.

For WEG's worldwide
operations visit our website

www.weg.net

+55 47 3276.4000
energia@weg.net
Jaraguá do Sul - SC - Brazil

Cod: 50071684 | Rev: 00 | Date (m/y): 07/2023.