

CHLORIDE INDUSTRIAL SYSTEMS

Secure Power Always

Nuclear power protection solutions



Secure Power, from nuclear island to connection to the grid

How we operate

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 aim is to provide the best possible service to our customers. This challenge, which drives everything we do, is met by our continual investment in staff training as well as in technology.

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.

Secure power of nuclear plants is a core competence of Chloride

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

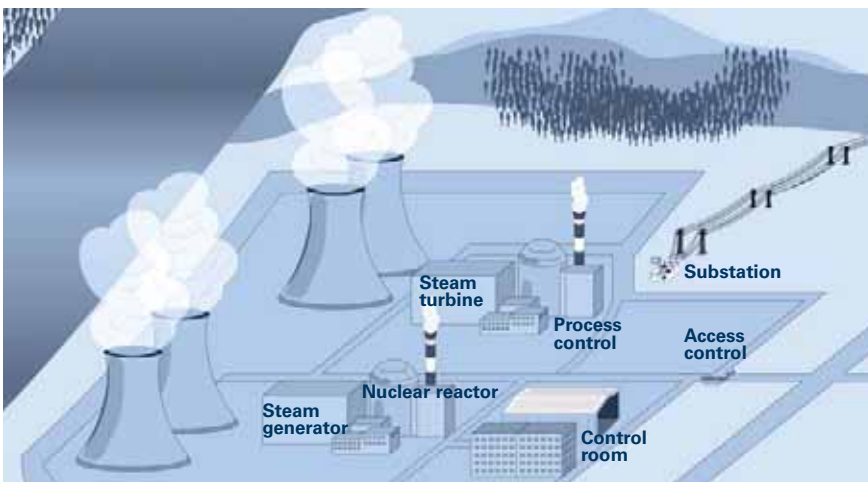
For more than 30 years, Chloride Industrial Systems has worked closely with Utilities to provide innovative solutions and services that meet the strictest requirements of nuclear applications.

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.



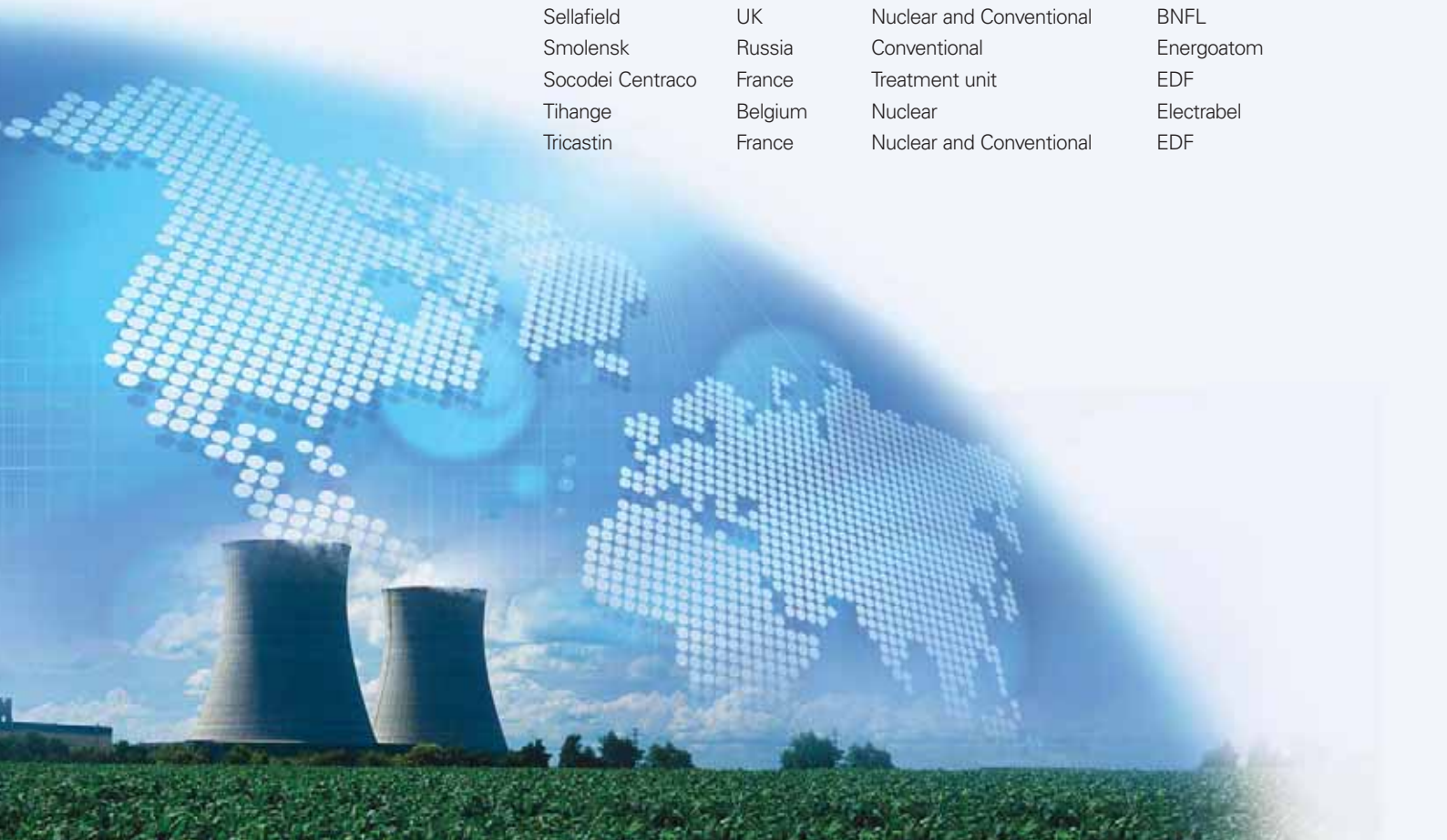
Secure Power facts:

- 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



Plant	Country	Application	Operator
Blayais	France	Nuclear and Conventional	EDF
Bugey	France	Nuclear and Conventional	EDF
CEA Cadarache	France	Laboratory	EDF
Chinon	France	Nuclear and Conventional	EDF
Dampierre	France	Nuclear and Conventional	EDF
Doel	Belgium	Nuclear	Electrabel
Dungeness A-B	UK	Nuclear	Magnox Electric Plc
Fessenheim	France	Nuclear and Conventional	EDF
Flamanville EPR	France	Nuclear	EDF
Gentilly	Canada	Nuclear	HydroQuebec
Gravelines	France	Nuclear and Conventional	EDF
Hunterston	UK	Nuclear	Scottish nuclear Ltd
La Hague	France	Treatment unit	EDF
Ling Ao	China	Conventional	LANPC
Lucas Height	Australia	Nuclear prototype	Ansto
Paluel	France	Nuclear	EDF
Qinshan	China	Conventional	QNPC
Saint Laurent	France	Nuclear and Conventional	EDF
Sellafield	UK	Nuclear and Conventional	BNFL
Smolensk	Russia	Conventional	Energoatom
Socodei Centraco	France	Treatment unit	EDF
Tihange	Belgium	Nuclear	Electrabel
Tricastin	France	Nuclear and Conventional	EDF



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.

Quality

Our French manufacturing facility, dedicated to manufacturing equipments for nuclear applications has been ISO 9001:2000 and ISO 14001:2004 accredited.



Safety

Further to our involvement to follow OHSAS 18001 as a guideline, we have been tailoring our quality system to meet nuclear safety standards such as German KTA 1401, American 10 CFR 50 Appendix B, French SGAQ (Spécification Générale d'Assurance Qualité).

Customer Care

All Chloride employees are regularly trained through the customer care program "Achieving Service Excellence" to better understand customers' expectations and perceptions and how to improve the quality of service delivery.

General UPS Standards

At Chloride, we are familiar with delivering UPS systems that strictly comply with international standards, such as IEC, IEEE, UL and NEMA.

THEME	IEC	IEEE/NEMA/UL
General and safety requirements for UPS	62040-1-2	NEMA PE1, UL 1778
EMC	62040-2	
Performance and tests	62040-3	
Low voltage switchgear	60439-1; -2; -3	UL 98, UL 489, UL198, UL 508
Semi-conductor converters	60146-1-1	
Inverters	60146-2	
Information technology - safety	60950	
Analogue measuring instruments	60051-1	
Dry type power transformers	60076	NEMA ST20
Protection degree	60529	NEMA 250
Battery chargers		NEMA PE5

Nuclear Standards

As nuclear projects require high level of safety, our nuclear team ensure our equipments, project management and services methods comply with:

THEME	RCC-E	IEEE
General documents	RCC-E CST applicable	IEEE 323 IEEE 650
Qualification program	Project specification ENGS 040036A	Project specification IEEE 650 §5
Functional & electrical	Project specified	Project specified
Ageing	Ageing evaluation test with dedicated test bench	IEE 650 §5.2.2.
Seismic	CRT 91C 1120 or analysis of specific standard	IEEE 344 and project data

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 fulfil 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



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

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.

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.



Climatic test.



Seismic test.

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



Seismic test.



Oven for ageing tests.

DC solutions

**Industrial DC UPS
systems (rectifiers /
chargers)**



Nuclear charger range - Single-phase input

RATINGS	From 25 to 250 A		
Input voltage (VAC)	1 x 230		
Voltage (VDC)	48	110	220
Range of ratings (A)	25 - 250	25 - 250	25 - 250

Nuclear charger range – Three-phase input

RATINGS	From 16 to 3600 A			
Input voltage (VAC)	3 x 400 (3 x 380, 3 x 415)			
Output voltage (VDC)	24	48	110	220
Range of ratings (A)	25 - 3600	25 - 3600	16 - 3600	16 - 3600

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



Cddi

RATINGS	From 20 to 200 A			
	110		220	
Input voltage (VDC)	110		220	
Input voltage tolerance	90 V to 155 V		180 V to 300 V	
Output voltage (VDC)	24	48	24	48
Ratings (A)	20	40		
20		•		•
40	•	•	•	•
50		•		•
80	•	•	•	•
100	•	•	•	•
160	•		•	
200	•		•	

Cddi – DC/DC converter key options for nuclear plants

System

Analogue meters to enhance local monitoring

Mechanical

Anti-seismic design to match seismic profile on site

Specific frame colour to meet on-site requirements

Top cable entry to ease cabling

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.

AC solutions

Industrial DC/AC inverter

Nuclear inverter range - Single-phase output

RATINGS	From 2.5 to 250 kVA			
Input voltage (VDC)	110		220	
Output voltage (VAC)	1 x 110	1 x 230	1 x 110	1 x 230
Range of ratings (kVA)	2.5 - 120	2.5 - 120	10 - 120	10 - 250

Nuclear inverter range - Three-phase output

RATINGS	From 2.5 to 320 kVA			
Input voltage (VDC)	110		220	
Output voltage (VAC)	3 x 220	3 x 400	3 x 220	3 x 400
Range of ratings (kVA)	5 - 160	5 - 200	10 - 250	10 - 320

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.

Industrial AC UPS systems

Nuclear UPS range - Single-phase output

RATINGS	From 2.5 to 250 kVA					
Input voltage (VAC)	3 x 400 (3 x 380, 3 x 415)					
Intermediate DC voltage (VDC)	110	110	220	220	400	400
Output voltage (VAC)	1 x 110	1 x 230	1 x 110	1 x 230	1 x 110	1 x 230

Nuclear UPS range - Three-phase output

RATINGS	From 2.5 to 500 kVA					
Input voltage (VAC)	3 x 400 (3 x 380, 3 x 415)					
Intermediate DC voltage (VDC)	110	110	220	220	400	400
Output voltage (VAC)	3 x 220	3 x 400	3 x 220	3 x 400	3 x 220	3 x 400

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.

AC solutions

Servo controlled AC voltage stabilisers



AVR range

RATINGS	From 5 to 500 kVA			
	Single phase		Three phase	
Input and output type	1 x 110	1 x 230	3 x 220	3 x 400
AC voltage (VAC)	5 - 250	5 - 250	5 - 500	5 - 500
Range of ratings (kVA)				

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

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 wave form distortion with any type of load
- Maintained +/-1% output voltage accuracy over the full range of input voltage variation, from 0 to 100% load.

Battery solutions

Battery, battery installation and protection solutions



Battery – Main requirements for nuclear

Lead Acid		
Battery type		Vented
Battery design life		12 to 20 years
Recommended number of cells (according to DC voltage for AC UPS)	110 VDC 220 VDC 400 VDC	60 114 192

Nickel Cadmium		
Battery type		Vented
Battery design life		20 to 25 years
Recommended number of cells (according to DC voltage for AC UPS)	110 VDC 220 VDC 400 VDC	90 170 293

Battery – Key options for nuclear

Installation
Anti-seismic rack to match seismic profile of nuclear applicationse
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...)
- End of life recycling services.

Monitoring solutions

Battery monitoring system



System architecture

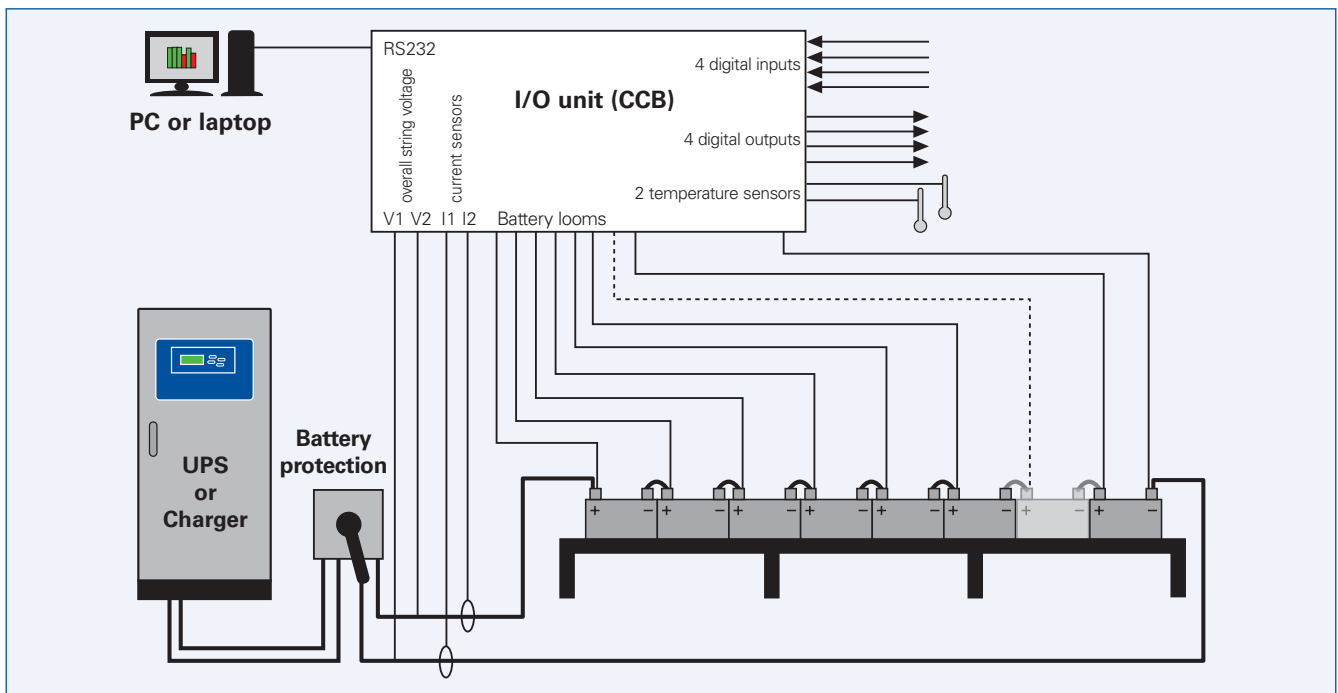
- CCB unit to interface with system sensors and pickups
- Data logger to coordinate multiple CCB units and to store and relay systems data
- Software for user interface

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



Features and benefits

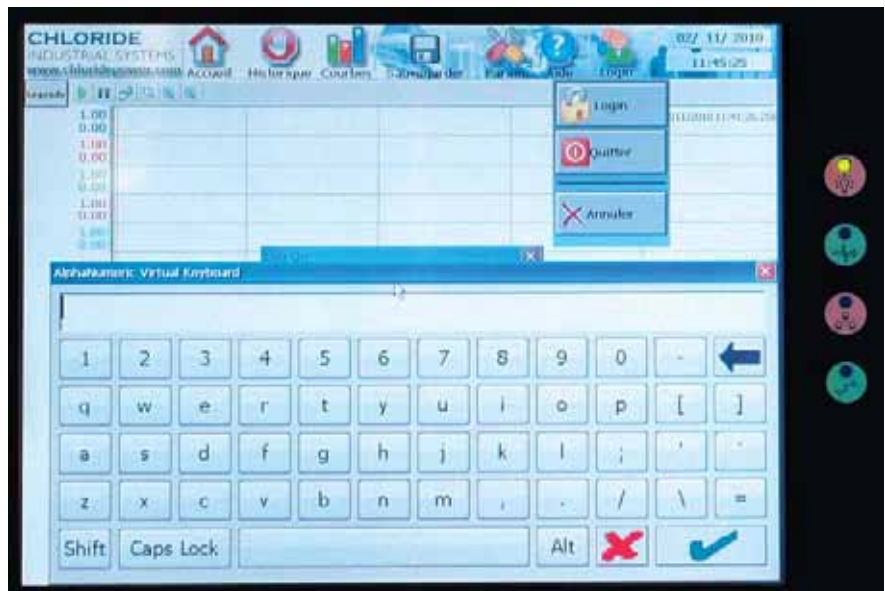
- Continuous monitoring of battery to allow automatic detection of a potential failure before damage occurs
- Permanent monitoring of battery blocks or cells, Lead Acid or Nickel Cadmium, to reduce maintenance or replacement costs
- Remote access to live and historical data thanks to integrated data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

LCD touch screen display

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

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.

Maintenance solutions

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 - mm (LxHxD)	520 x 266 x 500

Tests performed on battery chargers	
AC voltmeter 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

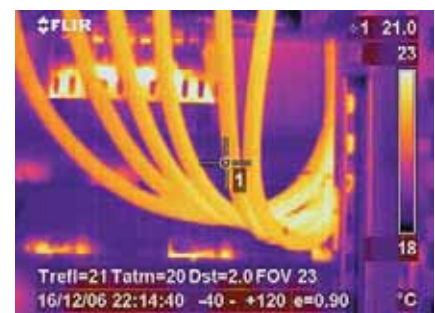
Thermal imaging

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.

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.



Power supply	Operation	Basic maintenance	Advanced support
Basic maintenance	<ul style="list-style-type: none"> • Operate the system in a safe and confident way • Understand basic information about the equipment (circuit diagrams, alarm signals) 	<ul style="list-style-type: none"> • Operate the system in a safe and confident way • Make first diagnosis upon equipment failure • Proceed to simple operations and preventive maintenance actions 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • How to perform basic operations in a safe and confident way 	<ul style="list-style-type: none"> • How to diagnose and trouble-shoot simple problems • How to perform simple maintenance operations 	<ul style="list-style-type: none"> • How to diagnose and trouble-shoot most known problems • How to analyse and solve complex situations • How to perform complex maintenance procedures
Audience	<ul style="list-style-type: none"> • Technicians and operators involved in the general knowledge and operation of the UPS systems 	<ul style="list-style-type: none"> • Technicians and operators involved in the general control and checking of LV installations 	<ul style="list-style-type: none"> • Senior technicians and engineers involved in regular maintenance of LV installations
Required skills	<ul style="list-style-type: none"> • Fundamentals and theoretical knowledge in electronic and electricity 	<ul style="list-style-type: none"> • Fundamentals and theoretical knowledge in electronic and electricity • Experience in maintenance operational process • Normal experience in low voltage practices 	<ul style="list-style-type: none"> • Strong knowledge in electronic and electricity • Day to day experience in maintenance operational process • Strong experience in low voltage practices
Content	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • “Operation level” content • Detailed presentation of sub-systems • Description of electronic boards • Description of status and alarms signals • Practice 	<ul style="list-style-type: none"> • ‘Basic maintenance level” content • Description of software architecture (settings, monitoring) • Practical course to place trainees into several common situations of preventive and corrective maintenance

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