



# Pitch Control

Increase reliability and availability with a field-proven design



**EMERSON**<sup>™</sup>





**Proven Pitch Control**  
Cost competitive and well-proven system with 30 years design life.



**Excellent Engineering**  
Robust and innovative design with top-shelf components only.



**High Availability**  
High reliability, simple maintenance procedures and on-the-fly testing.

# Electrical Pitch System

## A Proven Partner

Precise, safe and reliable performance is essential to ensure profitable wind turbine operation. With more than 60,000 control systems and 3,000 pitch systems in operation worldwide, Emerson is your proven technology partner. We introduce an optimized pitch system generation based on knowhow and best practice from previous pitch system generations. Being an integrated part of the wind turbine safety system, the Emerson pitch system is designed to effectively minimize operations and maintenance costs, reduce downtime and improve productivity.

## A New Standard

Emerson's pitch system is a standard turnkey solution that fits any three-bladed wind turbine model up to 10 MW. For turbines up to 20 MW, and for two-bladed turbines, our pitch system is customized with load-sharing between more pitch servo motors and blade units for each individual blade. Our pitch system provides a high degree of availability and reliability, while ensuring safe operation of the wind turbine. A complete standard pitch system is comprised of the following parts:

- 1 x Hub unit
- 3 x Blade units
- 3 x Servo motors
- 3 x Energy storage
- 3 x Sensor sets
- 1 x Customized set of mounting brackets
- 1 x Customized set of cables

Additionally, a service box is available for onsite manual operation.

## Key Benefits

- **Proven Pitch Control** - cost competitive, well-proven and certified system.
- **30 Years Design Life** - highly robust system.
- **Rugged Design** - IP65 units with seawater resistant housings.
- **Durability** - designed for extreme climate variations and high altitude.
- **Excellent Engineering** - top-shelf components only and thorough test procedures.
- **Open System** - open for development and integration of own software in the hub controller.
- **Open Solution** - turnkey or kit-set solutions.
- **High Availability** - high reliability, fast commissioning, self-test on-the-fly and simple maintenance procedures.
- **Performance Optimization** - including pitch performance optimization services.
- **Extended Warranty** - Five years warranty starting from the day of commissioning.
- **Full Support** - remote and onsite support by our Emerson engineers.
- **Certification** - ISO 13849-1, IEC 61400-1, IEC 61400-3, IEC 61400-22, GL 2010, GL 2012 and DNVGL-SE-0441.
- **Compliance** - GB/T 25386 and NB/T 31018.

## Emerson Pitch System

### Hub Unit



- Input voltage: 3 x 400 Vac + N + PE
- Frequency: 50/60 Hz
- Operation temperature: -30°C to +60°C
- Transportation/storage temperature: -40°C to +70°C
- Degree of protection: IP65

The hub unit is available in several ratings:

- Output: 3 x 47 A RMS
- Output: 3 x 76 A RMS

### Hub Unit

The hub unit is the central connection point for distributing power, safety and communication in the hub. The enclosure of the unit is designed to be placed centrally in the hub, or next to the blade 1 units. The unit is equipped with main fuses for each of the blade units, and a hub controller (WP100 Platform), that centralizes the pitch control of all blades and the communication with the wind turbine controller.

The hub unit comes in a rugged seawater-resistant aluminum housing that allows the unit to withstand fluctuations in temperature, humidity, and salty air. The protection class is IP65, and the unit is suitable for use in both on- and offshore wind turbines.

The hub unit is configured to meet the specific requirements of the pitch system and hub.

### Blade Unit



- Output voltage: 0-400 Vac
- Output frequency: 0-300 Hz
- Operation temperature: -30°C to +60°C
- Transportation/storage temperature: -40°C to +70°C
- Degree of protection: IP65

The blade unit is available in several ratings:

- Output nominal current: 45 A RMS
- Output nominal current: 74 A RMS

### Blade Unit

Emerson's pitch system consists of separate and independent blade units, working as an integrated part of the wind turbine safety system. This design allows each of the blade units to activate the safety system in case any unsafe condition develops within the pitch system.

Available in variants with different power performances, the blade unit can be combined with servo motors of different sizes, allowing a variety of combinations. The blade unit is mounted inside the hub near each blade root and is designed to withstand the severe conditions of that specific environment. The blade unit comes in a rugged seawater-resistant aluminum housing that allows the unit to withstand fluctuations in temperature, humidity, and salty air. The protection class is IP65, and the unit is suitable for use in both on- and offshore wind turbines.

### Energy Storage



- Rated voltage: 480 Vdc
- Max. voltage: 510 Vdc
- Operation temperature: -30°C to +60°C
- Transportation/storage temperature: -40°C to +70°C
- Degree of protection: IP65

The energy storage is available in several ratings:

- 480 V 1.9F
- 480 V 3.1F
- 480 V 3.8F
- 480 V 4.2F

### Energy Storage

The energy storage delivers the power and energy to the Emerson pitch system during grid fault (LVRT) and grid drop. The energy storage unit is designed to deliver the required amount of energy and power for safe operation of the pitch system in all conditions. The optimum energy storage unit variant is selected to deliver the required power and energy during LVRT and a following grid drop – and to store the regenerated energy from the pitch servo motors.

Long life of the energy storage unit is ensured by using high quality ultracapacitor cells with +0 to +20% capacitance, integrated voltage balancing of each of the ultracapacitor cells, preheating, temperature control and smart energy storage management. Preheating ensures high performance with low ESR and high current capability at low temperatures.

The energy storage unit comes in a rugged seawater-resistant aluminum housing that allows the unit to withstand fluctuations in temperature, humidity, and salty air. The protection class is IP65, and the unit is suitable for use in both on- and offshore wind turbines.

### Servo Motor



- Rated voltage: 3 x 400 Vac
- Operation temperature: -30 °C to +60 °C
- Transportation/storage temperature: -40°C to +70°C
- Protection class: IP65
- Paint finish: C4/C5
- Bearings: sealed and greased for life
- Cable connection: pluggable
- Temperature sensor: PT100/KTY
- Closed loop control: encoder/resolver
- Brake: safe holding brake
- Cooling: natural/forced ventilation

The servo motors are delivered in several ratings:

- Nominal speed: 1400 to 2800 rpm
- Nominal power: 7.5 to 30 kW
- Peak torque (3s): 150 to 600 Nm

### Servo Motor

The servo motor system includes three-phase asynchronous and synchronous PM motors that are designed as a plug-and-play solution with pluggable cable connections and predefined optimized parameter settings for the Emerson pitch system. The servo motor has integrated temperature sensor, holding brake, encoder/resolver and optional forced ventilation fan.

The holding brake is failsafe and ensures reliable operation in harsh operation and standstill (typhoon) conditions. The holding brake release timing and wear condition is controlled and monitored by the blade unit using overextension, reduced holding current and intelligent sensing. The servo motors are designed for frequency converter operation with isolated and sealed bearings.

The servo motor system includes servo motors that match both on- and offshore requirements, speed and torque requirements, as well as variants to fit the pitch gearbox flange and shaft tolerances.

# Pitch to Perfection



## High Reliability and Availability

Emerson's pitch system is designed to maximize availability and performance of your wind turbines, while applying minimum loads to the structure.

- **High Availability** - high reliability, fast commissioning, self-test on-the-fly and simple maintenance procedures.
- **High Reliability** - reduced components count and high level of integration into the blade units.

Our system pitches the rotor blades collectively (CPC) or individually (IPC) to maintain pitch angle and rotor speed at optimum, and keep the rotor speed within the design limits. For maximum safety, blades are pitched to feathering position - automatically and autonomously in case of safety system activation.

The pitch system continuously monitors the communication from the wind turbine controller, and the health of all system components, including servo motor and energy storage, and it ensures the wind turbine is stopped in case the wind turbine control system should fail to keep the turbine operation within the design limits. In case of grid fault and/or grid drop, Emerson's pitch system is powered from the energy storage.

### APQP4Wind

Emerson's pitch system is developed, tested and manufactured according to the APQP4Wind standard, and all parts come with an extended warranty starting from the day of commissioning.

## Durability

Emerson's pitch system is designed to prevent expensive downtime and costly maintenance. Only a small number of wear parts are used, which is crucial to attaining the long design life of the system, reducing failures at component level, and lowering the overall maintenance costs. This way, Emerson pitch system guarantees you the highest value of investment.

Customers benefit from a modularized pitch system based on various standardized sizes of hub units, blade units, brushless PM servo motors, asynchronous servo motors and energy storages based on either ultracapacitors or long life VRLA batteries.

The hub units can be configured from a long list of standardized options, and can finally be supplemented with customized software for integration with any third-party wind turbine control system, or any special feature required to meet specific demands in the wind turbine hub.

With predetermined parameter sets and a simplified workflow, we guarantee smooth installation, commissioning and maintenance with limited downtime and higher availability.

Whatever you choose, a turnkey- or kit-set solution, we are your dedicated electrical pitch technology partner. This includes pitch performance optimization services ensuring optimal wind turbine operation.

## Robust Design

Our system is designed for the harsh environment in the rotating hub of on- and offshore wind turbines. Emerson's pitch system performs effortlessly in wide temperature ranges from  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ , continuous vibrations and forces induced during constant rotation and emergency stops.

Emerson's pitch system is based on an innovative design with integrated drives.

## Comprehensive Test Procedures



- Emerson's pitch system is the result of thousands of engineering hours and an extensive quality test procedure. Every component is selected and tested specifically for our pitch system.
- To verify the required robustness and performance, we conduct a long range of tests ensuring every component is validated in our laboratories. Combined with automatic tests, this ensures a well-proven and high quality system.
- Even when the system is installed and running, we continue the focus on testing. Regular testing of the our system is conducted on-the-fly, while the turbine continues to operate. This means no expensive downtime is required to perform the scheduled automatic tests.

Without the traditional "cabinet in cabinet" approach, we are able to maximize the system reliability, avoiding high ambient temperatures inside the cabinet.

Remote monitoring, configuration, troubleshooting and software updates allows easy service access and minimal maintenance. Further, all forecasts of maintenance tasks are based on actual wear and the integrated condition monitoring system possibilities are capturing and storing all operational data. Operation and control of the Emerson pitch system is possible via your mobile-, tablet- or PC browser via a graphical and user-friendly desktop.

## Pitch Performance

Emerson's load and control engineers offer simulation of your wind turbine with all IEC61400 load cases, to ensure the pitch system meets the performance requirements in all relevant situations, and at the same time is not oversized.

A simulation report list all required peak, average and aggregated values to select the optimum units for the pitch system solution.

With these pitch performance calculations, you are guaranteed the optimal pitch system for your specific wind turbine.



# An Industry Leader With a **50+ Year** Legacy of **Enabling Increased Reliability** and **Low-Cost Production** of Wind Power

Supporting  
**Sustainability**


 **Wind Industry Pioneer  
Since 1969**

 **+40  
WTG Designs  
Retrofitted**

 **+47  
active markets**

 **+750  
Turbine Types  
Supported**

 **60,000  
Control Systems Worldwide**

 **Best-in-Class  
Software and Automation  
Technologies**  
Wind | Solar | Hydro | Biomass |  
Wave Biomass | Marine | District Heating

 **Focus on  
High Quality**

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