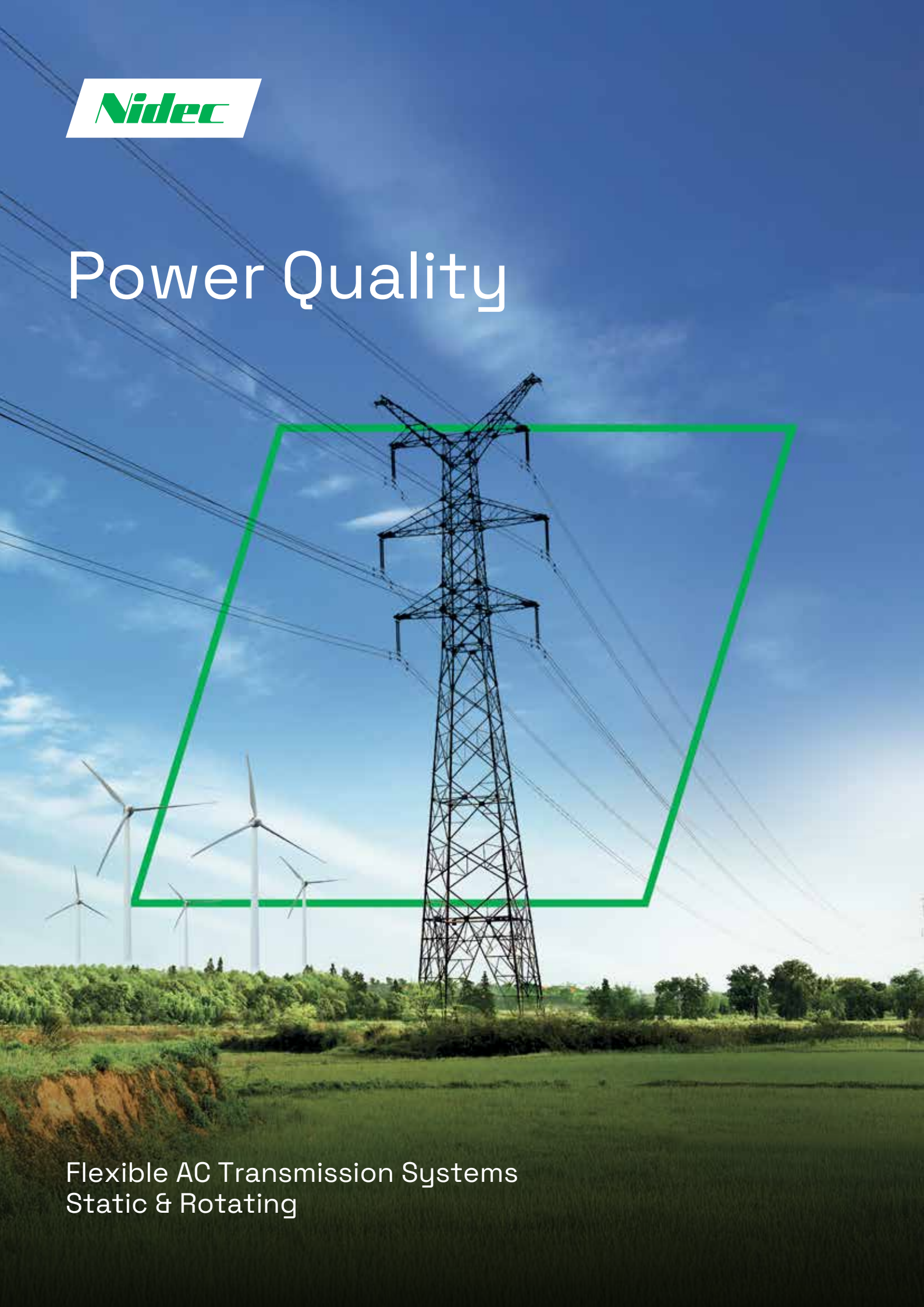
Nidec

Power Quality



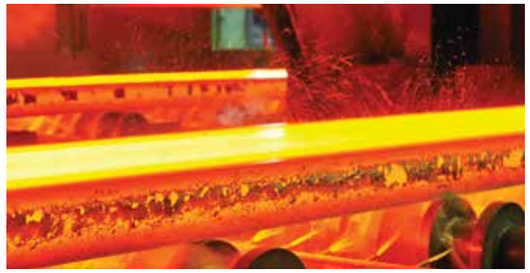
Flexible AC Transmission Systems
Static & Rotating

WE DELIVER TURNKEY SOLUTIONS WORLDWIDE

OVER 10 GVAr POWER INSTALLED
> 80 PROJECTS ACROSS THE GLOBE

Our expertise spans a wide range of industries including:

- Metals/mining
- Renewable Energy
- Oil & Gas
- Utility/grid
- Transportation



Electric arc furnaces and rolling mills in the steel industry

Transmission and distribution, renewables integration, smart grid applications in the energy sector

Wrapper, conveyors, crushers in mining industry

Voltage support systems in railways traction lines

NIDEC IN POWER QUALITY

Nidec is your partner for Power Quality. Whether you are facing Power Quality issues in industrial applications, in renewables or transmission & distribution, our highly qualified engineers will help you from network study to complete design of the system.

Whether Greenfield or Brownfield projects our solution enhance grid stabilization and productivity. We have developed a full range of products including SVC, MV Statcom, LV Statcom and Synchronous Condenser devices.

FULL SOLUTION PROVIDER

- Feasibility studies
- Basic and detail system design
- Modeling, network analysis
- Project management
- Civil work
- Delivery
- Functional performance tests
- Installation, as well as commissioning, on-site testing and maintenance
- Training of personnel

A robust economy requires stable and regular flows of electricity. Grid operators need voltage support for mitigation of voltage dips and sags, particularly on weak or congested grids, to deliver electrical power to consumers reliably and effectively. Industrial companies on the other hand need to be compliant with the Grid Operator's rules to avoid disturbance to the grid. Typical issues of plants on weak and on isolated grids are Power Factor Control, Load Balance, Flicker Mitigation, Harmonic Mitigation. The use of Power Quality systems helps reach stabilized voltage and harmonics mitigation, solving these issues for all stakeholders.

Power Quality Solutions mitigate oscillations for a balanced power supply

MARKETS & APPLICATIONS

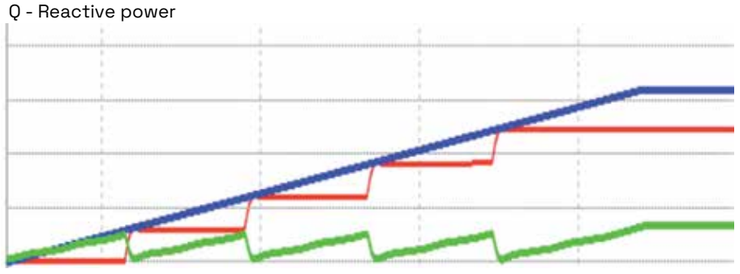
Main Benefits:

INDUSTRY:

- Up to 15% more power transfer capacity
- Up to 20% less line losses
- Higher and steadier grid voltage
- No reactive power fees
- Flicker mitigation: reduction factor up to 5 (mitigation values above 5 can be reached after dedicated analyis)
- Harmonic mitigation on selected harmonic order
- Increasing on procuction performances: increase in castings up to 4 per day and electrodes consumption reduction

UTILITIES AND GRID:

- Higher and constant power factor: according to Grid operator requirement, up to unity power factor
- Less than 1% of residual current unbalance
- Flicker mitigation: reduction factor up to 5 (mitigation values above 5 can be reached after dedicated analysis)
- Improvement of voltage transient stability
- POD feature
- Voltage support feature



Mitigation of MCSs switching transients in Hybrid RPCS using Silcovar-D for a smooth increase/ decrease of the reactive power injected into the grid

LV STATCOM FOR WIND FARM

PYRÉNÉES ORIENTALES (FRANCE)

The challenge:
To provide voltage support for 100 MW Wind Farm in Pyrénées Orientales (France).

The solution:
In order to help 100 MW wind farm to achieve grid code compliance in terms of steady state reactive power supply, voltage control and dynamic grid stability, it was decided to add a Hybrid Compensation System (RPCS): LV Statcom, MSCs (Mechanically Switched Capacitors) and MSRs (Mechanically Switched Reactors).

The main advantages delivered from Nidec's solution:

- Increase of dynamic grid stability: reactive power support always available, even with Wind Farm out of service
- 70% less power losses compared to Wind Farm with full reactive capability thanks to Hybrid RPCS
- Reactive power steady state error lower than 0.5%
- Fast response time: step response from -Q to + Q in less than 4 ms
- Low equipment cost: cost effective solution thanks to Hybrid RPCS

Scope of supply:
RPCS, able to operate in the reactive power range [-26; +32] MVAr at 33kV, with dynamic control of 3 MSCs and 2 MSRs.

TAILOR MADE SOLUTIONS

We study your challenges to meet your specific needs

Nidec offers significant experience in engineered-to-order solutions. Whether you are looking at installing new equipment or revamping existing facilities, our highly qualified team of engineers have the expertise in power solution design to deliver the best tailored solutions to solve your technical and economic problems due to poor Power Quality.

Nidec is recognized for its depth of experience and know-how in the design phase of power quality solutions.
Our team carefully study the phenomena and carry out the required analysis and calculations to enhance stability and performance of the system.

Our design expertise covers the optimal sizing and selection of technology (SVC, CSRT, MV Statcom, LV Statcom and Synchronous Condenser), the design and implementation of the digital control system as well as the design and implementation of the main components.

FROM NETWORK STUDY TO COMPLETE DESIGN OF THE SYSTEM

Collecting data from customers

- Single line diagrams and information about network, plant and industrial process
- Characteristics of installed devices
- Technical requirements
- Grid Codes and/or other rules to be compliant with

Analysis and common calculations

- Use of state of the art tools for:
  - Electromagnetic transients
  - Harmonics' analysis
  - Grid fault analysis.

Design of Reactive Power Compensation system

- Sizing calculations
- Definition of all RPCS components:
  - Power Electronic converters
  - Protection devices
  - Metering instruments
  - Transformers
  - Auxiliary systems.

Detailed Engineering Design

- RPCS single line diagram
- Schematics
- 3d drawings
- Layout drawings
- Planning of manufacturing
- Testing
- Delivery and commissioning.

Support to the customer

- Nidec experience and tools for:
  - Interface to Civil Works
  - Structures design
  - MV/HV components
- Assembly supervision
- 24/7 service support

PRODUCTS YOU CAN RELY ON

Silcovar D

Technical Data Summary:

- Suitable for demanding applications
- Reactive Power rating: From ± 0.5 MVAr to ±10 MVAr and up to [0; 20] MVAr
- Max rated voltage: any Medium Voltage level with standard transformer
- Rated frequency: 50/60Hz
- Cabinet and container solutions
- Cooling: forced ventilation/Water
- Modular and flexible solution: scalable to different power and voltage levels
- Suitable for redundant operation

Common Applications:

- Steel, Mining, Oil&Gas
- Renewables
- Utilities
- Traction

Key features:

- Very low total harmonic distortion
- Fast and stable response time of current control
- Fast active and reactive load current extraction
- Fast power factor correction
- Fast compensation of negative sequence of load current
- Mitigation of switching transient of capacitor filter
- Active damping and mitigation of grid voltage oscillation
- Voltage support and mitigation of voltage dips

Silcovar H

Technical Data Summary:

- Suitable for demanding applications
- Reactive Power rating: From ± 2,6 MVAr to ± 300MVAr. Greater Power than 300 MVAr can be reached with customized solutions, please contact Nidec
- Maximum rated voltage 40 kV. Greater voltage ratings than 40 kV can be reached with customized solutions, please contact Nidec
- Rated frequency: 50/60Hz
- Container, Cabinet and Building solutions
- Cooling: Air forced or Water
- Modular and flexible solution: scalable to different power and voltage levels
- Suitable for redundant operation

Common applications:

- Heavy industries such as Melt Shop with Electrical Arc Furnace
- Renewables
- Utilities
- Traction

Key features:

- Flicker mitigation and Selective Harmonic mitigation
- POD function
- Very low total harmonic distortion
- Fast and stable response time of current control
- Fast active and reactive load current extraction
- Fast power factor correction
- Fast compensation of negative sequence of load current
- Mitigation of switching transient of capacitor filter
- Active damping and mitigation of grid voltage oscillation
- Voltage support and mitigation of voltage dips

Silcovar C

Technical Data Summary:

- Well-proven technology
- Reactive Power rating: up to 330 MVAr. Greater power ratings than 330 MVAr can be reached with customized solutions, please contact Nidec
- Maximum rated voltage 35 kV. Greater voltage ratings than 35kV can be reached with customized solutions, please contact Nidec
- Cooling: Water
- Rated frequency: 50/60Hz
- Electrically and Light Triggered Thyristors (BCT, PCT, LTT)

Common applications:

- Electric arc furnaces and rolling mills
- Transmission lines

Key features:

- Flicker mitigation
- Low total harmonic distortion
- Fast active and reactive load current extraction
- Power factor correction
- Compensation of negative sequence of load current
- Voltage support

Silcovar T

Technical Data Summary:

- Outdoor panel solution:IP 54
- Reactive Power rating: up to 5,4 MVAr (greater value can be offered after dedicated analysis)
- Cooling: Air Forced
- Rated frequency: 50/60Hz
- IGBT Technology

Common applications:

- Renewable
- Transmission and distribution
- Rolling mills,steel,Mining,Oil&Gas, etc..
- Utilities

Key features:

- N-1 Power redundancy
- Modular power design
- Pollution degree 3
- Power factor correction
- Voltage support

SPECIAL SIZES AND GREATER POWER RATING CAN BE PROVIDED UPON REQUEST

TODAY WITH SUPERCAPACITOR SYSTEM FOR ACTVIE POWER EXCHANGE

Silcovar S

Technical Data Summary:

- Delta connected solution
- Reactive Power rating: up to ± 300MVAr Greater Power than 300 MVAr can be reached with customized solutions, please contact Nidec
- Maximum rated voltage 40 kV Greater voltage ratings than 40 kV can be reached with customized solutions, please contact Nidec
- Rated frequency: 50/60Hz
- Container and Building solutions
- Cooling: Water
- Modular and flexible solution: scalable to different power and voltage levels
- Suitable for redundant operation
- Supercapacitors embedded in Statcom level

Common Applications:

- Transmission and distribution
- Renewables
- Utilities
- General Industry

Key features:

- Synthetic inertia
- Voltage and frequency regulation
- Active and Reactive power injection/absorption
- Very low total harmonic distortion
- Black Start support
- Perfect solution in very weak grid: low short circuit power

Synchronous containerized

Technical Data Summary:

- Reactive Power rating:
  - From 1 to 80MVAr over-excited
  - From 1 to 50MVAr under-excited
- Maximum rated voltage 13,8 kV +-10%
- Rated frequency: 50/60Hz
- Number of Poles: 4 Poles
- Cooling: IC01, IC6, IC8, TEWAC, TEAAC, WP, TEPV
- IP 21 to IP56
- Optimized X"d (high short circuit current)
- Inertia constant up to 7s with Flywheel. More on demand
- Excitation system:
  - Brushless or Static
  - Digital AVR system, PSS as an option
- Starting method:
  - Pony motor system
  - Converter starts
- Our scope is:
  - Either all major components to be integrated in the substation
  - Or full turnkey project
  - Up to 5 MVAr we can deliver containerized turnkey solution

Greater ratings can be reached with customized solutions, please contact Nidec

Common applications:

- Transmission and distribution
- Renewables
- Utilities
- General Industry

Key features:

- Large rotating inertia, frequency stabilisation on power surge
- Voltage stabilization with management of large amount of reactive power
- Reliability of protection selectivity with High short circuit power.
- Reduction of voltage THD
- Perfect solution in very isolated grid with large renewable intermittent energy

Customer Proximity remains one of our strongest commitments.

Our capabilities extend to personalized assistance to meet customer's need. Our staff of highly qualified supervisors, as well as our Service Engineering team, are available to oversee complex interventions should the need arise.

Nidec guarantees original manufacturers' spare parts for the life of your equipment and offers a wide range of personalized contracts for preventive and predictive maintenance which are tailored around your needs and production schedule.

Nidec has over 180 subsidiaries and affiliates across the globe, providing manufacturing, sales and service support to Nidec's extensive customer base.

Nidec

All for dreams

Nidec Power

Nidec Conversion

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