

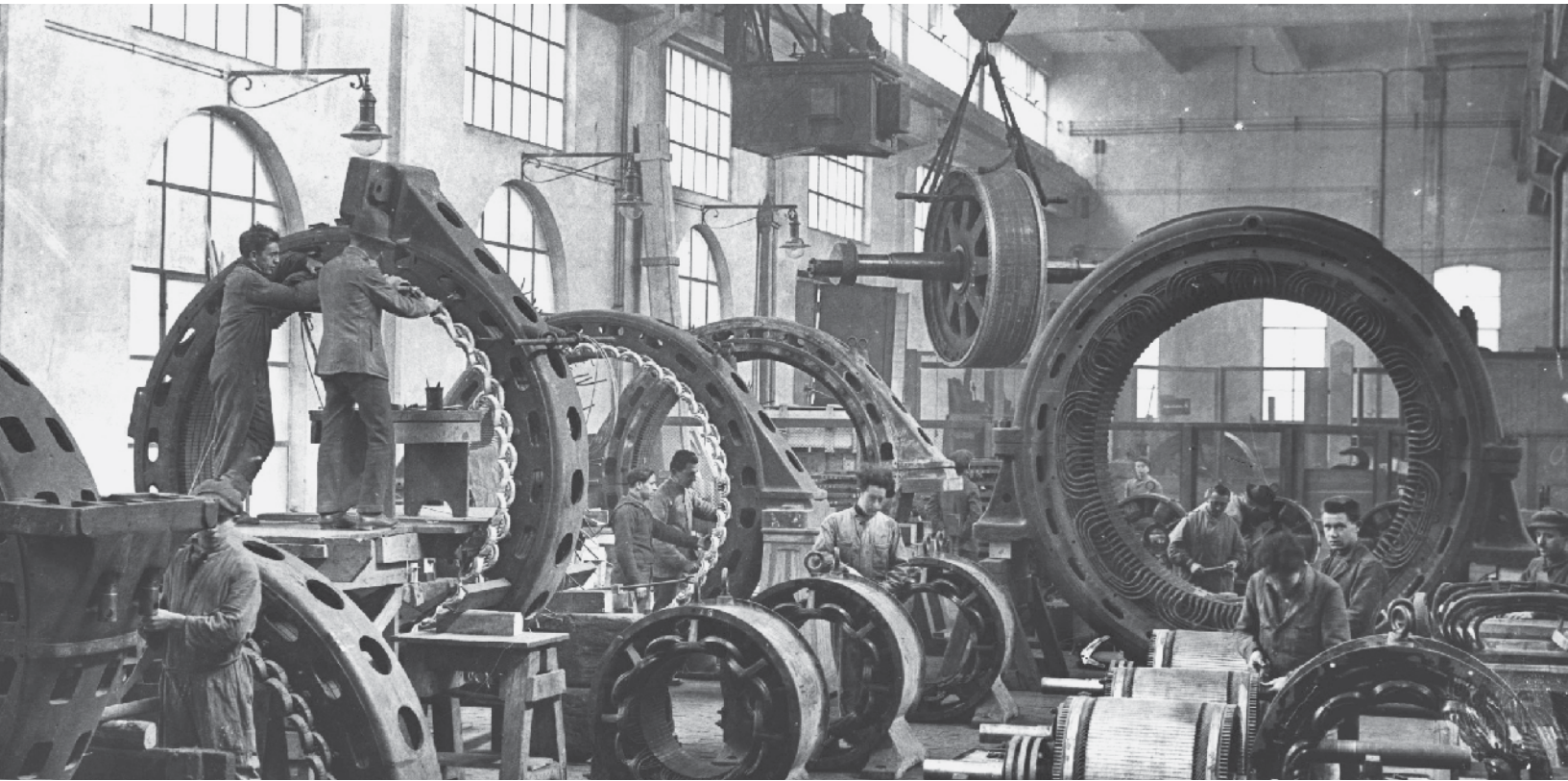


## Motors & Generators





# Number one in electric motors



Nearly 200 years  
of experience  
in the design  
and manufacture  
of electric motors  
& generators



**Nidec: destined to be  
number one  
in industrial power  
solutions.**

With the acquisition of Ansaldo Sistemi Industriali and the Emerson motors and generators divisions Nidec can now offer customers more than 200 years of combined experience in the design and manufacture of electric motors & generators for the energy, metal, environmental, marine and industrial markets. Nidec has the experience to deliver process oriented electric motors either as a stand-alone component or a fully engineered system with drives, switch gears and controls.

The combination of technologies and background is the base of our expertise in engineering flexible, customized solutions for global industrial markets at competitive prices.



# Pareto Efficiency solutions



**Designing motors  
and generators with the  
right fit for your needs**

## **The most efficient and robust machines for heavy duty industrial applications**

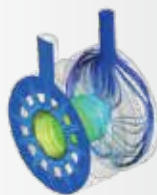
Nidec Industrial Solutions has built its reputation in the electric motors & generators market based on the ability to engineer and manufacture machines to meet Customer specifications right down to the choice of color. It should come as no surprise that our motors and generators are widely used in demanding applications such as oil and gas where new technical challenges emerge with each new project. We also have a line of standard motors that offer the highest level of efficiency available on the market today.

Key features such as our rigid shaft design for 2 pole machines, long life bearings, rugged fabricated steel frames, standard aggressive environment painting cycle, and one of the most advanced test rooms in Europe - able to perform full load testing up to 60 MW (in back-to-back configuration) - ensure maximum reliability.

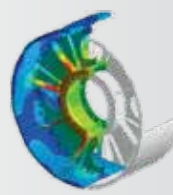




Our motor and generator solutions are fully developed using finite elements and advanced analytical tools



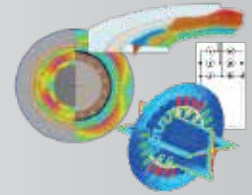
thermo fluidynamics



structural



rotordynamics



electromagnetic



# Tailor fit solutions



One of the things that sets us apart from our competitors is our engineer-to-order capability. Not only can our machines be designed to meet specific application needs on a job-by-job basis but we can customize our products to create specific solutions for our customers.



Certified induction motors for nuclear power plant



**-60° – C the operating temperature of the electric motors on the transiberian pipeline**



**60 MW – largest MV & HV electric motor built to date**



**Enhanced engineering design – our machine can be designed to meet specific applications needs**

## **Engineered to order custom color and finish**

Nidec Industrial Solutions Standard Aggressive Environment Painting Cycle (class C5-M ISO 12944-6) was specifically designed for severe aggressive ambient conditions and is highly resistant to:

- Abrasive dust
- Chemical contaminants
- High relative humidity
- Saline atmosphere



Induction motor for cement plant



We design motors fully compliant with different standards and challenging specifications like Shell® DEP or API Standards. Optimum performance is supported by attention for each design detail. The innovative cooling design of this TEFC motor for screw compressor application allowed installation in cramped spaces.



Organic Rank Cycle turbines are usually paired with 4-pole generators equipped with gearboxes. Desiring a more compact and efficient system, an OEM asked us to engineer a 2-pole generator that would not require a gearbox. We responded by designing a 2-pole synchronous generator that couples directly to the turbine to offer a more robust and efficient solution than the traditional configuration.



We supplied engineered-to-order synchronous motors for centrifugal compressors in a refinery. To facilitate field service operations and reduce inspection time, the customer asked us to design the motors with incorporated access stairs ensuring full compatibility with stringent safety standards.



# Construction features

Different cooling methods available according to international standards and customer requirements

Aluminum or copper cage rotors (also brass available on request)

Rolling bearings (L5-L10 design) and sleeve bearings (self or forced lubricated) available. We meet the toughest standards for vibration requirements on 2 pole (such as API 541 and 546).

Horizontal or vertical mountings available

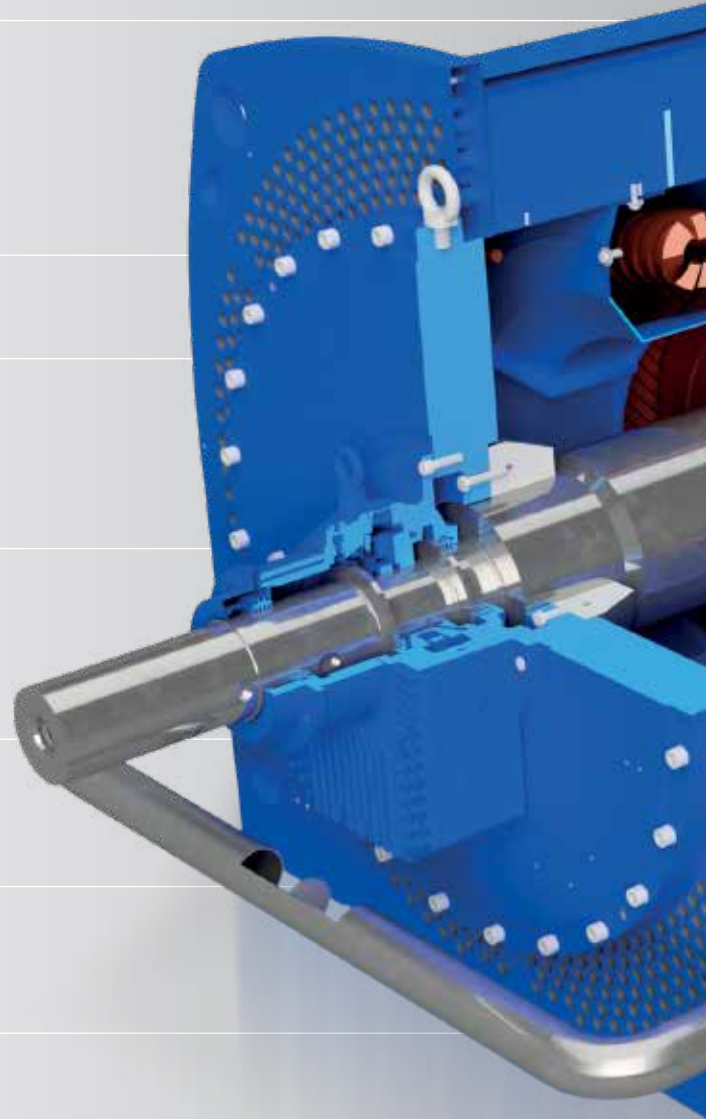
Starting methods: DOL, VFD (rigid shaft design for application's speed range), Soft starter

Advanced VPI insulation system, more than 50 years of proven field experience

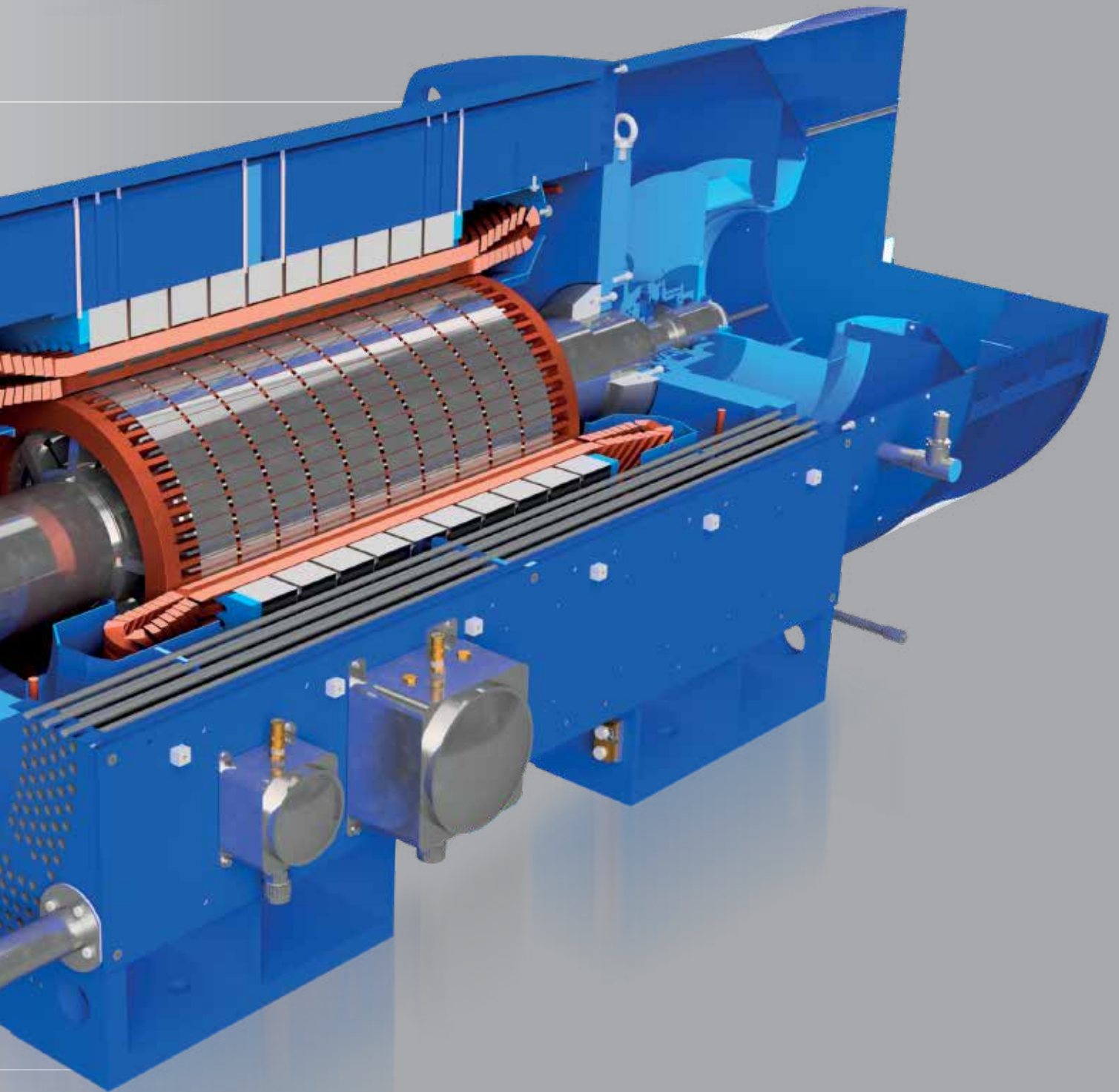
Compliance with most stringent standards

Different types of protection available according to area classification

Applications: pumps, fans, compressors, extruders, processing lines







# Induction machines

Our standard Induction machines are built with an aluminum squirrel cage rotor. Rotor packs are made from single punch laminations up to size 800. Larger packs are made using amination segments. End rings are made of a special aluminum alloy which is welded to the cage using state of the art techniques. Stators are built as self-contained units which are mounted into the frame after the coils have been inserted and the whole unit has undergone our **Micasystem® VPI** process.



## INDUCTION MACHINES

### Power rating:

150 ÷ 25,000 kW

200 ÷ 33,000 HP

### Voltage:

up to 15 kV

### Mass:

1,500 ÷ 120,000 kg

### Number of poles:

2 ÷ 36

### Frame size:

315 mm through 1120, 10, 11, 12, 13

### Type of Cooling:

IC 611 - 81W - 31 - 01 - 411 - 416





#### CAplus

##### IEC Power rating:

Up to 2200 kW

##### NEMA Power rating:

Up to 2600 kW

##### Voltage:

Up to 6.6 kV

##### Number of Poles:

2-4-6

##### Frame size:

315 – 500 mm

##### Type of Cooling:

IC411

Higher power density and better efficiency make our CA series the perfect choice for your heavy duty industrial applications. The CAplus is available in four standard configurations (see dedicated product brochure for details). Thanks to the innovative cooling system this machine offers:



#### CAplus

New generation of Totally Enclosed Fan Cooled motors.

>97.0%

EFFICIENCY

0.89

POWER FACTOR

# Hazardous area applications

Our motors can be designed to meet the specifications of hazardous area applications. Our machines meet the most stringent requirements and standards (Shell®, Saudi Aramco®, ExxonMobil®) and the main international standard IEC 60079.

Available executions for hazardous areas:

Ex p = pressurized,  
Ex nA = non-sparking,  
Ex e = increased safety,  
Ex t = combustible gas tight,  
Ex d = flame proof

All above ATEX marking are also available with IEC Ex and North America marking

Type of protection available:

IIA/IIB Gas group for "North America Group C & D"; IIC Gas group for "North America Group A & B"; IIIC Dust Group



## FLAME-PROOF MACHINES (EXD)

### **Power rating:**

160 ÷ 4,500 kW

### **Voltage:**

up to 15 kV

### **Mass:**

1,800 ÷ 25,000 kg

### **Type of Cooling:**

IC 511 - 411

### **Gas group:**

IIA - IIB - IIC

### **Series CAD**

Series CAD covers totally enclosed frame surface cooled machines for installation in hazardous areas. External cooling fins and internal fans, designed for optimum streamline air flow, provide effective cooling. This optimized cooling system and the special electromagnetic design that went into making this series make it suitable for variable speed drive applications.

Degree of protection is IP 55 according to IEC standards.  
Cooling method is IC 411 according to IEC standards.



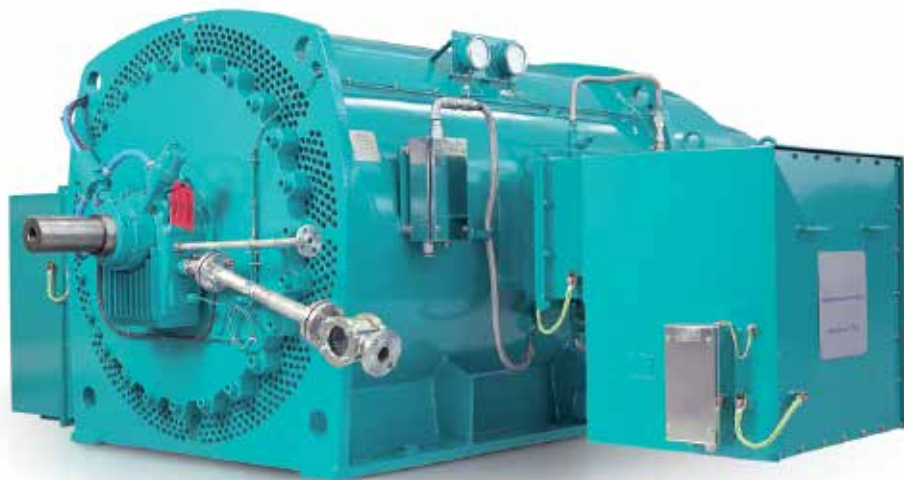




**Certified for temperature  
from -60°C through +60°C  
without heaters needed**

#### **Series ET**

Series ET covers totally enclosed, self ventilated machines with Ex d flameproof casing and built in air to air heat exchanger. The heat exchanger consists of a bank of corrosion resistant steel tubes which are situated around the stator core. Ambient air is forced through the tubes by an external shaft mounted fan. Two internal shaft mounted fans circulate the primary (internal) cooling air through the active parts of the motor and the tube bank. The tubes are carefully assembled and sealed to meet the required standards for flame proof applications.



# Synchronous motors

As a standard our synchronous machines are built with either salient pole or cylindrical rotors, depending on the speed and size of the machine. Designed to meet specific application needs on a job-by-job basis, our synchronous motors provide outstanding performance and reliability. Nidec ASI also has consolidated experience in generators coupled to diesel engines and turbines of all types.



Synchronous motor for LNG plant

## SYNCHRONOUS MOTORS

### Power rating:

150 - 60,000 kW

200 - 80,000 HP

### Voltage:

up to 15 kV

### Mass:

1,500 - 160,000 kg

### Number of poles:

2- 36

### Frame size:

450 - 1120 mm, 10, 11, 12, 13

### Type of cooling:

IC 01 - 81W - 611 - 31





# Synchronous generators

Nidec has a complete line of LV and HV generators up to 60 MVA. The range includes both synchronous and induction machines. Our sweet spots include: on-board power generation for marine applications, electric generator solutions for co-generation and biomass plus hydrogenerators for small and large hydropower stations. Generators for hydro applications represents one of the key areas of expertise of our Motortecnica factory in S.Cipriano Picentino (Italy).



Cruise ship power generator

## SYNCHRONOUS GENERATORS

### Power rating:

150 - 60,000 kVA

### Voltage:

up to 15 kV

### Mass:

1,500 - 160,000 kg

### Number of poles:

2- 36

### Frame size:

450 - 1120 mm, 10, 11, 12, 13

### Type of cooling:

IC 01 - 81W - 611 - 31



# High speed

Nidec Industrial Solutions has over 10 years of experience in the manufacture of high-speed motors. Reaching over 20,000 r/min these hi-tech machines are the epitome of our superb engineering capabilities. Generally used in turbomachinery applications, these packages offer energy efficiency and low maintenance advantages over traditional motors with gear boxes. Coupled with our state-of-the-art variable speed drive controls, these packages are pushing the edge of electric drive technology as a replacement for mechanical prime movers.

## High speed benefits



**- 48%**  
total installed  
cost



**- 35%**  
footprint



**- 85%**  
maintenance

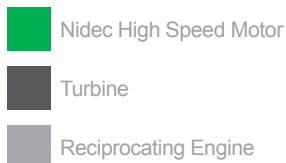


**- 60%**  
spare parts



**- 90%**  
environmental  
impact

higher availability  
and fuel efficiency



### HS & HSMS Series

#### HS power rating:

500-20,000 kW

#### HSMS power rating:

5,000-75,000 kW

#### Voltage:

up to 13.2 kV

#### HS Mass:

4,000-40,000 kg

#### HSMS Mass:

10,000-160,000 kg

#### Speed range:

70%-105%

#### HS top speed:

20,000 r/min

#### HSMS top speed:

22,000 r/min

#### Type of cooling:

IC 86W - 37 - 616 - 06



# Permanent magnet technology

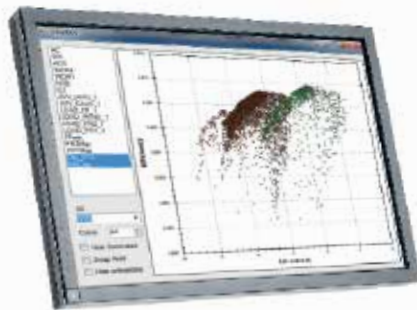


**Our PM machines are always tailor designed on the customer needs**

Nidec Industrial Solutions has significant experience in the design and manufacture of Permanent Magnet Machines. We work on the development of custom series for OEM manufacturers, developing innovative solutions that contribute to making their product offering more competitive. Permanent Magnet Machines offer smaller footprints, higher efficiency and greater design flexibility than traditional induction motors. They can be sized precisely to application needs eliminating the need for gear boxes, for example. Thanks to multi-objective optimization techniques we can define the best design solution for your needs, identifying the best technical design to match both performance and cost objectives. Some of our designs include:

## **Segmented 2 MW wind generator**

This innovative design allows the generator to continue producing electricity even in the case of a fault in one of the windings. In addition, the segments can be replaced inside the nacelle.



## **High Speed marine generator**

This 2MW, 22500r/min, 750Hz PM was designed for direct connection to a gas turbine prime mover; fluid cooled, it is extremely compact. Its dedicated power converter ensures quick loadability of the 3kV DC line output, ideal for this special on-board power requirement.

## **High Speed motor for compressor**

This 1 MW @ 14000r/min machine is based on a slotless stator, adopts a Halbach rotor and mounts active magnetic bearings – offering very high efficiency and very high dynamic response for specific turbo applications.

PM generator for wind turbine



PM generator for navy applications



PM motor for high speed compressor

# DC motors

Our DC motors and generators come in 22 different shaft heights and nearly 100 different frame sizes to cover all applicable industry applications. All DC machines are laminated frame design and can be supplied by any DC converter system. Our DC series offers outstanding performance features:

- High dynamic response
- Wide speed range
- High maximum speeds
- High efficiency
- High commutating capacity during current transients

Insulating systems on DC line are class H; large frames (above 225) always provided with compensating windings.



## Series DH

### Power rating:

100 - 2500 kW

### Voltage:

up to 1,000 V

### Mass:

800 - 35,000 kg

### Frame size:

225- 900 mm

### Type of cooling:

IC 06 - 666 - 86 W - 37

Comply with AISE  
(Association of Iron and Steel  
Engineers - USA) n. 1 Std

## Series GH

### Power rating:

up to 1700 kW

### Voltage:

up to 800 V

### Mass:

400 - 9000 kg

### Number of poles:

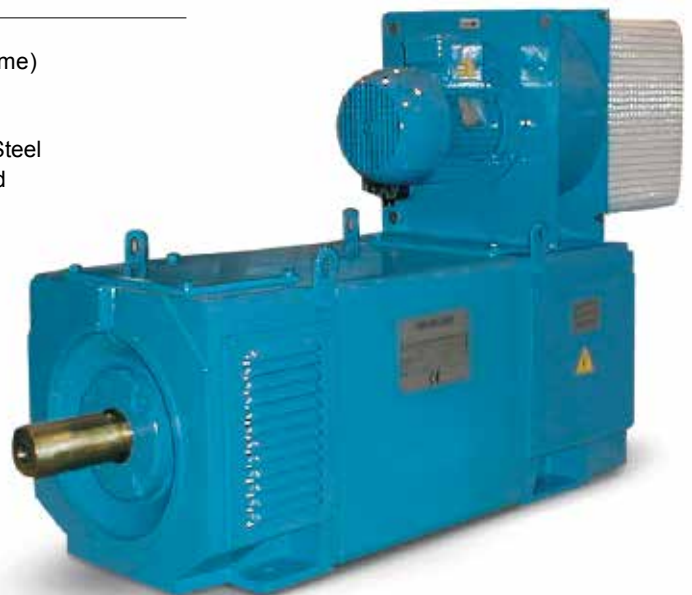
4 - 6

### Frame size:

804 - 824 (split frame)

810 - 816 (laminated frame)

Comply with AISE  
(Association of Iron and Steel  
Engineers - USA) n. 1 Std







DC propulsion motor

#### Series MD 800-MDL 800

##### Power rating:

up to 500 kW

##### Voltage:

up to 500 V

##### Mass:

400 - 9000 kg

##### Number of poles:

4 - 6

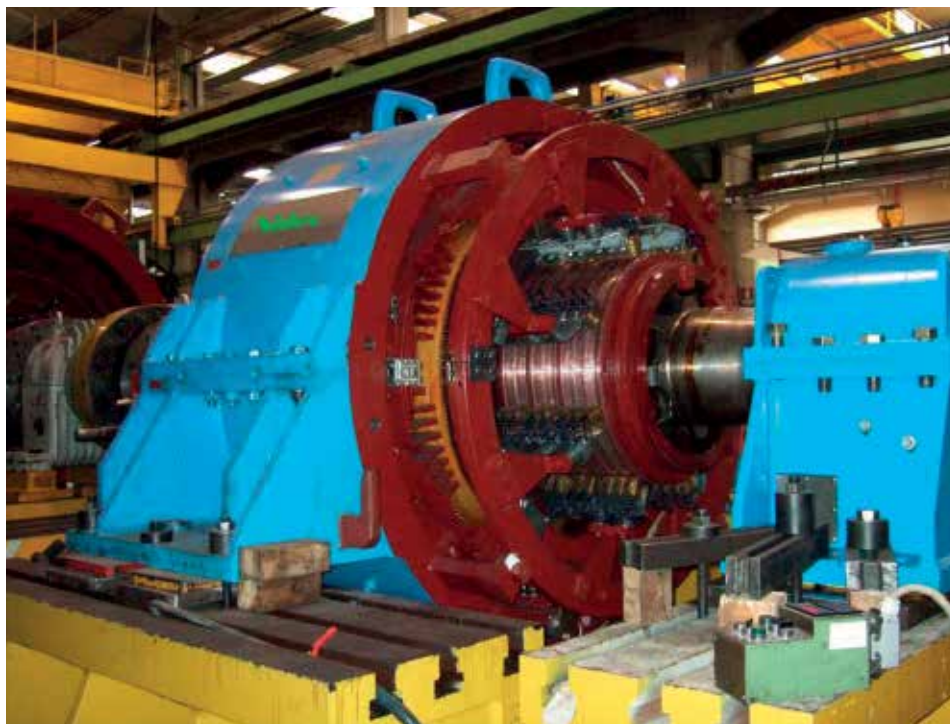
##### Frame size:

804 - 824 (split frame)

810 - 816 (laminated frame)

Comply with AISE  
(Association of Iron and Steel  
Engineers - USA) n. 1 Std

**We can replace  
legacy brands**



DC motor for cold rolling mill

# Full system testing



Our test room is one of the best equipped in Europe. Our internal test area measures 3600 mq with platforms that are fully equipped with MV AC and DC power supply and the necessary auxiliary circuits to run functional and performance tests on induction, synchronous and DC machines including full load testing capability up to 60 MW in back-to-back configuration. We also have an additional 1500 mq external test area for complete system tests. Summary of test benches in our facility

- 7 test bays for large machines
- 5 test bays for small machines
- 3 test bays for vertical testing

Our facility is also able to handle special tests such as heat run tests, inertia moment evaluation, shaft voltage and ring tests (on stator cores before winding assembly).







The following is a list of the routine tests carried out on all induction motors produced in the Monfalcone factory.

- **Windings ohmic resistance measurement**  
Test Method: IEEE 118
- **Direction of rotation check**  
Test Method: IEC 60034 - 8  
Acceptance Criteria: IEC 60034 - 8
- **Phase sequence check**  
Test Method: IEC 60034 - 8  
Acceptance Criteria: IEC 60034 - 8
- **No-load characteristic determination**  
Test Method: IEEE 112
- **Locked rotor test**  
Test Method: IEEE 112  
Acceptance Criteria: IEC 60034 - 1
- **Overspeed test**  
Test Method: IEC 60034 - 1  
Acceptance Criteria: IEC 60034 - 1
- **Vibration level measurement**  
Test Method: IEC 60034-14  
Acceptance Criteria: IEC 60034 - 14
- **High voltage test**  
Test Method: IEC 60034 - 1  
Acceptance Criteria: IEC 60034 - 1
- **Insulation resistance measurement**  
Test Method: IEEE 43  
Acceptance Criteria: IEEE 43
- **Visual and dimensional check**  
Test Method: as per drawing  
Acceptance Criteria: as per drawing

Special tests which may be carried out in the Monfalcone factory:

- Heat run test
- Current, speed and torque vs. time during acceleration (squirrel cage motors only)
- Inertia moment evaluation
- Shaft voltage
- Noise (SPL, sound pressure level) at no load (according to IEC 60034 - 9)
- Breakdown torque evaluation
- Polarization index
- Dielectric loss factor on test coils
- Impulse voltage test
- Ring test (on stator cores before winding assembly)

Member of CIRS Federation

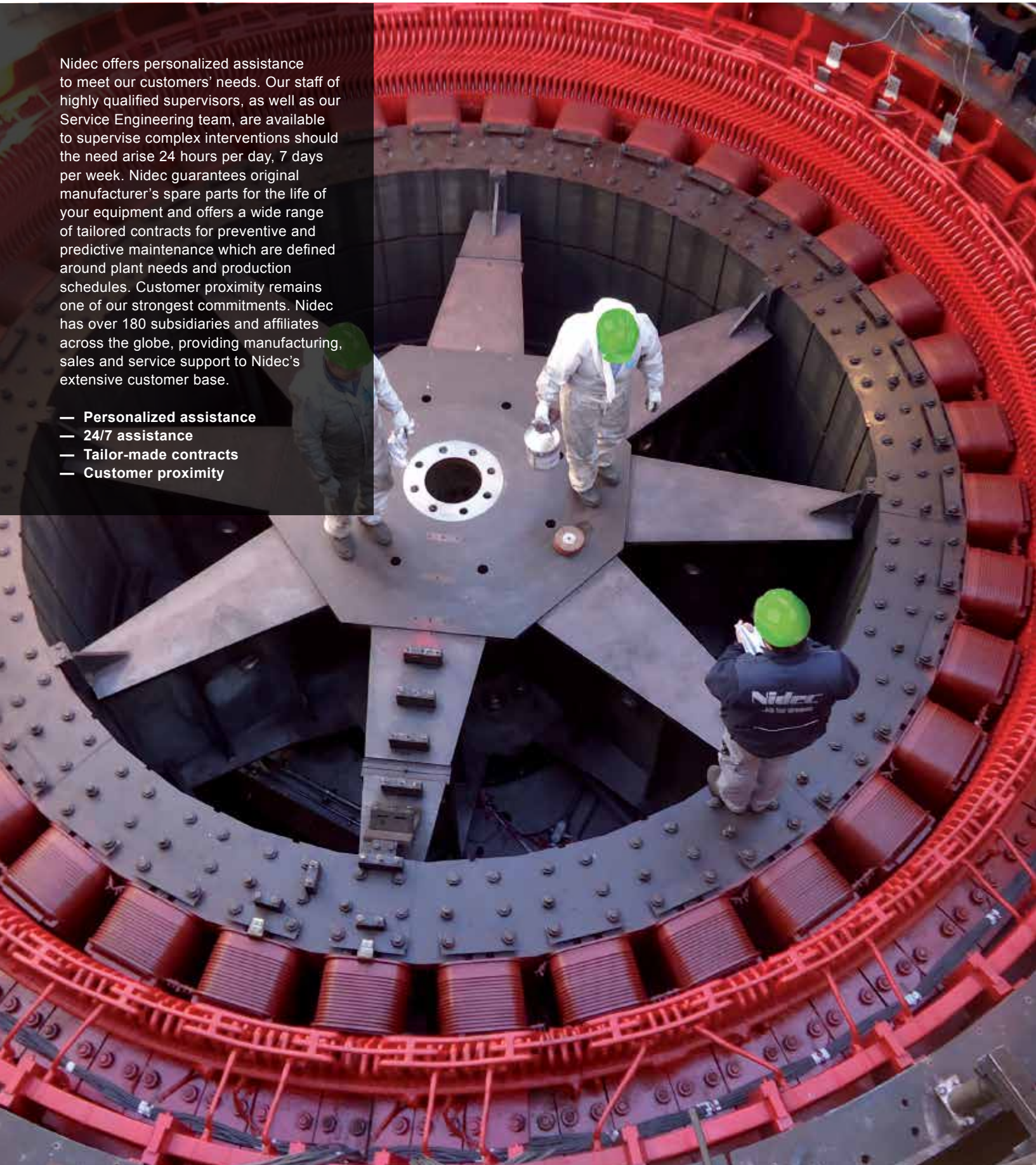




# Service

Nidec offers personalized assistance to meet our customers' needs. Our staff of highly qualified supervisors, as well as our Service Engineering team, are available to supervise complex interventions should the need arise 24 hours per day, 7 days per week. Nidec guarantees original manufacturer's spare parts for the life of your equipment and offers a wide range of tailored contracts for preventive and predictive maintenance which are defined around plant needs and production schedules. Customer proximity remains one of our strongest commitments. Nidec has over 180 subsidiaries and affiliates across the globe, providing manufacturing, sales and service support to Nidec's extensive customer base.

- **Personalized assistance**
- **24/7 assistance**
- **Tailor-made contracts**
- **Customer proximity**









INDUSTRIAL SOLUTIONS