Grid Solutions

F35-72.5 KV GIS

Gas-Insulated Substations For Wind Turbines With SF_6 or SF_6-free with g^3 gas

Handling more power while reducing energy losses

Globally, governments are advocating for incorporating more renewable energy into electrical grids. Windfarms are seeing significant growth with more powerful windfarms gradually moving into deeper waters, much farther from shore. The F35-72.5 kV GIS is capable of doubling the voltage as compared with medium-voltage technologies. Energy from a wider area can be handled by a single platform using 66 kV AC, and energy losses can be reduced.

Withstand to harsh environment

F35-72.5kV GIS is designed to cope with the saline environment, the high shocks and accelerations at every stage from construction, transport, installation and commissioning, and with turbulent offshore weather.

Short installation time

Full modules are assembled, cabled, tested in factory and transported as ready-to-plug-in components.

Expert condition monitoring system

The BWatch condition monitoring system monitors gas density and provides trend information to anticipate losses and plan maintenance.

Reduced carbon footprint

The F35-72.5 kV GIS is available in a fully SF_6-free version using Grid Solutions' g^3 technology, allowing for a 99% reduction CO_2-eq gas contribution to global warming while maintaining the same performance and ratings as SF_6 equipment. Its low mass reduces the impact of the manufacturing phase on global warming, and its advanced sealing system and improved tightness help minimize gas leaks and the amount of maintenance.

The Path to Decarbonization

- The F35g-72.5 kV SF_6-free GIS is part of our GRiDEA portfolio of solutions designed to accelerate the decarbonization of the grid
- Contribution to carbon emission of the gas embedded in the GIS is reduced by 99% using g^3 gas instead of SF_6

Key Features

- Bays are completely factory-assembled, wired and tested before shipment
- The HV substation can be integrated in the wind turbine tower or in the transition piece
- Easy HV cable connection with T-connector (based on EN50180/ EN50181 and future EN 50673) or standard plugin type IEC 62271-209
- Remote operation with digital monitoring and control
- Extensive experience in offshore GIS since 2005

Dual Gas Concept

- The GIS is applicable to offshore wind turbines (OWT) with SF_6 or g^3 gas
- The dimensions and ratings are the same for both GIS
- Both solutions offer the same compactness and modularity

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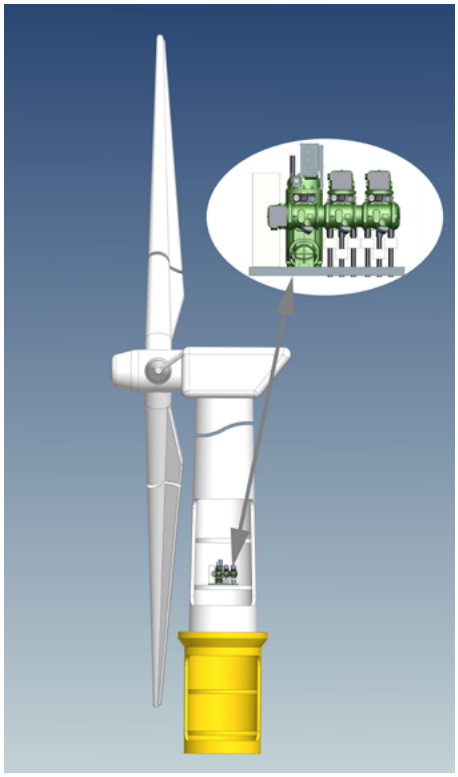
Main Components

- The design is modular and accommodates all types of configurations or single-line-diagrams.
- The circuit-breaker safely interrupts high capacitive current on cables - a specific feature of wind-farms with no risk of non-disruptive discharge.
- The system, fitted with disconnecting circuit-breakers and make-proof earthing switches, provides a high resilience to misoperations.
- The operation of make-proof earthing switches is secured by capacitive sensors providing a voltage presence indication on the cable entries.
- The three-phase power voltage transformer enables provision of emergency power supply.
- Efficient cable connection with the latest T-connector design, Type F (based on EN50180/EN50181 and future EN 50673).
- The local control cubicle integrates all protection and control systems with digital communication.

Typical GIS Configuration, built as “Plug & Play Module”

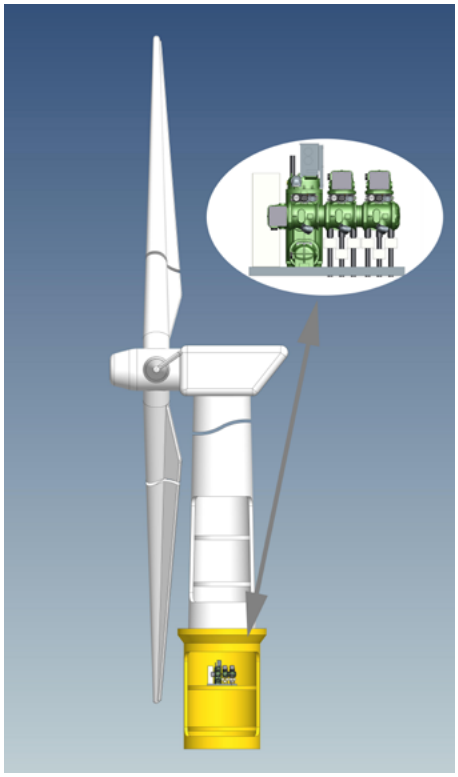
Configuration can be flexibly adapted to customer requirements all pretested on a common frame. Displayed setup contains double circuit breaker, double cable array connector, connector to the wind turbine generator (WTG), busbar with three-position disconnector-earthing switches, make proof earthing switches, Service Voltage Transformer (SVT), Metering Voltage Transformer (VT), manual disconnecting devices for VTs, voltage detection systems for cable interfaces acc. IEC 61243-5, cable ring core CTs, integrated protection & control cubicle, IEC 61850, fully type-tested for offshore floating conditions.

Several Implementation Choices



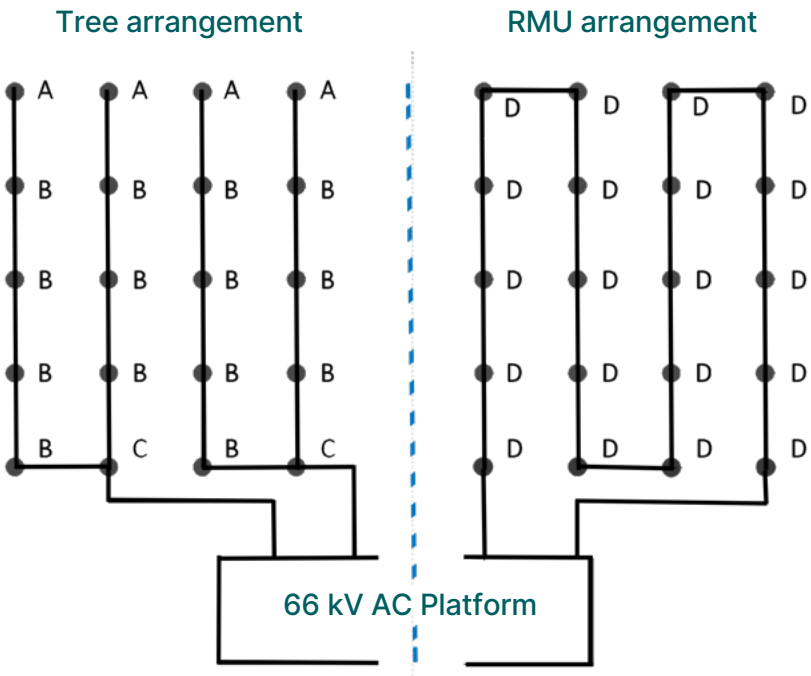
GIS in turbine tower

GIS in transition piece



GIS split between tower and transition piece

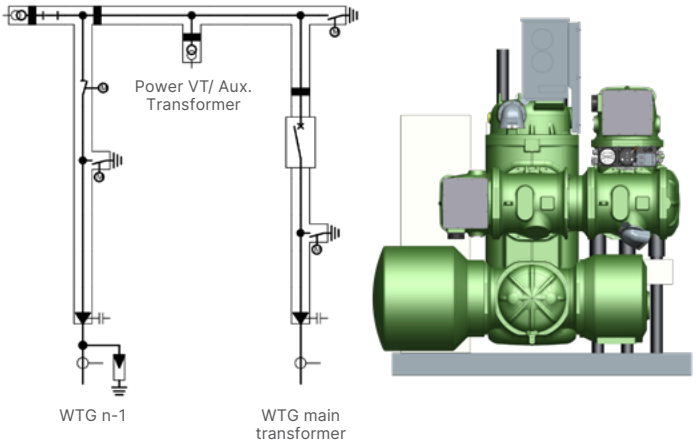
Wind Farms In Tree Arrangement Or In Ring Main Unit Arrangement



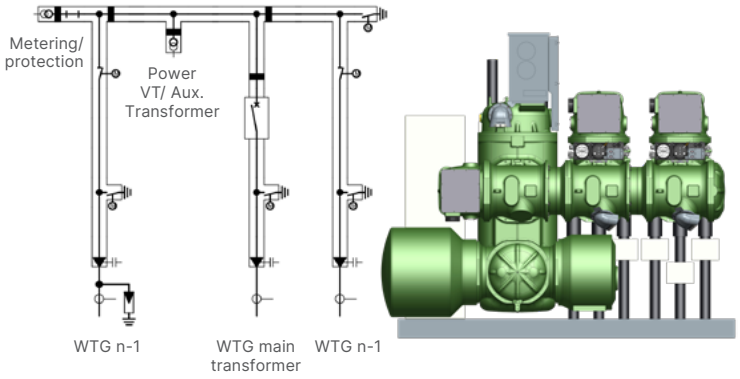
GIS Configurations in Tree Arrangement

Examples of configurations with power voltage transformer. Other configurations available on request. Caption for schemes below: WTG means Wind Turbine Generator

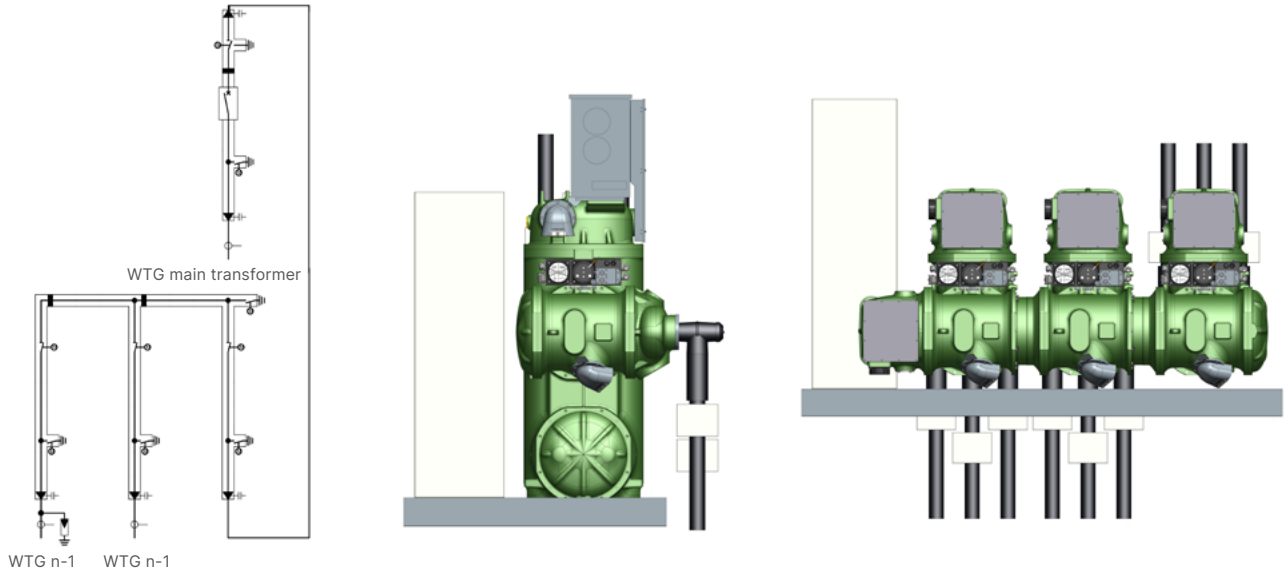
Configuration A – 1 Sea Cable



Configuration B – 2 Sea Cables



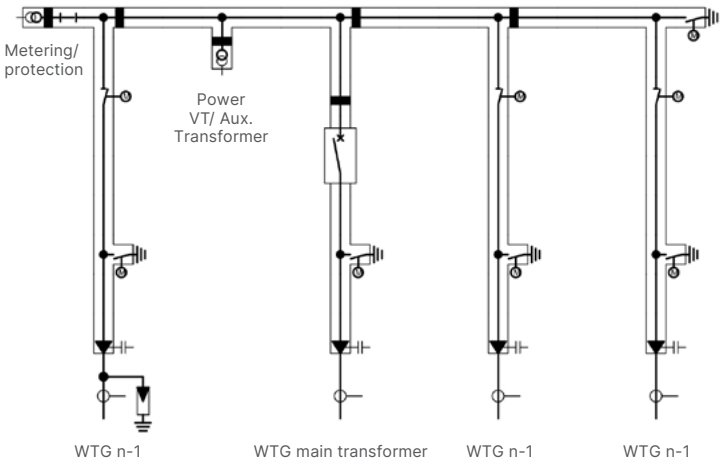
Configuration "B split"- 2 Sea Cables, GIS Split Between Tower and Transition Piece

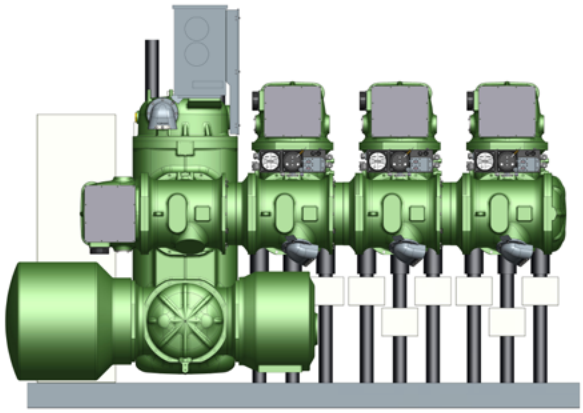


The HV Gas-Insulated Substation fits into the wind turbine.

The wind farm can handle more power while reducing energy losses.

Configuration C – 3 Sea Cables

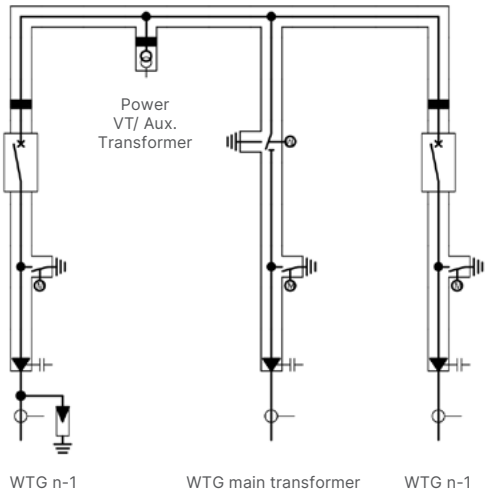


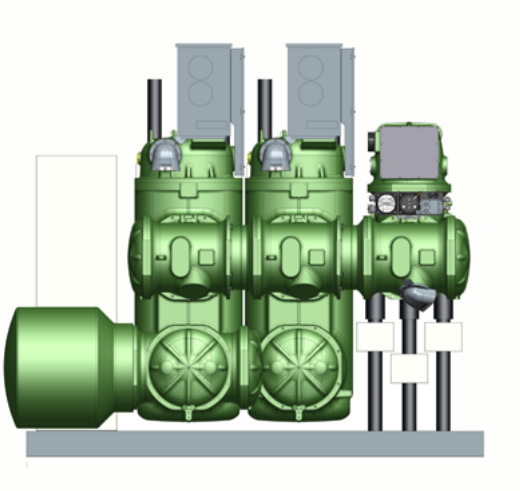


GIS Configurations in Ring Main Unit (RMU) Arrangement

The RMU arrangement provides a higher availability of the network and consequently higher revenues.
It also improves the staff safety during maintenance operations since the modules can be perfectly isolated from the network.

Configuration D - RMU





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F35 72.5 kV Wind module

Seismic tests performed on shaking table at CESI Laboratory, in Italy.

Manufactured in our competence center in Oberentfelden, Switzerland.

1.0g

- √ Seismic (Earthquake) tests according to IEEE 693
  Highest performance level passed 1.0g, inclusively O-CO
- √ Random vibration test passed

Technical Specifications

GENERAL RATINGS			
Reference electrotechnical standards		IEC / IEEE	IEC / IEEE
Rated voltage	kV	72.5	72.5
Insulating and switching gas		g^3	SF_6
Withstand voltages • Short-duration power-frequency , phase-to-earth/ across isolating distance • Lightning impulse, phase-to-earth/ across isolating distance	 kV kVp	 140/160 325/375	 140/160 325/375
Frequency	Hz	50/60	50/60
Continuous current	A	up to 2500	up to 2500
Short-time withstand current	kA	31.5	31.5
Peak withstand current	kAp	85	85
Internal arc classication class	GIS compartments: 31.5 kA - 0.5 s (IEC 62271-203) Full module: IAC A FLR 25 kA - 0.5 s (IEC 62271-200 - free standing)		
Vibrations	IEEE-normalized seismic test at 1.0 g, including O-CO switching operations Random vibration test acc. IEC at level 2M4.		
Cable interfaces	F-Type outer cone acc. EN 50 181 (T-Connector) or IEC 61271-209		
Installation		Indoor/Outdoor	Indoor/Outdoor
CIRCUIT BREAKER RATINGS			
First-pole-to-clear factor		1.5/1.3	1.5/1.3
Short-circuit breaking current	kA	31.5	31.5
Short-circuit making current	kAp	85	85
Operating sequence		O-0.3s-CO-3 min-CO/ CO-15s-CO	O-0.3s-CO-3 min-CO/ CO-15s-CO
Drive type (three-phase)		Pure-spring	Pure-spring
Switching capacity	Class	S2	S2
Mechanical endurance	Class	M2	M2
Capacitive currents switching	Class	C2	C2
DISCONNECTOR AND LOW-SPEED EARTHING SWITCH RATINGS			
Capacitive current switching	A	0.1	0.1
Bus-transfer current switching capability	A / V	1600/10	1600/10
Mechanical endurance	Class	M2	M2
MAKE-PROOF EARTHING SWITCH RATINGS			
Making current capability	kAp	85	85
Switching capability - electromagnetic coupling	A / kV	80/2	80/2
Switching capability - electrostatic coupling	A / kV	2/6	2/6
Mechanical endurance	Class	M1	M1

Gas Data*

The functioning of this equipment relies upon SF_6 or a gas mixture based on CO_2/O_2 and 5% of an additive, C_4F_7N (also known as C_4-FN or Iso-C_3F_7CN), a fluorinated greenhouse gas, which helps preserve dimensions and performance equivalent to those of SF_6 equipment while reducing the gas carbon footprint

	SF_6	g^3	
		C_4F_7N additive**	**g^3 gas mixture**
Average mass of gas/mixture in the equipment (kg)*	38.9	3.83	18.8
GWP_{100} of gas/mixture (CO_2-equivalent)	24,300	2,750	560
CO_2-eq of gas/mixture in the equipment ($t_{co2\text{-}eq}$) *	945.3	10.5	10.5

*For information purposes only considering a typical GIS arrangement (double busbar cable bay). It varies depending on the equipment considered.
** This component's physical properties are essential to g^3.

For more information visit
gevernova.com/grid-solutions

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English
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