



BONFIGLIOLI WIND INNOVATIVE SOLUTIONS

PERMANENT MAGNET MOTORS WITH INTEGRATED INVERTERS
FOR WIND YAW & PITCH SYSTEMS



We engineer dreams

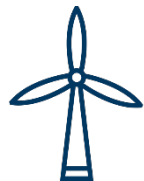
MARKET LEADER IN WIND INDUSTRY

30

OVER 30 YEARS OF EXPERIENCE
with the world's major Wind OEM



CO-ENGINEERING
tailor made solutions



1 OUT 3 WIND TURBINE GLOBALLY
is equipped with Bonfiglioli Yaw & Pitch drive



UNIQUE FOOTPRINT



DEDICATED OFFSHORE SOLUTIONS



GEARED SYSTEMS

PITCH AND YAW SYSTEMS

Both **pitch** and **yaw systems** may take the advantage of the permanent magnet motor technology drive by inverter due to the increased demand of:



RELIABILITY



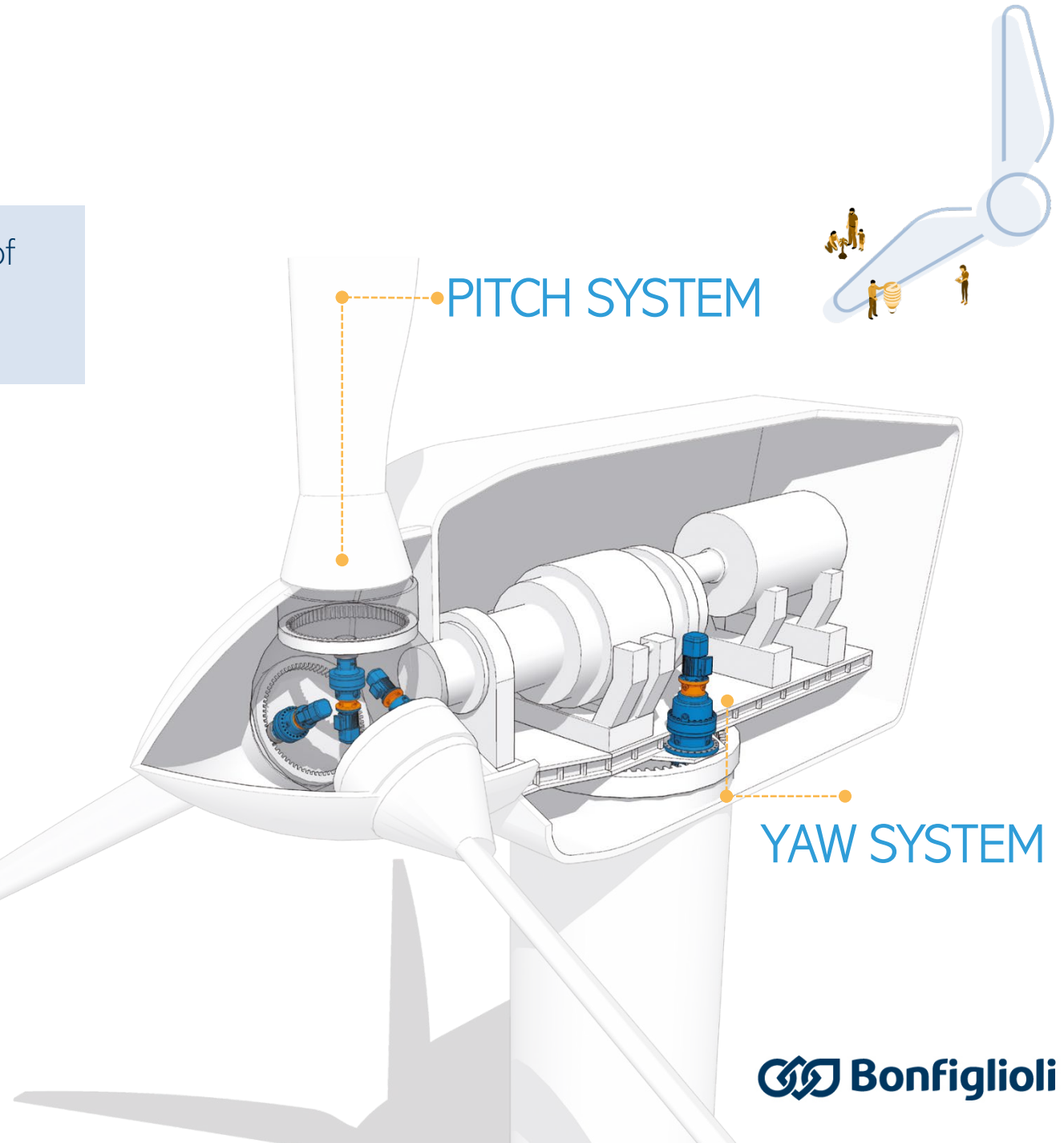
COMPACTNESS



EFFICIENCY



PROFITABILITY AND LOW MAINTENANCE

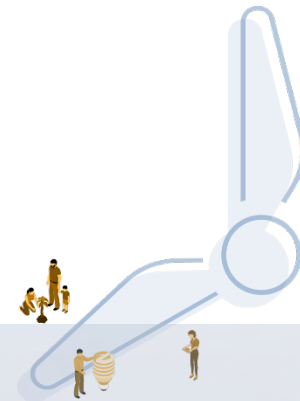


BONFIGLIOLI OFFERS

PERMANENT MAGNET SYNCHRONOUS AC MOTORS

Exploiting its **long-time experience as wind customer supplier** as well as electric motors manufacturer, **Bonfiglioli** is able to provide custom motors with:

- Interior permanent magnet rotor technology
- Frame size up to IEC 200
- Totally enclosed or fan ventilated executions
- Fail safe electromechanical brake
- Absolute position feedback





Thanks to our experience in e-motor control drive units,
Bonfiglioli is able to provide inverter with customized control logic with:

Solutions size up to 22 kW (on board) – 1200 kW (in cabinet):

- Open and close loop controls
- Several field bus communication modules:



CANopen

PROFI[®]
BUS

PROFI[®]
NET

EtherCAT[®]



PERMANENT MAGNET MOTORS ADVANTAGES

PERFORMANCES



Typical characteristics that can be exploited to comply with customer requirements and system redesign:

- High torque density
 - Motor compactness or higher power rating
 - High overload torque or drive rating optimization
- Low rotor inertia
 - More dynamic and shorter cycles



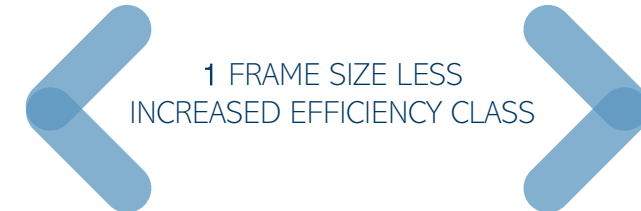
HIGH OUTPUT PACKAGE:

SMALLER FRAME FOR SAME OUTPUT POWER AND EFFICIENCY CLASS OF INSUCTION MOTOR



BMD 112MB 6
5 kW IE4 EFFICIENCY CLASS

BN 132MB 6
5 kW IE1 EFFICIENCY CLASS



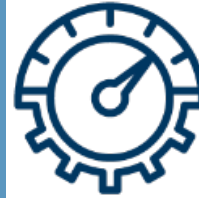
1 FRAME SIZE LESS
INCREASED EFFICIENCY CLASS

PERMANENT MAGNET MOTORS ADVANTAGES

1

Higher Performances thanks to drive control

precise speed and position control; torque control from 0 speed;
Fully 4-quadrant control; extended operations under flux weakening control;
parameters monitoring via drive measurements



2

High motor Efficiency

Regenerative braking exploitation; optimization of multiple axes supply system and
backup system for emergency motor operations; total system efficiency improvement



3

Feedback opportunities

- Mechanically robust and reliable feedbacks - e.g. resolver or bearing-less encoder
- Digital protocols for high noise immunity feedback data transmission - e.g. encoders with bidirectional serial interface and embedded safety functions



4

Brake management

System reliability and maintenance intervals can be improved thanks to the lack of brake wearing due to the fact that dynamic braking does not occur and only holding and emergency braking operations are still required



1

High inverter Power Density

i.e. 55kW in 20kg and less than 30 liters volume



2

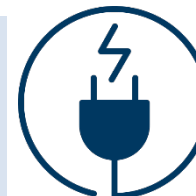
Regenerative operation to save energy

range 10 ÷ 500kVA



3

High Overload Capability

150% I_n for 60s - 200% I_n for 1s

4

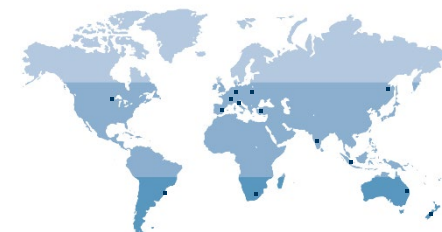
Robust inverter

Coated boards, different mounting variants, cold-plate option



5

Global presence and support





Accurate **Torque control** in all operating points:

- The magnetizing current is ensured shortly before [ms] brake opening
→ **Coordination with brakes**
- **Precise positioning** in both open and closed loop
- Restrict max speed when motor works at rated load
→ **Limit peak torque during rotation**
- Reduce mechanical stress
→ **Smaller holding brakes for slewing ring**
- **Speed control** with torque limit for unwinding operation

4-Quadrant operation

Control of the backlash of the mechanical system

→ **Keep mechanical yaw system in tension**

Torque Sharing

Master / Slave configuration



WIND PACKAGE

E-MOTOR AND DRIVE SIZES*



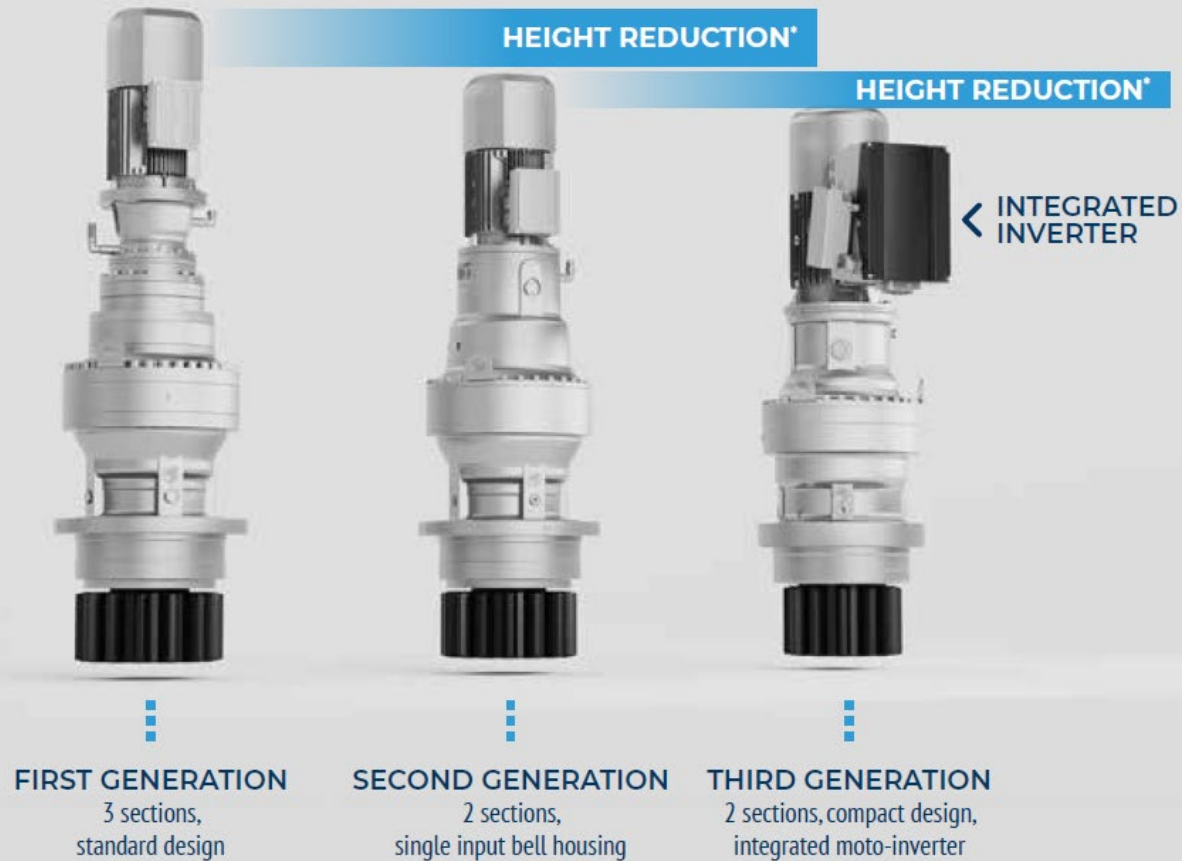
IEC Motor size	Rated speed [min ⁻¹]	Continuous power IC410 [kW]	 Onboard Inverter size	 Cabinet Inverter size
112M	1000	3.7	B	2
	2000	5,0	C	3
132S	1000	4.4	C	3
	2000	6,2	C	3
132L	1000	6.6	C	3
	2000	9,2	D	3
160	1000	11	D	5
	2000	18	D	5
200L	1000	34**	-	6
	2000	55**	-	6

*E-Motor and Drive power output may be subject to de-rating, depending on environmental conditions

**Servo ventilation



Three product generations compared



ONE STOP SHOP, Bonfiglioli will be accountable for the whole entire system, reducing the complexity in managing separate component at customer end.

OVERALL COST SAVING, thanks to the reduced installation cost including a reduced size of electric cabinet

SIMPLER BILL OF MATERIAL, Wind Turbine Bill of Material strong simplification



THANK YOU

We engineer dreams

