Nuclear power protection solutions

Secure Power, from nuclear island to connection to the grid
Chloride is a world leader in protecting mission-critical systems and processes from the damaging effects of poor quality electrical power and power interruptions.

Our mission
Chloride has a comprehensive range of secure power products, utilising the latest technology which is designed and tailored to the customer’s applications. Underpinning Chloride’s total solutions approach, is a commitment to providing customers with industry-leading service and support through our global network of highly qualified engineers and technical support staff.

Chloride’s Industrial Systems division focuses on power protection solutions and services for the high demanding industrial sectors such as power, oil and gas, transport and manufacturing.

Our focus on innovation, flexibility and reliability, our integrity and our respect for our customers, combined with our 24/7-manned service centres, make us the supplier of choice for many leading organisations, worldwide.

Our values
Customer focus
• We anticipate our customer’s needs to find the best solution
• We strive to exceed our customer’s expectations in the performance of our people, technology and solutions

Service and support
• We seek to support customers in the long term
• We anticipate and respond to customer’s concerns

Integrity and reliability
• We keep our promises and fulfil our commitments
• We offer exceptional reliability through our people, technology and solutions

Core to our success are ....

Secure power always - through leading technology and exceptional customer support.
Chloride Industrial Systems power protection solutions secure the complete nuclear plant.

**Your requirements**
Safety, licensing process, risk management, proven track record, sustainability, business continuity, lifelong services and operational excellence are at the forefront of our customers, and of Chloride. Whether you are a utility company, an Independent Power Producer (IPP), a national safety authority, a project management consultant, or an engineering and construction services provider, you need to talk to a power protection company that is equipped to deal with specific requirements of nuclear power plant projects.

At Chloride, we have a dedicated nuclear team to provide seamless solutions for:

- **Utilities/Independent Power Producers**
  We deliver advises on technical issues, autonomies, environmental conditions, international standards and undertake comprehensive feasibility studies.

- **National Safety Authority**
  We help operators, integrators and contracting companies licensing the power protection equipment. We provide full documentation package and define the mandatory equipment scope of installation and maintenance.

- **Contractors**
  We offer the best technical and commercial solutions to meet end user’s power protection needs and ensure that the delivered equipments satisfy with the nuclear applied standards and safety authority requirements.

**Your applications**
Nuclear plant complex projects need a reliable and uninterrupted power to secure several mission-critical applications. Chloride Industrial Systems can help you in determining the appropriate power protection solution for:

- **Nuclear island**
  - Uranium rod reactor process control system
  - Fire detection devices
  - Emergency shutdown devices (ESD)
  - Emergency Lighting

- **Turbine island**
  - Steam generator process control system
  - Steam turbine process control system
  - Emergency shutdown devices (ESD)
  - Emergency lighting
  - Instrumentation
  - Motor Starting
  - Lube oil pump power supply
  - Fire & Gas detection devices

- **Electrical balance of plant**
  - Medium and low voltage switchgear
  - Process control systems
  - Data processing, SCADA, plant control room
  - Telecommunication systems
  - Emergency plant shutdown
  - Alarm and safety devices
  - Access control
  - Emergency lighting
  - Emergency gen-set

- **Substation**
  - High voltage switchgears
  - Telecommunication system
  - Electrical control system

**Our experience**
For more than 30 years, Chloride Industrial Systems has worked closely with Utilities to provide innovative solutions and services that meet the strictest requirements of nuclear applications. Today, Chloride Industrial Systems is one of the leading providers of power protection solutions for the nuclear industry.

**Our competences**
Our global capabilities mean:

- We work alongside our customers to design a power protection solution that best fits the technical and commercial requirements of both utilities and contracting companies.
- We design power protection solutions for the complete nuclear plant, from nuclear island to the substation.
- We provide lifelong support, no matter the original design life of the equipment, including refurbishment of other UPS brands.

**Secure Power facts:**
- More than **30 years experience** in the nuclear sector.
- Up to **60 years design** life equipments
- **AC and DC power solutions qualified for the new EPR reactor**, as well as for PWR and BWR reactors.
Some of our nuclear achievements around the world

<table>
<thead>
<tr>
<th>Plant</th>
<th>Country</th>
<th>Application</th>
<th>Operator</th>
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<tbody>
<tr>
<td>Blayais</td>
<td>France</td>
<td>Nuclear and Conventional</td>
<td>EDF</td>
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<tr>
<td>Bugey</td>
<td>France</td>
<td>Nuclear and Conventional</td>
<td>EDF</td>
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<td>CEA Cadarache</td>
<td>France</td>
<td>Laboratory</td>
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<td>Chinon</td>
<td>France</td>
<td>Nuclear and Conventional</td>
<td>EDF</td>
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<td>Dampierre</td>
<td>France</td>
<td>Nuclear and Conventional</td>
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<td>Doel</td>
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<td>Dungeness A-B</td>
<td>UK</td>
<td>Nuclear</td>
<td>Magnox Electric Plc</td>
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<td>Fessenheim</td>
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<td>Nuclear and Conventional</td>
<td>EDF</td>
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<td>Flamanville EPR</td>
<td>France</td>
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<td>Gentilly</td>
<td>Canada</td>
<td>Nuclear</td>
<td>HydroQuebec</td>
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<td>EDF</td>
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<td>Hunterston</td>
<td>UK</td>
<td>Nuclear</td>
<td>Scottish nuclear Ltd</td>
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<td>La Hague</td>
<td>France</td>
<td>Treatment unit</td>
<td>EDF</td>
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<td>Ling Ao</td>
<td>China</td>
<td>Conventional</td>
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<td>Lucas Height</td>
<td>Australia</td>
<td>Nuclear prototype</td>
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<td>Sellafield</td>
<td>UK</td>
<td>Nuclear and Conventional</td>
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<td>Smolensk</td>
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Quality and international standards

At Chloride, the international organisational standards ISO 9001, ISO 14001 and OHSAS 18001 (Occupational Health and Safety Assessment Series) are our working guidelines. This means that all our processes, procedures and safety measures are fully documented and made available to all of our employees.

<table>
<thead>
<tr>
<th>THEME</th>
<th>IEC</th>
<th>IEEE/NEMA/UL</th>
</tr>
</thead>
<tbody>
<tr>
<td>General and safety requirements for UPS</td>
<td>62040-1, 2</td>
<td>NEMA PE1, UL 1778</td>
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<td>EMC</td>
<td>62040-2</td>
<td></td>
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<td>Performance and tests</td>
<td>62040-3</td>
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<td>Low voltage switchgear</td>
<td>60439-1, 2, 3</td>
<td>UL 98, UL 489, UL 198, UL 508</td>
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<td>Semi-conductor converters</td>
<td>60146-1</td>
<td></td>
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<tr>
<td>Inverters</td>
<td>60146-2</td>
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<tr>
<td>Information technology - safety</td>
<td>60950</td>
<td></td>
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<td>Analogue measuring instruments</td>
<td>60051-1</td>
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<td>Dry type power transformers</td>
<td>60076</td>
<td>NEMA ST20</td>
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<td>Protection degree</td>
<td>60529</td>
<td>NEMA 250</td>
</tr>
<tr>
<td>Battery chargers</td>
<td></td>
<td>NEMA PE5</td>
</tr>
</tbody>
</table>

Safety Culture

Safety Culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance (International Atomic Energy Agency. Safety report 75-INSAG-4). That’s why we train our nuclear personnel towards Safety Culture for them to act in a fully responsible and safe manner, such as STOP and THINK before ACTING and REVIEWING.
Our total solutions approach

From project conceptual study to the procurement stage, you need special skills for the power protection part of your project.

Chloride Industrial Systems has the highly qualified and experienced team to assist in conceptualizing your needs and formulating competitive financial proposals to meet your performance requirements and budget.

A customized UPS solution for each nuclear plant:
- Full analogue control of power electronics
- Seismic qualification of equipment
- High short-circuit withstanding
- Dedicated battery charging modes

System design
Our nuclear team works alongside you to analyze your project data:
- Technical specification
- Low voltage electrical distribution network
- Load flow studies and load shedding
- Short-circuit requirements
- Power quality
- EMC and Noise rejection analysis (Harmonic current and voltage distortion)
- Grounding/Neutral networking
- Failure rates, FMEA (Failure Mode and Effect Analysis), reliability calculation
- Emergency and stand-by power requirements
- Battery type and configuration under all load, environmental and aging conditions
- Electrical environment
- Mechanical environment

Once all of these points have been reviewed, we submit a technical and commercial proposal, along with project delivery scheduling.

Equipment qualification
We follow rigorous qualification procedures to fulfill any of the requirements issued by national nuclear safety authorities. Thus, we propose several solutions to ensure the UPS is or will be qualified, such as:
- Submit a full package of documentation justifying that the equipment we propose has already been qualified for nuclear application (class 1E, IEEE 650, RCC-E, KTA)
- Offer to fully achieve a new qualification process to validate that the equipment we submit is fully compliant for the nuclear project and meets the required operation design life.
- Provide an obsolescence management file needed for any type of equipment installed on a nuclear plant.
- Define the maintenance program. This program is mandatory and must not be considered as a recommended maintenance plan.
Throughout the operating life of your equipment, you need to maximize performance and reliability.

Our extensive service network, highly qualified engineers and advanced service management systems ensure that we are able to fulfil our commitment to providing life-long service and technical support for your mission critical system.

A service offering to meet nuclear requirements:
- Spare parts obsolescence management
- Maintenance plans and contracts to meet national safety authority requirements
- On-site intervention (installation supervision, commissioning, maintenance) according to defined task procedures and performed by nuclear-certified service engineers
- Regular preventive maintenance
- On-site specific tests and qualification tests
- Troubleshooting training
- Multi-brands maintenance or refurbishment solutions

Services for nuclear plant

Project services
Our nuclear service team schedules commissioning logistics to ensure system start-up is achieved on-time. The necessary deliverables include:
- Defining the installation and commissioning procedures via a method statement file
- Setting-up the spare-parts obsolescence management file
- Scheduling and ensuring the qualification tests

Once all documents have been submitted and approved, our nuclear service engineer goes on-site to:
- Carry installation, commissioning and operational tests
- Fill in risk assessment and method statement documents
- Train local operators to best use equipment
- Provide site acceptance test report
- Fill-in the end-of-commissioning report.

Lifecycle services
Delivering lifecycle services in nuclear plants is mandatory to ensure the requirements of 60 years UPS equipment design life. In respect with the maintenance plan earlier defined at qualification stage, we:
- Strictly follow the task procedures provided (method statement files) to meet the nuclear maintenance requirements
- Ensure the UPS maintenance phasing with the plant shutdown
- Maintain the UPS with appropriate spare parts
- Perform site acceptance tests (requalification) to ensure the maintained UPS keeps its operational features originally required for safety qualification.

Our service team can also provide revamping or refurbishment solutions either on Chloride or other UPS brands equipments.

Project Management

Our nuclear project management team is dedicated to supporting nuclear projects, either new power plants or refurbishment projects. Our task force is fully accountable for:
- Acting as single contact point for Customer engineers and project managers
- Submitting timely drawings as per agreed supplier document schedule
- Establishing full historical file of equipment installed on nuclear plant
- Providing timely documentation as per Customer specifications
- Ensuring adjustments are fulfilled accordingly with customer's expectations and defined scope of supply
- Providing the best technical advice for revised requirements
- Ensuring factory acceptance test is 100% compliant with customers request
- Handling packing and logistics issues
- Delivering 100% equipment on-time
- Ensuring correct documents and resources allocation for trouble-free installation
- Understanding project's commissioning requirements
Key competencies

One single provider for a total industrial power protection solution:

- Single-phase AC UPS
- Three-phase AC UPS
- AC voltage regulators, single or three-phase
- DC UPS systems
- DC/DC converters
- Battery and battery protection (MCCB) box
- UPS monitoring solutions
- Battery monitoring system

Specific system design
Leveraging our long, expert history in the field of power protection, we are well positioned to guide you for the design of your UPS. Our equipments comply with the highest nuclear standards by including:

- A full analogue control of the equipment to ensure no soft programming failure will occur into the equipment control logic
- A crowbar device to avoid that any high input overvoltage is transmitted to both DC voltage and AC output voltage
- An inverter module to withstand short-circuits up to 6/7 rated load current
- A dedicated operation mode that forces the static switch to operate until its death in case of highly critical situation on the load
- A specific battery charging management device with analogue control to independently and permanently monitor the battery voltage and current.
Equipment qualification
Our UPS systems are designed, tested and qualified according to our customer’s specifications and expectations. We are able to ensure several tests and qualification to ensure safe UPS operation on the nuclear site, among which:

- Vibration tests
- Seismic tests
- Climatic tests
- Ageing tests
- Electrical tests (new Forsmark test)
- EMC tests

Nuclear Project Management
Beyond delivering project schedules, drawings, datasheets and UPS documentation, our dedicated nuclear team also manages several critical tasks to ensure nuclear requirements are fulfilled. These can include:

- Studying and strictly following the national or international standards implemented on the nuclear project
- Justifying our UPS internal components selection by providing dedicated documentation and selection calculation
- Defining the quality controls to be implemented on the project and ensuring the follow-up (e.g. checking of soldering, welding, fastening, terminals)
- Rigorously following a specific numbering system for the complete documentation set to guarantee that the file is fully recorded into the customer’s documentation process.

Dedicated service capabilities
Our nuclear service capabilities go far beyond delivering maintenance plans. We are able to deliver service solutions such as:

- A spare-parts obsolescence management system to ensure the UPS will remain operational during its complete 60 years lifetime
- A reference file to follow the UPS life from delivery until end of life
- An on-site intervention file to track on-site component maintenance and replacement tasks
- A maintenance suitcase tool to regularly and easily check that the UPS settings are in line with the operational requirements
DC solutions

Industrial DC UPS systems (rectifiers / chargers)

Nuclear charger range - Single-phase input

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>From 25 to 250 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage (VAC)</td>
<td>1 x 230</td>
</tr>
<tr>
<td>Voltage (VDC)</td>
<td>48</td>
</tr>
<tr>
<td>Range of ratings (A)</td>
<td>25 - 250</td>
</tr>
</tbody>
</table>

Nuclear charger range - Three-phase input

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>From 16 to 3600 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage (VAC)</td>
<td>3 x 400 (3 x 380, 3 x 415)</td>
</tr>
<tr>
<td>Output voltage (VDC)</td>
<td>24, 48, 110, 220</td>
</tr>
<tr>
<td>Range of ratings (A)</td>
<td>25 - 3600, 25 - 3600, 16 - 3600, 16 - 3600</td>
</tr>
</tbody>
</table>

Nuclear charger range – DC UPS key options for nuclear plants

**Rectifier / charger**
- Crowbar device (Forsmark requirements) to keep the DC voltage within accepted tolerance
- 12-pulse rectifier to reduce THDi
- Output dropping diodes to control the output voltage within DC load tolerance
- Isolated DC/DC converter (Cddi range)

**System**
- Parallel configurations for redundancy to increase availability of the load
- Analogue meters on front panel for quick visualisation
- LCD touch panel display on front door

**Mechanical**
- Anti-seismic design to match seismic profile on site
- Specific frame colour to meet on-site requirements

**Features and benefits**
- Analogue control technology to inhibit software issues in highly critical applications
- Up to 60 years system design life (with appropriate and recommended maintenance schedule) to meet most demanding nuclear requirements
- Natural cooling on most of the range to increase systems’ reliability
- Integrated input transformer to fully isolate the battery circuit from the mains.
Industrial isolated DC/DC converter

**Features and benefits**

- Galvanic isolation to ensure the DC load is safe from any disturbances on the input circuit
- Analogue control technology to inhibit software issues in highly critical applications
- High input voltage tolerance to meet the wide battery circuit voltage range
- Available as a stand-alone unit or integrated into a UPS system to meet any requirement.

<table>
<thead>
<tr>
<th>Cddi – DC/DC converter key options for nuclear plants</th>
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<tbody>
<tr>
<td><strong>System</strong></td>
</tr>
<tr>
<td>Analogue meters to enhance local monitoring</td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
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<tr>
<td>Anti-seismic design to match seismic profile on site</td>
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<tr>
<td>Top cable entry to ease cabling</td>
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<tbody>
<tr>
<td>Input voltage (VDC)</td>
<td>110</td>
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<tr>
<td>Input voltage tolerance</td>
<td>90 V to 155 V</td>
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<td>Output voltage (VDC)</td>
<td>24</td>
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<td>Ratings (A)</td>
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<td>180 V to 300 V</td>
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- 200
Industrial DC/AC inverter

Nuclear inverter range - Single-phase output

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>From 2.5 to 250 kVA</th>
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</thead>
<tbody>
<tr>
<td>Input voltage (VDC)</td>
<td>110 220</td>
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<tr>
<td>Output voltage (VAC)</td>
<td>1 x 110 1 x 230</td>
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<tr>
<td>Range of ratings (kVA)</td>
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Nuclear inverter range - Three-phase output

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>From 2.5 to 320 kVA</th>
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<tbody>
<tr>
<td>Input voltage (VDC)</td>
<td>110 220</td>
</tr>
<tr>
<td>Output voltage (VAC)</td>
<td>3 x 220 3 x 400</td>
</tr>
<tr>
<td>Range of ratings (kVA)</td>
<td>5 - 160 5 - 200</td>
</tr>
</tbody>
</table>

From 2.5 to 320 kVA (500 on request) - DC/AC inverter key options for nuclear plants

Inverter / Static switch
- Specific inverter short-circuit capacity to support specific loads
- Specific operation mode of static switch to support highly critical load situations

System
- Analogue meters on front panel for quick visualisation
- LCD touch panel display on front door

Mechanical
- Anti-seismic design to match seismic profile on site
- Specific frame colour to meet on-site requirements

Features and benefits
- Analogue control technology to inhibit software issues in highly critical applications
- Up to 6/7 In inverter short circuit capacity to ensure full load safety
- Up to 60 years system design life (with appropriate and recommended maintenance schedule) to meet most demanding nuclear requirements
- Integrated output transformer to fully isolate the load from the DC circuit.
Secure Power Always

Industrial AC UPS systems

Nuclear UPS range - Single-phase output

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>From 2.5 to 250 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage (VAC)</td>
<td>3 x 400 (3 x 380, 3 x 415)</td>
</tr>
<tr>
<td>Intermediate DC voltage (VDC)</td>
<td>110 110 220 220 400 400</td>
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<tr>
<td>Output voltage (VAC)</td>
<td>1 x 110 1 x 230 1 x 110 1 x 230 1 x 110 1 x 230</td>
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</tbody>
</table>

Nuclear UPS range - Three-phase output

<table>
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<tr>
<th>RATINGS</th>
<th>From 2.5 to 500 kVA</th>
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<td>3 x 400 (3 x 380, 3 x 415)</td>
</tr>
<tr>
<td>Intermediate DC voltage (VDC)</td>
<td>110 110 220 220 400 400</td>
</tr>
<tr>
<td>Output voltage (VAC)</td>
<td>3 x 220 3 x 400 3 x 220 3 x 400 3 x 220 3 x 400</td>
</tr>
</tbody>
</table>

Nuclear UPS range - AC UPS key options for nuclear plants

Rectifier / charger

- Crowbar device (Forsmark requirements) to keep the DC voltage within accepted tolerance
- 12-pulse rectifier to reduce THDi
- Extended charger sizing to increase battery autonomy and reduce recharge time

Inverter / Static switch

- Specific inverter short-circuit capacity to support specific loads
- Specific operation mode of static switch to support highly critical load situations

Reserve supply

- By-pass transformer to fully isolate the output from the input
- By-pass stabiliser (AVR range) to fully control the output voltage within load tolerance, in by-pass mode

System

- Parallel configurations for redundancy to increase availability of the load
- Analogue meters on front panel for quick visualisation
- LCD touch panel display on front door

Mechanical

- Anti-seismic design to match seismic profile on site
- Specific frame colour to meet on-site requirements

Features and benefits

- Analogue control technology to inhibit software issues in highly critical applications
- Up to 60 years system design life (with appropriate and recommended maintenance schedule) to meet most demanding nuclear requirements
- Crowbar technology to meet latest Forsmark tests requirements
- Up to 6/7 in inverter short circuit capacity to ensure full load safety.

www.chloridepower.com
AC solutions

Servo controlled AC voltage stabilisers

Features and benefits
• 40 years minimum design life with appropriate recommended servicing to meet nuclear requirements
• Low internal impedance capable of sustaining high surge current
• Very low waveform distortion with any type of load
• Maintained +/-1% output voltage accuracy over the full range of input voltage variation, from 0 to 100% load.

AVR range

<table>
<thead>
<tr>
<th>RATINGS</th>
<th>From 5 to 500 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input and output type</td>
<td>Single phase</td>
</tr>
<tr>
<td>AC voltage (VAC)</td>
<td>1 x 110</td>
</tr>
<tr>
<td>Range of ratings (kVA)</td>
<td>5 - 250</td>
</tr>
</tbody>
</table>

AVR – AC voltage stabiliser key options for nuclear plants

System
• Nuclear qualification 1E
• Analogue meters to enhance local monitoring
• Volt-free contacts for remote monitoring
• Isolating transformer
• In/output switch
• Natural or forced cooling according to specifications

Mechanical
• Anti-seismic design to match seismic profile on site
• Specific frame colour to meet on-site requirements
• Top cable entry to ease cabling
Battery solutions

Battery, battery installation and protection solutions

Battery – Main requirements for nuclear

<table>
<thead>
<tr>
<th>Lead Acid</th>
<th>Vented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery type</td>
<td>Vented</td>
</tr>
<tr>
<td>Battery design life</td>
<td>12 to 20 years</td>
</tr>
<tr>
<td>Recommended number of cells (according to DC voltage for AC UPS)</td>
<td>110 VDC 220 VDC 400 VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nickel Cadmium</th>
<th>Vented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery type</td>
<td>Vented</td>
</tr>
<tr>
<td>Battery design life</td>
<td>20 to 25 years</td>
</tr>
<tr>
<td>Recommended number of cells (according to DC voltage for AC UPS)</td>
<td>110 VDC 220 VDC 400 VDC</td>
</tr>
</tbody>
</table>

Battery – Key options for nuclear

Installation
- Anti-seismic rack to match seismic profile of nuclear application
- Anti-seismic battery cabinet for space saving (if recombination batteries are specified)

Battery – Key options for nuclear

Electrical protection
- Protection of the battery through circuit breaker (MCCB) to allow remote shutdown of the battery circuit (also available: fuse or fuse-switch)

Installation of battery protection
- Wall-mounted box

Features and benefits
- Wide choice of batteries from the world’s leading battery manufacturers
- Self-made battery calculation thanks to Chloride’s long experience in the battery field
- Pre-sales recommendations for battery installation (for civil works, air flow...)
Monitoring solutions

Battery monitoring system

Features and benefits

- Continuous monitoring of battery to allow automatic detection of a potential failure before damage occurs
- Permanent monitoring of battery blocks or cells, Lead Acid or Nickel Cadmium, to reduce maintenance or replacement costs
- Remote access to live and historical data thanks to integrated data logger
- Multiple site supervision possible via interface panels or remote SCADA systems with enabled telemetry
- Compatible with any new or existing system.

System architecture

- CCB unit to interface with system sensors and pickups
- Data logger to coordinate multiple CCB units and to store and relay systems data
- Software for user interface

Monitoring

- Local or remote via PC, permanently or temporarily connected

Software

- View and storage of real time data
- Review systems events and historical files
- Production of hard copy reports
- Setting of alarm thresholds and event-driven output actions
LCD touch screen display

<table>
<thead>
<tr>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
</tr>
<tr>
<td>Redundant. Under mains failure, the display is powered by the battery</td>
</tr>
<tr>
<td>Screen Size - mm (H x L)</td>
</tr>
<tr>
<td>170 x 130</td>
</tr>
<tr>
<td>Measures</td>
</tr>
<tr>
<td>Acquisition and display of critical values for charger and inverter</td>
</tr>
<tr>
<td>Inputs</td>
</tr>
<tr>
<td>Acquisition of operating modes and alarms</td>
</tr>
<tr>
<td>Event memory</td>
</tr>
<tr>
<td>Recording of each event of the system (status, warning, alarm)</td>
</tr>
<tr>
<td>Event dynamic display</td>
</tr>
<tr>
<td>Real time visualisation of events related to a block of the system</td>
</tr>
<tr>
<td>Measures recorder</td>
</tr>
<tr>
<td>Permanent recording of selected critical measures from charger and inverter</td>
</tr>
</tbody>
</table>

Touch screen display – key options for nuclear

Options

- Customisation capability (software programming) to tailor the monitoring solution to the nuclear plant needs
- TCP capability to remotely monitor the UPS from the plant control room

Features and benefits

- Fully independent embedded microprocessors and software to keep the UPS control system safe from programming mistakes
- Small size, low power and economical solution
- Industry level of durability
- Designed to cope with industrial environmental conditions.
Portable maintenance tool

Features and benefits
- A dedicated tool to quickly check operational settings and thresholds of analogue controlled systems
- One dedicated tool for battery chargers and one for inverters systems; The combination of both allows to test a complete UPS system
- Portable system
- A wide range of testing features to easily check UPS system settings.

Features
- Power supply: 230 VAC / 50 Hz
- Output voltage setting: Via front-face potentiometers
- Faults simulation: Via front face switches
- Parameters visualisation: Via front-face digital meters
- Dimensions: 520 x 266 x 500 mm

Tests performed on battery chargers
- AC voltmetric relays: Test of the AC input voltage thresholds
- DC voltage: Test of the high DC voltage and low DC voltage thresholds
- Battery current limitation: Test of the battery current threshold
- Charger current limitation: Test of the charger current threshold

Tests performed on inverters
- Inverter DC thresholds: Test of the high input DC voltage, low input DC voltage and end of discharge voltage thresholds
- AC reserve supply: Test of the reserve input voltage tolerance thresholds
- Battery current limitation: Test of the battery current threshold
- Overload: Test of inverter overload capacity

Thermal imaging

Thermal imaging is a very useful technology to evaluate potential problems within UPS systems. Chloride’s service offer includes a thermal imaging survey on UPS systems. By using a hand-held thermal imaging camera, our service engineer checks temperature variations inside the UPS system or on the battery bank. The detection of hotspots or temperature differences is of great help to identify deviations from normal operation conditions. Thus, any predictive maintenance operation is enhanced by revealing developing problems before they turn into serious damage. Thermal imaging inspection is of great help to detect:
- Loose contacts
- Corroded connection points
- Unbalanced loads
- Overloaded transformer
- ...

Features and benefits
- Anticipation of a potential problem before it turns into serious damage
- Distant measuring technique which allow the service engineer to operate in safe area
- Digital picture taken (same view as the thermal imaging camera) to quickly locate hotspots.

Thermal imaging inspection is of great help to detect:
- Loose contacts
- Corroded connection points
- Unbalanced loads
- Overloaded transformer
- ...
Training

Considering the Safety Culture as being the keyword for nuclear power plants, Chloride is able to deliver tailor-made training sessions to help on-site technicians and engineers have deeper knowledge of our equipments. Several levels of training sessions can be offered according to your needs. These training sessions are delivered on site, on your specific equipment.

Features and benefits

• Enhanced Health and safety policy through understanding of UPS existing dangers
• Reduced human errors thanks to better UPS knowledge
• Increased secure power availability through reduced maintenance time.

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Operation</th>
<th>Basic maintenance</th>
<th>Advanced support</th>
</tr>
</thead>
</table>
| Basic maintenance | • Operate the system in a safe and confident way  
  • Understand basic information about the equipment (circuit diagrams, alarm signals) | • Operate the system in a safe and confident way  
  • Make first diagnosis upon equipment failure  
  • Proceed to simple operations and preventive maintenance actions | • Operate the system in a safe and confident way  
  • Analyse and solve complex equipment malfunctions  
  • Carry out most common repairs and preventive maintenance work  
  • Perform additional settings on Chloride systems |

Overview

<table>
<thead>
<tr>
<th>Overview</th>
<th>Basic maintenance</th>
<th>Advanced support</th>
</tr>
</thead>
</table>
| How to perform basic operations in a safe and confident way | How to diagnose and trouble-shoot simple problems  
  How to perform simple maintenance operations | How to diagnose and trouble-shoot most known problems  
  How to analyse and solve complex situations  
  How to perform complex maintenance procedures |

Audience

<table>
<thead>
<tr>
<th>Audience</th>
<th>Basic maintenance</th>
<th>Advanced support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technicians and operators involved in the general knowledge and operation of the UPS systems</td>
<td>Technicians and operators involved in the general control and checking of LV installations</td>
<td>Senior technicians and engineers involved in regular maintenance of LV installations</td>
</tr>
</tbody>
</table>

Required skills

<table>
<thead>
<tr>
<th>Required skills</th>
<th>Basic maintenance</th>
<th>Advanced support</th>
</tr>
</thead>
</table>
| Fundamentals and theoretical knowledge in electronic and electricity | Fundamentals and theoretical knowledge in electronic and electricity  
  Experience in maintenance operational process  
  Normal experience in low voltage practices | Strong knowledge in electronic and electricity  
  Day to day experience in maintenance operational process  
  Strong experience in low voltage practices |

Content

<table>
<thead>
<tr>
<th>Content</th>
<th>Basic maintenance</th>
<th>Advanced support</th>
</tr>
</thead>
</table>
| Instructions for safety procedures  
  Theoretical reminder about electricity and the main functions of a UPS  
  Presentation of your installed UPS  
  Instructions for user operation  
  Practice | “Operation level” content  
  Detailed presentation of sub-systems  
  Description of electronic boards  
  Description of status and alarms signals  
  Practice | “Basic maintenance level” content  
  Description of software architecture (settings, monitoring)  
  Practical course to place trainees into several common situations of preventive and corrective maintenance |
Chloride offers global service cover

Chloride operates through a worldwide network of Chloride sales and service offices and joint ventures, with operations across 80 countries including:

- Principal sales & service offices
- Service network

Almaty, Kazakhstan
Bangkok, Thailand
Beijing, China
Makati City, Philippines

Bologna, Italy
Buenos Aires, Argentina
Chicago, USA

Dubai, UAE
Erlangen, Germany
Ho Chi Minh City, Vietnam

Lisbon, Portugal
Istanbul, Turkey
Madrid, Spain

Moscow, Russia
Paris, France
Pune, India

Sao Paolo, Brazil
Shanghai, China
Singapore

Southampton, UK
Sydney, Australia
Warsaw, Poland

Chicago, USA
ONEAC® manufacturing, R&D centre North America HQ

London, UK
Group HQ Chloride Group plc

Erlangen, Germany
R&D centre

Dubai, UAE
Middle East HQ

Shenzhen, China

Lyon, France
Industrial UPS manufacturing, R&D centre

Bologna, Italy
UPS manufacturing, R&D centre International sales HQ

Singapore
SE Asia HQ

For a full list of contacts please visit our website at www.chloridepower.com