Chloride™
Power to Protect

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Chloride® NP90R

3-phase input – 6 Pulses - DC output

Chloride® NP90R

Rectifier – Battery charger
3-phase input – 6 Pulses - DC output

1 Scope

This document describes a continuous duty three phase input, stand-alone, Direct Current (DC) output Uninterruptible Power System (UPS).

The Nuclear charger range meets customers' technical specifications for nuclear power plant applications.

The Nuclear range is part of Chloride's know-how and 30-years relationship with Utilities, including those engaged in Nuclear power generation.

Chloride Industrial Power services include:

- Consultancy services
- Pre-engineering design and support
- Project Management (contract management, detailed engineering, documents for approval, manufacturing, product testing, witness-testing if requested, shipment, tailored user manual)
- Services (recommended commissioning spare parts, commissioning services, product lifetime spare parts, hotline, trainings, maintenance contracts, etc…)

2 General requirements

2.1. ISO certification

Chloride France S.A. is certified by the British Standard Institution (BSI), as a company with a total quality and environmental control system in accordance with the ISO 9001 and ISO 14001.

2.2. Applied standards

The Nuclear range of battery chargers shall have the CE mark in accordance with the Safety and EMC Directives 2006/95/EC and 2004/108/EC.
The Nuclear charger range is designed and manufactured in accordance with the following international standards:

- IEC60146 Semi conductor converters:
  - IEC60146-1-1 specifications of basic requirements
  - IEC60146-1-3 transformers and reactors
  - IEC60146-2 self-commutated semiconductor converters including direct dc converters.
- IEC60950 Safety of information technology equipment including electrical business equipment
- IEC60439 Low voltage switchgear and control gear assemblies
  - IEC60439-1 Type-tested and partially type-tested assemblies
  - IEC60439-2 Particular requirements for busbar trunking systems (busways)
  - IEC 60439-3 Particular requirements for LV switchgear and control gear assemblies intended to be installed in places where unskilled persons have access for their use – distribution boards
- IEC60529 Degrees of protection provided by enclosures (IP Code)
- IEC60726 Dry-type power transformers
- EN61000-6-2 Electromagnetic compatibility (EMC) Generic standards – Immunity for industrial environments
- IEC61000-6-4 Electromagnetic compatibility (EMC) Generic standards – Emission standard for industrial environments.
- IEC60068-2-6 Environmental testing - Test Fc. Vibration (sinusoidal).
- IEC60068-2-57 Environmental testing - Test Ff. Vibration. Time-history & sine-beat method.
- IEC60068-3-3 Environmental testing - Seismic test methods for equipment.

Our nuclear qualified products have a long history of reliability, proven performance, and exceptional quality. Our UPS product offering includes a complete line of Chargers, Inverters & Static Switches qualified to IEEE-650 (general & ageing), IEEE-344 (seismic), IEEE-323 (environmental) and RCC-E 2005 standards.

2.3. Nuclear quality program

The Chloride Industrial Power Quality Program meets the requirements of the nuclear industry.
Our quality program is structured to meet the requirements of:

- 10CFR50 Appendix B
- RCC-E 2005
- KTA 1401
- IAEA 50-C-Q
- NAQ-1
- SGAQ 2004/04 domaine IPS
- NTAQ07/0403 classe 1
- 10 CFR Part 21
- ISO9001 & ISO14001.

3 Range overview

The system described is a static direct current uninterruptible power supply system (DC UPS) as shown in Figure 1. The system operates on an analogue controlled thyristors charger. The nuclear range do not use any programmable component so that software qualification is not needed. By adding system components, such as paralleling diodes, safety and disconnecting devices, isolated or non-isolated DC/DC converters, it is possible to set up elaborated systems ensuring complete DC load protection.

3.1. The system

The DC UPS provides high quality DC power for electronic equipment loads. It offers the following features:

- Increased DC power quality
- Full compatibility with all types of loads
- Power blackout protection (for systems associated with battery)
- Full battery care
- Design life up to 60 years, combined with an appropriate preventive maintenance
- Operation temperature of 0 to 40°C permanent.
- Operation under extreme earthquake conditions.

The DC UPS automatically provides continuous electrical power, within the defined limits and without interruption, upon failure or degradation of the network supply AC source. The length of the back-up time, i.e. autonomy time in the event of power network failure, is determined by the battery capacity.

3.2. Models available

The Nuclear charger range includes several DC voltage output models as specified in paragraph 9. It is of the three-phase input type.

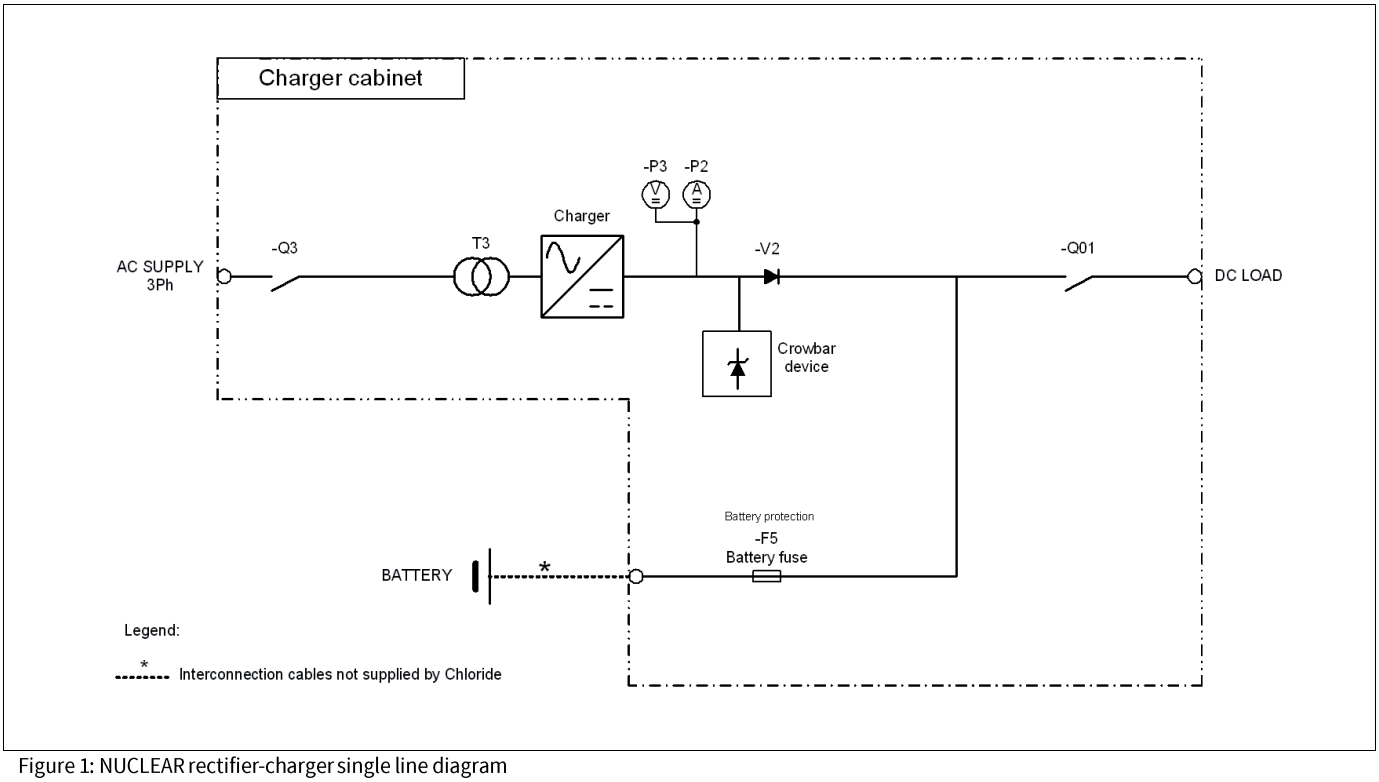


Figure 1: NUCLEAR rectifier-charger single line diagram

4 System description

In this section, the main power electronic features and the operating modes of the Nuclear battery charger range are described.

4.1. General description

The three-phase current taken from the AC source is converted to a regulated DC voltage by a 6-pulse rectifier.
In order to protect the power components within the system, the rectifier bridge is fused with a fast acting fuse. A transformer is provided at the input of the rectifying bridge.

The rectifier/charger is able to operate with the following types of battery:

- Valve regulated Lead Acid
- Vented Lead Acid
- Recombination Nickel Cadmium
- Vented Nickel Cadmium

The selection of the optimum charging method is completely managed by an analogue control board to allow the necessary complete range of settings.

4.2. Components

The DC UPS shall consist of the following major components:

- One input isolator
- One main transformer
- Thyristors bridge Rectifier / battery charger
- One LC smoothing circuit
- One Crowbar device (protection against Forsmark effect)
- One Control unit, based on one analogue control board CC6P
- Control and visualisation devices (meters, LEDs)
- Battery stand or matching battery cubicles if requested

4.3. Operating modes

The Nuclear charger is regulated with constant voltage and current limiting, respecting an UI characteristic. The DC UPS operates as follows:

4.3.1. Normal operation

The critical DC load is continuously supplied by the rectifier. The rectifier/ charger derives power from the AC source and converts it into DC power for the critical load whilst simultaneously maintaining the battery in a fully charged and optimum operational condition. The rectifier-charger operates in floating mode, floating voltage being determined by the battery type and data.

4.3.2. AC supply failure

Upon fault of the AC source, the critical load is still supplied by the battery. The critical DC load draws its power from the associated battery without switching. During failure, reduction or restoration of the AC source, there is no interruption to the critical load.

4.3.3. AC supply fast transient ('Forsmark' effect)

This is mainly due to a disconnection of the power alternator from the grid. This is a new accidental condition to UPS's which occurred at Forsmark with an AC supply voltage dropping down to 80%, then raising up to 130% with fast slew rate. In worst case, this can lead to a temporary high DC voltage on charger output (even with a charged battery connected to the DC bus) of up to +60%.

Thanks to our Crowbar device, we can eliminate the risk of tripping for sensitive DC loads like inverters.

The Crowbar device consists in:

- Independent electronic board (CASC printed circuit board) to monitor permanently DC voltage, trigger the thyristor and stop the charger in case of overvoltage.
- Dedicated electrical circuit (thyristor + choke) to limit the DC overvoltage to max +10% of the nominal voltage (within 3ms)
- Blocking diode to avoid battery short-circuit during Crowbar device operation
- Automatic restart will occur few seconds after the AC disturbance (this feature can be latched upon request).

4.3.4. Recharge operation

Upon restoration of the AC source, the rectifier-charger automatically restarts and gradually takes over both the DC load and the battery recharge, even if the batteries are fully discharged.
This operational mode is a fully automatic function and does not cause any interruption to the critical load. It operates as follow:
For a power failure below 5 minutes, the rectifier-charger automatically remains in floating mode upon restoration of the AC source.
For a power failure beyond 5 minutes and upon restoration of the AC source, the rectifier-charger automatically switches to the equalizing charge mode for 15 hours (adjustable) and then switches back to the floating mode.

4.3.5. Boost mode

This operating mode is a specific mode dedicated to vented type batteries. It is used when boost charge or commissioning charge is requested. Before launching this operating mode, the operator shall check that all DC

loads are disconnected from the DC UPS output.
During Boost mode, the voltage limitation is increased (up to 2.65V per cell for a Lead Acid battery and up to 1.7V per cell for a Nickel Cadmium battery).

Restoration of the FLOATING mode is automatic after a preset typical time of 5 hours, unless the FLOATING mode is manually initiated by the operator through the control unit.

4.4. Electrical features

4.4.1. Total harmonic distortion of input voltage

The maximum voltage THD allowed on the rectifier input is 8% to guarantee the correct operation of the system (either from utility or from generator).

4.4.2. Rectifier current limitation

The rectifier-charger current is limited to the nominal value either in floating, charge and boost mode.

4.4.3. Battery current limitation

The battery current is limited to 0,1C (Pb) or 0,2C (NiCd) of the associated battery, in floating or charge modes. In equalization mode, the battery current is limited to 0,05C (Pb) or 0,1C (NiCd).

4.4.4. Over voltage protection

The rectifier-charger is automatically turned off if the DC voltage exceeds the maximum value associated to their operational status.

5 Advanced Battery Care

The Nuclear charger range increases battery life by using several battery care features, as described hereafter.

5.1. Operating parameters

Unless specified in the customer's technical specification, the battery parameters are determined by Chloride Industrial Power in full respect with the customer's application and the choice of battery type.

The battery parameters to be determined and set up in the DC UPS are:

- High voltage alarm (V)
- Float voltage (V)
- Charge voltage (V)
- Boost voltage (V)*
- Battery discharging alarm (V)
- Minimum battery test voltage (V)**
- Imminent shutdown alarm (V)

*according to battery type
**optional

5.2. Automatic battery test (optional with CTB option)

The operating conditions of the batteries are automatically tested by the control unit at selectable intervals, e.g. weekly, fortnightly or monthly. A short-time discharge of the battery is made to confirm that all the battery blocks and connecting elements are in good working order. In order to avoid a faulty diagnosis, the test is launched 15 hours after the last battery discharge at the earliest.
The battery test is performed without any risk to the user, even if the battery is wholly defective. A detected battery fault is alarmed to the user. The battery test does not cause any degradation in terms of expected life of the battery.

5.3. Ambient temperature compensated battery charger

The rectifier-charger output voltage operates within narrow limits according to the battery manufacturer's technical data. In order to ensure an optimum battery charging, regulation is automatically adjusted to the ambient temperature.

The float voltage and the discharge voltage of the battery are automatically adjusted as a function of the temperature in the battery

compartment in order to maximise battery operating life.

The temperature adjustment is:
-3 mV/°C/cell

5.4. Battery Monitoring System (optional)

The battery associated to the system can be connected to our Battery Monitoring System, upon request (contact us for more details).

The use of the Battery Monitoring System significantly increases the reliability and safety of batteries, and thus the reliability of the entire DC UPS unit.

The features of the Battery Monitoring System option are:

- It uses a highly precise measuring unit to automatically monitor the UPS battery as a complete unit
- It monitors each individual battery block (of 6V or 12 V) or cell (2V or 1.2V) throughout all phases of DC UPS operation.
- It diagnoses changes and faults in the battery system
- It warns the user early enough before the breakdown of the whole DC UPS.
- It helps localise errors by measuring the voltages of each battery block or cell.
- It helps to drastically reduce ongoing maintenance costs.

NOTE: Despite the fact that the Battery Monitoring System do not require any Nuclear qualification, the connection to the battery and the design of wiring is achieved not to affect the UPS / battery qualification.

6 Monitoring and Control Interfaces

The rectifier-charger incorporates the necessary controls, instruments and indicators to allow the operator to monitor the system status and performance and take any appropriate action. Furthermore, several interfaces are available upon request, which allow extended monitoring and control, as well as service functions.

6.1. Light emitting diodes (LEDs)

The rectifier-charger includes 6 external Light Emitting Diodes (LEDs) to indicate the overall system operation status.

LEDs operation is described in Figure 2.

Further 6-LED modules can be added upon request, i.e. depending on optional devices (Earth Fault Monitoring, Crowbar detection…)

6.2. On / Off switch

Starting and Stopping the charger is manually achieved via the front panel switch S1, available on the right part of the LED signalling panel (see Figure 3)

6.3. Measurements reading

2 analogue measuring units (P2 and P3) are available as standard on the front panel of the equipment. These allow the user to visualise the charger output DC voltage (P3) and the charger output DC current (P2) – see Figure 3.

	LED colour	**Label**	**Description**	
	Red	Charger fault	Charger is off or AC supply is not present or internal fault	
	Red	Charger high voltage	DC output voltage beyond defined high limit	
	Red	Charger low voltage	DC output voltage beyond defined low limit	
	Yellow	Floating mode	Charger is on float	
	Yellow	Equalisation mode	Charger is in equalisation mode (initiated either manually or automatically)	
	Yellow	Boost mode	Charger is in boost mode (manually initiated)	

Figure 2: Nuclear rectifier-charger – Light Emitting Diodes (LED) operation description

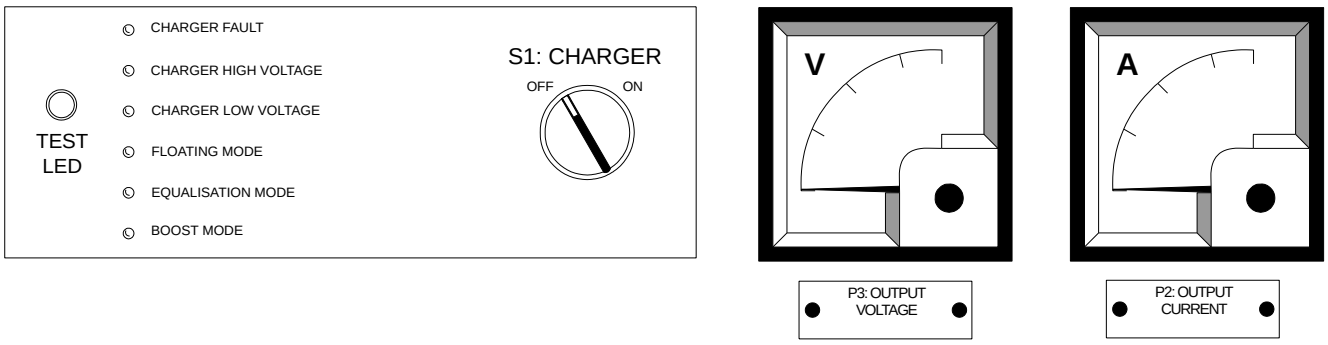


Figure 3: Nuclear rectifier-charger – Local human-machine interface.

6.4. Remote signalling and control signal

6.4.1. Logic outputs for remote indications

The Nuclear charger is able to deliver several output information. Upon request, these output information can be made available on double-pole change-over (dpco) contacts (8A/250V AC1; 8A/30V DC1; 1A/60V DC1).

The following information can be made available on voltage-free contacts:

Charger OK
High DC voltage
Low DC voltage
Mains OK
Floating Mode
Equalization Mode
Initial charge mode
Battery test mode

6.4.2. Logic inputs

The Nuclear charger range allows the signalisation of specific alarms from the customer's environment and eventually takes the appropriate action on the DC UPS thanks to dedicated logic inputs available.

Upon request, the following logic inputs can be wired:

Remote control on/off
Battery protection status
DC earth fault
Input protection status

7 Mechanical data

Boost /commissioning mode
Battery room ventilation system failure

7.1. Enclosure

The Nuclear rectifier-charger is housed in a space-saving modular enclosure including front doors and removable panels (standard external protection IP 20). The enclosure is made of sheet steel. The doors can be locked. The enclosure is of the stand-alone type. For harsh environmental conditions (dust, water), a higher degree of protection, of up to IP42 is available upon request.

7.2. Seismic build

Our Nuclear range of rectifier-chargers is designed to meet any requirement of worldwide seismic spectrums (0.5 to 6g acceleration stress). This is basically achieved by selecting the appropriate cabinet among our choice of mechanical structures and rigorously applying nuclear dedicated manufacturing procedures.

Panel thickness is of 2mm on the complete nuclear range.

7.3. Ventilation

Natural air cooling is standard on the Nuclear rectifier range.

The cooling air entry is in the base and the air exit at the top of the device (some ratings also need side and/or rear clearance). It is recommended that the enclosure is installed with at least 400 mm of free space between device and ceiling at the top in order to allow an unhindered cooling air exit.

7.4. Cable entry

Cable entry is achieved via the bottom of the cabinet. Top cable entry is also available upon request.

7.5. Enclosure design

All the surfaces of the enclosure are finished with an electrostatically applied powder-epoxy-polyester coat, cured at high temperature. Colour of the enclosure is RAL 7032 (pebble grey) textured semi-gloss.
Specific surface finishing and colour of the enclosure are available upon request.

7.6. Cabling

Internal cables are halogen-free cables.These cables are of the flame-retardant type according to IEC 332-3 standard (LSF – Low Smoke Fume).

7.7. Components identification

Main components are identified by self-adhesive vinyl labels. In option, the Nuclear charger offers the possibility to include specific component identification by engraved traffolyte labels.

7.8. Access to integrated subassemblies

All internal subassemblies are accessible for typical and most frequent maintenance from the front of the unit. Top access is available for replacement of cooling fans, if any. Rear access is not required for installation or servicing. In any case and if side or rear access is required, the side and rear panels are removable.

7.9. Installation

The rectifier-charger is forkliftable from the front and equipped with lifting lugs to facilitate its installation on site.
Chloride will issue calculation notes for fixing devices in order to meet on-site building requirements (e.g. Halfen rail, concrete anchors, bolts, etc…)

8 Environmental conditions

The Nuclear rectifier-charger is capable of withstanding any combination of the following environmental conditions. It operates without mechanical or electrical damage or degradation of operating characteristics.

8.1. Ambient temperature

The rectifier-charger is capable of operating permanently from 0° to 40°C.

8.2. Relative humidity

The rectifier-charger is capable of withstanding up to 90% humidity level (non-condensing) for an ambient temperature of 20°C.

8.3. Altitude

The maximum altitude without derating is 1000 metres above sea level. Please consult us for operating the system above 1000 metres.

9 Technical data

Data common to the complete Nuclear charger range

Rectifier input

Nominal input voltage	(V)	400 [380 / 415] (other upon request)
Input phases		3 ph + N
Input voltage tolerance	(%)	+15 / -15 (-20% upon request)
Nominal frequency	(Hz)	50 / 60 (factory setting selectable)
Tolerance on frequency	(%)	+5 / -5
Rectifier type		6 pulse SCR (thyristors)*
Isolation transformer		Standard
Maximum recommended voltage distortion (THD) from Mains (or generator) on the input of the rectifier	(%)	8

Rectifier output

DC voltage stability	(%)	+/-1 (+/-1.5 for paralleled systems)
DC voltage ripple in float (with battery connected)	(% rms)	1
Rectifier-charger current limitation (in floating, charge or boost)		I nominal

System data

External protection degree		IP 20
Internal protection degree		IP 20 open door
Cable entry		Bottom
Access		Front
System design life	(years)	20 minimum, up to 60 with appropriate maintenance

Environmental data

Operating temperature	(°C)	0 to 40 (permanent operation)
Storage temperature	(°C)	0 to +70
Maximum relative humidity (non condensing)	(%)	<90
Operating altitude		1000 m (without system derating)

Battery

Battery types	Lead Acid or Cadmium Nickel, vented or recombination types
Battery autonomy	From 10 minutes to hours
Battery current limitation in floating and charge modes	According to customer's specification Typical values: 0.1C (Lead Acid battery) 0.2C (Nickel Cadmium battery)
Battery current limitation in boost mode	0,05C (Lead acid battery) 0,1C (Nickel Cadmium battery)

(*)Primary Thyristors / double-star transformer/secondary diodes technology is used for very high ratings in 24VDC

Data for 24 VDC output systems

Ratings	(A)	25	60	100	125	160	200	250	320	400
Rectifier input										
Current consumption at full load	(A)	2	4	7	8	10	12	15	19	24
Rectifier output										
Battery nominal voltage	(V)	24								
Output voltage in floating	(V)	27.24								
Max DC current	(A)	25	60	100	125	160	200	250	320	400
System data										
Heat dissipation system(*)		N	N	N	N	N	N	N	N	N
Dissipated power	(W)	227	488	681	799	957	1196	1395	1785	2231
Efficiency(***)	(%)	75	77	80	81	82	82	83	83	83
Noise	(dBA)	60	60	60	60	60	60	60	60	60
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	600	600	600	800	800	800	800	800	800
Depth	(mm)	600	600	600	800	800	800	800	800	800
Footprint	(m^2)	0.36	0.36	0.36	0.64	0.64	0.64	0.64	0.64	0.64
Mass(**)	(kg)	270	290	300	310	330	330	350	360	400
Drawing code (see page 21)										
Code for general arrangement		AN0	AN0	AN0	BN0	BN0	BN0	BN0	BN0	BN0

Ratings	(A)	**500**	**600**	**800**	**1000**	**1250**	**1500**	**2000**	**2500**
Rectifier input									
Current consumption at full load	(A)	30	36	45	56	70	84	112	140
Rectifier output									
Battery nominal voltage	(V)	24							
Output voltage in floating	(V)	27.24							
Max DC current	(A)	500	600	800	1000	1250	1500	2000	2500
System data									
Heat dissipation system(*)		N	N	N	N	N	N	N	N
Dissipated power	(W)	2790	3348	4463	3714	4643	5572	7430	9286
Efficiency(***)	(%)	83	83	83	88	88	88	88	88
Noise	(dBA)	60	60	60	60	63	63	63	66
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	1200	1200	1200	800	1200	1200	1600	1600
Depth	(mm)	800	800	800	800	800	800	800	1000
Footprint	(m^2)	0.96	0.96	0.96	0.64	0.96	0.96	1.28	1.60
Mass(**)	(kg)	430	490	600	650	700	900	1200	1350
Drawing code (see page 21)									
Code for general arrangement		CN0	CN0	CN1	BN1	CN1	CN1	EN1	FN1

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (12 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 3x400VAC Mains input at cos phi=0,85. The system can also be designed and pre-set for use with any other type of stationary battery.

-(*) N: Natural cooling / F: Fan-assisted cooling

-(**) For information only. Mass may vary according to configurations and options

-(***) For tolerance, see IEC 60146-1-1

Data for 48 VDC output systems

Ratings	(A)	**25**	**40**	**60**	**80**	**100**	**125**	**160**	**200**	**250**
Rectifier input										
Current consumption at full load	(A)	3	5	7	9	11	14	18	22	28
Rectifier output										
Battery nominal voltage	(V)	48								
Output voltage in floating	(V)	54.48								
Max DC current	(A)	25	25	25	25	25	25	25	25	25
System data										
Heat dissipation system(*)		N	N	N	N	N	N	N	N	N
Dissipated power	(W)	319	415	577	769	814	1018	1188	1347	1683
Efficiency(***)	(%)	81	84	85	85	87	87	88	89	89
Noise	(dBA)	60	60	60	60	60	60	60	60	60
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	600	600	600	600	600	800	800	800	800
Depth	(mm)	600	600	600	600	600	800	800	800	800
Footprint	(m^2)	0.36	0.36	0.36	0.36	0.36	0.64	0.64	0.64	0.64
Mass(**)	(kg)	280	300	310	310	330	340	350	370	400
Drawing code (see page 21)										
Code for general arrangement		AN0	AN0	AN0	AN0	AN0	BN0	BN0	BN0	BN0

Ratings	(A)	**320**	**400**	**500**	**600**	**800**	**1000**	**1200**
Rectifier input								
Current consumption at full load	(A)	35	44	55	66	88	110	131
Rectifier output								
Battery nominal voltage	(V)	48						
Output voltage in floating	(V)	54.48						
Max DC current	(A)	320	400	500	600	800	1000	1200
System data								
Heat dissipation system(*)		N	N	N	N	N	F	F
Dissipated power	(W)	2155	2693	3367	3026	3632	4843	7264
Efficiency(***)	(%)	89	89	89	90	90	90	90
Noise	(dBA)	60	60	60	60	63	63	63
Height	(mm)	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	800	800	1200	1200	1200	1200	1600
Depth	(mm)	800	800	800	800	800	800	800
Footprint	(m^2)	0.64	0.64	0.96	0.96	0.96	0.96	1.28
Mass(**)	(kg)	460	500	530	580	620	680	760
Drawing code (see page 21)								
Code for general arrangement		BN0	BN0	CN0	CN1	CN1	CN1	EN1

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (24 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 3x400VAC Mains input at cos phi=0,85. The system can also be designed and pre-set for use with any other type of stationary battery.

-(*) N: Natural cooling / F: Fan-assisted cooling

-(**) For information only. Mass may vary according to configurations and options

-(***) For tolerance, see IEC 60146-1-1

Data for110 VDC (120VDC) output systems

Ratings	(A)	16	25	40	60	80	100	125	160	200
Rectifier input										
Current consumption at full load	(A)	4	6	10	15	20	24	30	38	47
Rectifier output										
Battery nominal voltage	(V)	104								
Output voltage in floating	(V)	118.04								
Max DC current	(A)	16	25	40	60	80	100	125	160	200
System data										
Heat dissipation system(*)		N	N	N	N	N	N	N	N	N
Dissipated power	(W)	415	562	769	1058	1411	1459	1824	2098	2335
Efficiency(***)	(%)	82	84	86	87	87	89	89	90	91
Noise	(dBA)	60	60	60	60	60	60	60	60	60
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	600	600	600	600	600	600	800	800	800
Depth	(mm)	600	600	600	600	600	600	800	800	800
Footprint	(m^2)	0.36	0.36	0.36	0.36	0.36	0.36	0.64	0.64	0.64
Mass(**)	(kg)	290	300	320	330	330	370	440	440	490
Drawing code (see page 21)										
Code for general arrangement		AN0	AN0	AN0	AN0	AN0	AN0	BN0	BN0	BN1

Ratings	(A)	250	320	400	500	600	800	1000	1200
Rectifier input									
Current consumption at full load	(A)	59	74	93	116	139	185	232	278
Rectifier output									
Battery nominal voltage	(V)	104							
Output voltage in floating	(V)	118.04							
Max DC current	(A)	250	320	400	500	600	800	1000	1200
System data									
Heat dissipation system(*)		N	N	N	N	N	N	N	F
Dissipated power	(W)	2919	3284	4105	51332	6159	7108	8885	9041
Efficiency(***)	(%)	91	92	92	92	92	93	93	94
Noise	(dBA)	60	63	63	63	66	66	66	69
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	800	1200	1200	1200	1200	1200	1600	1600
Depth	(mm)	800	800	800	800	800	800	800	800 or 1000
Footprint	(m^2)	0.64	0.96	0.96	0.96	0.96	0.96	1.28	1.28
Mass(**)	(kg)	500	540	590	630	700	740	960	1050
Drawing code (see page 21)									
Code for general arrangement		BN1	CN0	CN1	CN1	CN1	CN1	EN1	EN3 (or FN3)

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (52 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 3x400VAC Mains input at cos phi=0,85. The system can also be designed and pre-set for use with any other type of stationary battery.

-(*) N: Natural cooling / F: Fan-assisted cooling

-(**) For information only. Mass may vary according to configurations and options

-(***) For tolerance, see IEC 60146-1-1

Data for 220 VDC (240 VDC) output systems

Ratings	(A)	**16**	**25**	**40**	**60**	**80**	**100**	**125**	**160**	**200**
Rectifier input										
Current consumption at full load	(A)	8	12	19	28	37	46	57	73	91
Rectifier output										
Battery nominal voltage	(V)	208								
Output voltage in floating	(V)	236.08								
Max DC current	(A)	16	16	16	16	16	16	16	16	16
System data										
Heat dissipation system(*)		N	N	N	N	N	N	N	N	N
Dissipated power	(W)	515	656	934	1401	1868	1777	2221	2843	3014
Efficiency(***)	(%)	88	90	91	91	91	93	93	93	94
Noise	(dBA)	60	60	60	60	60	60	60	63	63
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	600	600	600	600	800	800	800	800	800
Depth	(mm)	600	600	600	600	800	800	800	800	800
Footprint	(m^2)	0.36	0.36	0.36	0.36	0.64	0.64	0.64	0.64	0.64
Mass(**)	(kg)	290	310	340	380	380	410	490	510	560
Drawing code (see page 21)										
Code for general arrangement		AN0	AN0	AN0	AN0	BN0	BN0	BN0	BN1	BN1

Ratings	(A)	**250**	**320**	**400**	**500**	**600**	**800**	**1000**
Rectifier input								
Current consumption at full load	(A)	113	145	181	224	269	358	448
Rectifier output								
Battery nominal voltage	(V)	208						
Output voltage in floating	(V)	236.08						
Max DC current	(A)	250	320	400	500	600	800	1000
System data								
Heat dissipation system(*)		N	N	N	N	N	N	N
Dissipated power	(W)	3767	4822	6027	6213	7455	7869	12425
Efficiency(***)	(%)	94	94	94	95	95	96	96
Noise	(dBA)	63	66	66	66	69	69	69
Height	(mm)	1870	1870	1870	1870	1870	2270	2270
Width	(mm)	1200	1200	1200	1200	1600	1600	1600
Depth	(mm)	800	800	800	800	1000	1000	1000
Footprint	(m^2)	0.96	0.96	0.96	0.96	1.60	1.60	1.60
Mass(**)	(kg)	620	650	730	820	930	1090	1300
Drawing code (see page 21)								
Code for general arrangement		CN1	CN1	CN1	CN1	EN1	GN1	HN3

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (104 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 3x400VAC Mains input at cos phi=0,85. The system can also be designed and pre-set for use with any other type of stationary battery.

-(*) N: Natural cooling / F: Fan-assisted cooling

-(**) For information only. Mass may vary according to configurations and options

-(***) For tolerance, see IEC 60146-1-1

10 Parallel operation

The Nuclear battery charger systems have the capability to be connected in parallel for dual configurations between units of the same rating. The parallel connection of Nuclear battery chargers increases reliability for the DC load.

10.1. System description

The Nuclear charger range is capable of operating in parallel as shown on Figure 4.

In this configuration, both chargers concur to charge the same battery. The DC load is equally shared between both rectifiers.

10.2. Operating principle

The paralleling principle is based on static regulation.

The characteristic U = f(I) is slightly changed to give it a small slope (of 0.5 to 1%) - (see Figure 5).

The internal voltage reference U0 is modified according to the current the charger must supply, so that the characteristic becomes:

$U_S = U_0 - kI$ where:

U_S = output voltage

U_0 = reference voltage

k = static regulation coefficient

I = charger output current

Thus, when 2 chargers are connected in parallel, the characteristics are:

$U_{S1} = U_{01} - k_1 I_1$

$U_{S2} = U_{02} - k_2 I_2$

And, $U_{S1} = U_{S2}$

The U_0, k and I parameters are set to the same values so that output currents are similar: $I_1 = I_2$

(see Figure 6)

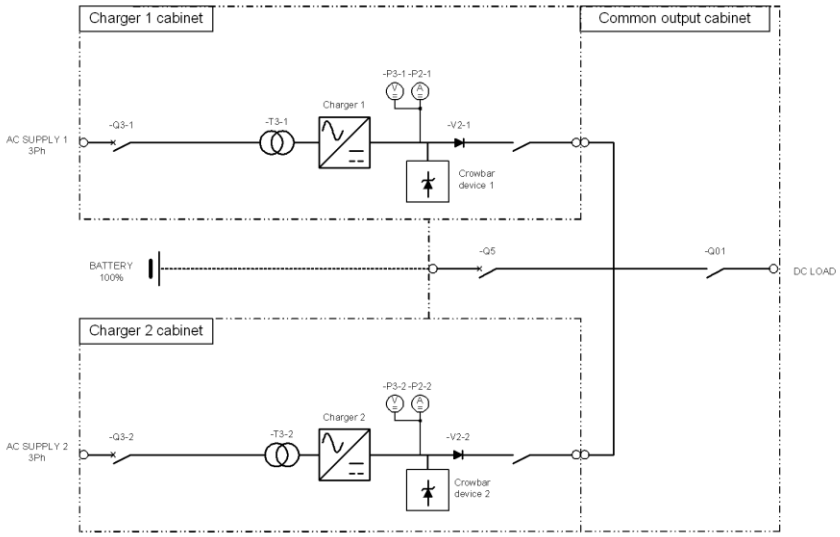


Figure 4: Single line Diagram of 2 rectifiers in parallel configuration

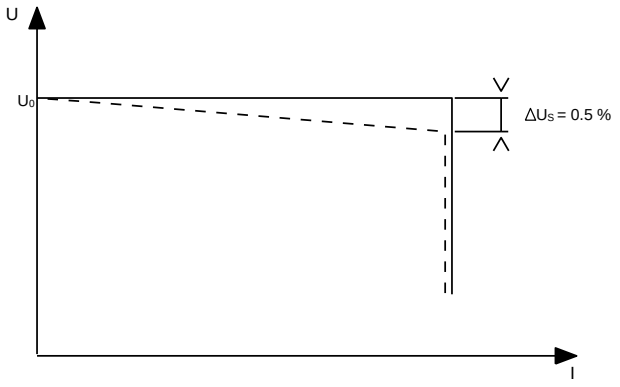


Figure 5: Slope description for static regulation of paralleled chargers

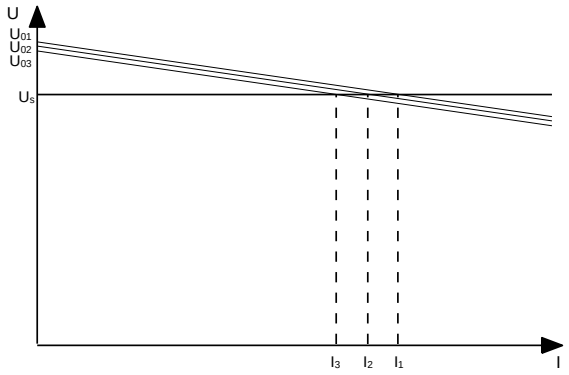


Figure 6: Curve principle of 3 chargers in parallel

11 Options

11.1. Main electrical options

The list of options described in this section is non-exhaustive. Please consult us for any other requirement.

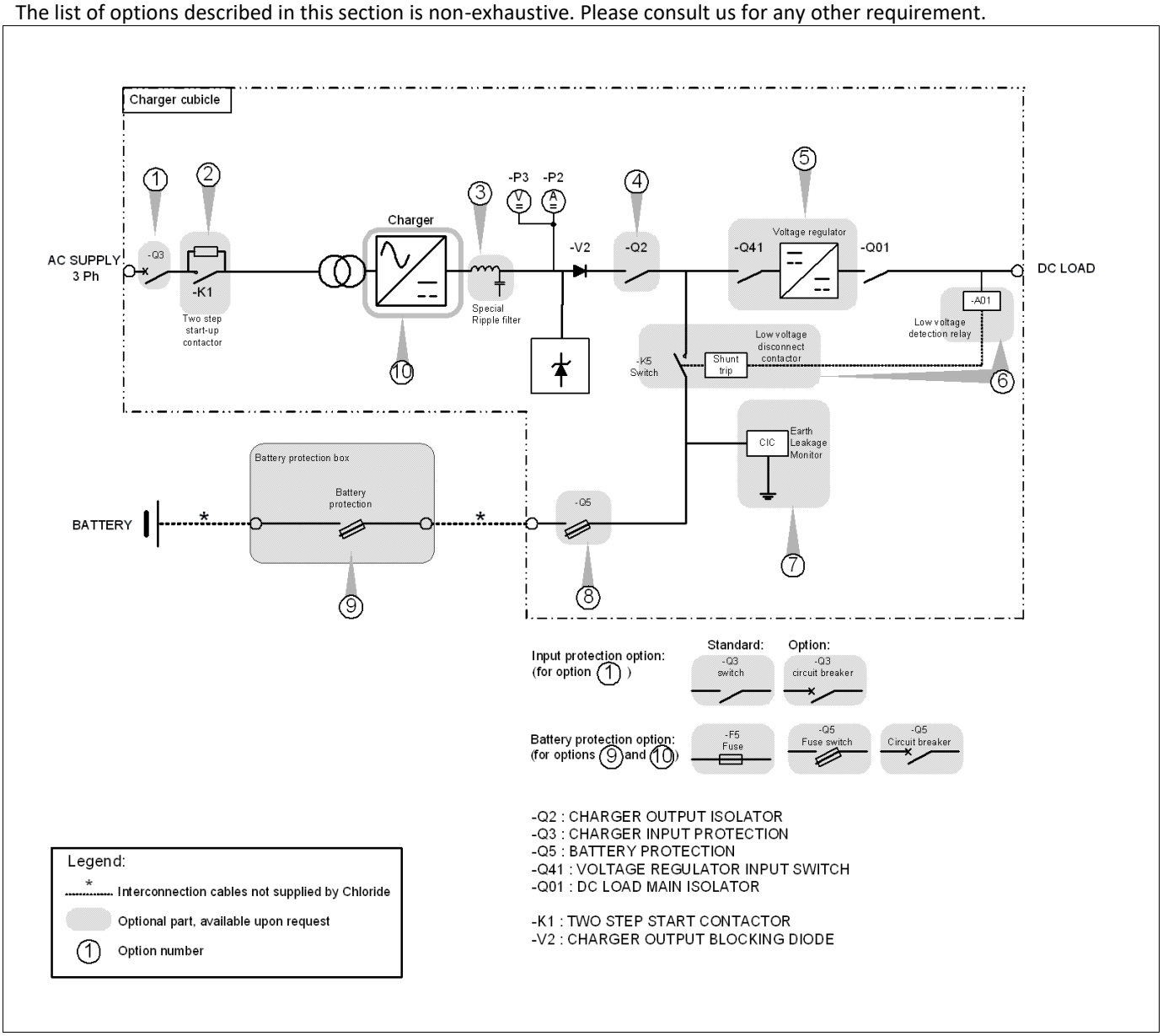


Figure 7: Nuclear rectifier charger – overview of electrical options

Option No.	Option name	Function / description
①	Charger input protection	Protect the input of the DC UPS system by a triple-pole input circuit breaker. *Chloride's standard is a triple-pole input switch.*
②	Two-step start-up contactor	Limit the inrush current on starting up the system to 8 times the nominal input current (15 times as standard). Addition of a two-steps start-up device to limit the inrush current due to the magnetisation of the transformer. *Please note that the rectifier dimensions mentioned in this document may not be maintained with this option.*
③	Additional ripple filter	Reduce the DC voltage ripple below the Chloride standard of 1% RMS. 2 filter configurations are made available to reach the following data: – Telecommunication filter. CCITT curve. – Current ripple 0.1C/10 rms, battery connected, for VRLA batteries.
④	Charger output switch	Isolate the charger output. The adjunction of this switch allows safe maintenance of the charger module. By opening the charger input circuit and the charger output circuit, it becomes possible to safely maintain the charger module.
⑤	Voltage regulator	Adapt the system output voltage to make it compatible with the DC connected loads. Operating conditions and technical data of some batteries are often not compatible with the critical DC load connected to the UPS output. This is particularly the case when operating the DC UPS with Nickel Cadmium batteries, with which the gap between charge voltage and discharge voltage is wide. The voltage regulator option allows answering to these operating conditions. *This option may affect the overall dimensions of the system.*
⑥	Low voltage disconnect contactor (LDV)	Protect the battery from deep discharges and thus enhance battery lifetime. The LDV option includes an output contactor controlled by voltage relay in order to disconnect the load at the end of battery autonomy period. Reconnection of the load is automatic at the charger restoration and upon the resumption of normal conditions.
⑦	Earth leakage monitor (DC earth fault alarm)	Monitor the insulation resistance on the DC bus. Used in conjunction with the isolation transformer, this option is made of an electronic circuit "Chloride CIC" (or equivalent). It is fitted into the rectifier/charger cubicle and delivers remote indication by a changeover voltage-free contact. Local indication (inside the cabinet) by two LED's is available on the PCB (or moulded device) to indicate the polarity on fault. A local test push-button is also available on the device to simulate fault conditions (+ or -).
⑧	Battery protection	Prevent any short-circuit that could occur on the battery circuit and therefore prevent the battery cables from fire risks. 3 types of protections are made available: – Fuse: fully rated fuse with auxiliary contact for the monitoring of its operating status. – Fuse switch: fully rated fuse switch with auxiliary contact for the monitoring of its operating status. – Circuit breaker: fully rated circuit breaker and an additional auxiliary contact for the monitoring of its position.
⑨	External battery protection	Protect the battery circuit as for option 8. The battery protection device is housed in a wall-mounted metal box for battery systems mounted on racks and it is supplied with the battery cabinet, when the battery is fitted in a matching cubicle. Furthermore, this device serves as a safety element for the cross section of the power cable between the UPS and the remotely placed battery system. Therefore, the wall-mounted box must be installed as close as possible to the battery and the length of cables between battery and UPS system must be the shortest.
⑩	Special charging modes	Manage the battery charging modes according to customer's requirements. The battery charging modes can be tailored according to the battery specification and to the customer's specific requirements.

11.2. Environment-related options

11.2.1. External cubicle protection

According to IEC 60529 (Degrees of protection provided by enclosures-IP Code), it is possible to protect the rectifier/charger cubicle from solid or liquid intrusion. The protection levels available are:

- IP 21
- IP 22
- IP 40
- IP 41
- IP 42

In all cases, even for standard IP 20 level, the third number shall be 7, representing mechanical protection.

11.2.2. Special enclosure finishing

Standard finishing of the enclosure is RAL 7032 (grey) textured semi gloss. Any other type of painting specification is also achievable upon request, in compliance with AFNOR, RAL or BS standards.

11.2.3. Specific ambient operation conditions

- Specific temperature conditions: Upon request, the Nuclear charger is able to operate above 40°C (and up to 55°C) or below 0°C.
- Special seismic design: Specific modifications of the system may be added to allow the UPS to operate in seismic risks areas. Please consult us.

In such extreme conditions, the customer must specify the required service conditions, as specified in IEC 60146-2, §5.

11.2.4. Anti-condensation heater

This option includes a heater which is fitted inside the cubicle, to prevent internal components from condensation, mainly when the UPS is stored for a long period.

11.2.5. Temperature monitoring

This option consists in a thermostat fitted inside the cubicle to indicate abnormal heating in the UPS. This device is adjustable below 90°C and includes a remote indication available on a normally open, voltage-free contact.

11.3. Other options

11.3.1. Top cable entry

The option allows power cable entry from the top of the DC-UPS, by adding an external cabinet to drive the cables down to the bottom of the UPS.

NOTE
This option affects the overall dimensions of the system.

11.3.2. Internal lighting

Internal lighting is available upon request to improve internal visibility of the system.

11.3.3. Portable maintenance tool

This maintenance dedicated tool allows a quickly checking of operational settings and thresholds of our nuclear analogue controlled systems.

NOTE:
This option must be stated at the project order stage in order to have the necessary components built-in the equipment for easy connection.

11.4. Monitoring options

11.4.1. Customer interface relays

It is possible to increase the number of outputs described in paragraph 6 by providing additional output relays. These outputs can be used to monitor several parameters specified by the user.

11.4.2. LCD Touch screen

Figure 8: Touch screen panel screenshot

The LCD touch screen solution is available to locally and remotely monitor the Nuclear charger range. This microprocessor-based device is fully independent from the charger analogue control system, thus keeping the DC load safe from soft-computing mistakes.

NOTE:
This fully independent device does not require any qualification for class IE equipment.

The Event dynamic display function allows real time visualisation of events related to the system.

It allows local and remote (via TCP) visualisation of the following information:

- Measured values
- Operating modes
- Alarms and warnings

The embedded Event Memory function allows recording of each system event (status, warning, and alarm).

The Measures recorder function allows permanent recording of selected measures from the charger.

This touch screen panel offers an industry level of durability as it is designed to cope with industrial environmental conditions.

11.4.3. Battery Monitoring

Nuclear chargers can be connected to the battery management system from Chloride.

This system provides the following features:

- Voltage measurement of each battery block by mean of separate battery measuring modules.
- Analysis of each battery block with measuring of the minimum and maximum voltage values.
- Graphic visualisation and analysis by means of dedicated software

This system brings the following benefits:

- Early detection of faults in the battery circuit, increasing the safety of the DC UPS system
- On-time fault recognition, enhancing the reliability of the system
- Easy detection of the defective battery block, reducing correction and maintenance costs
- Compatible with Nickel Cadmium and Lead acid batteries.

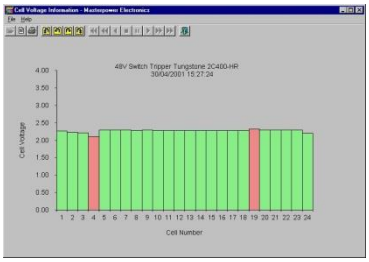
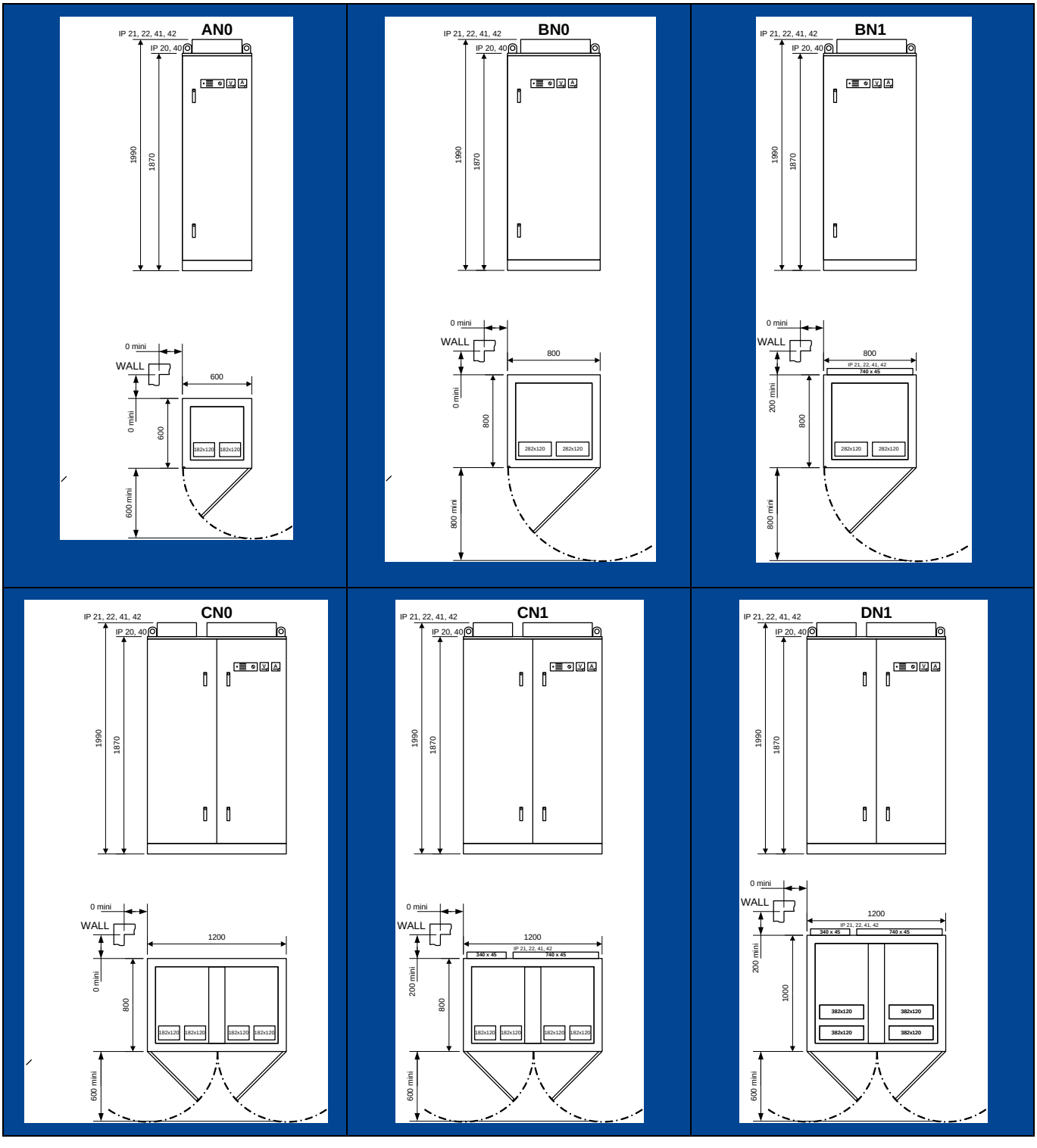
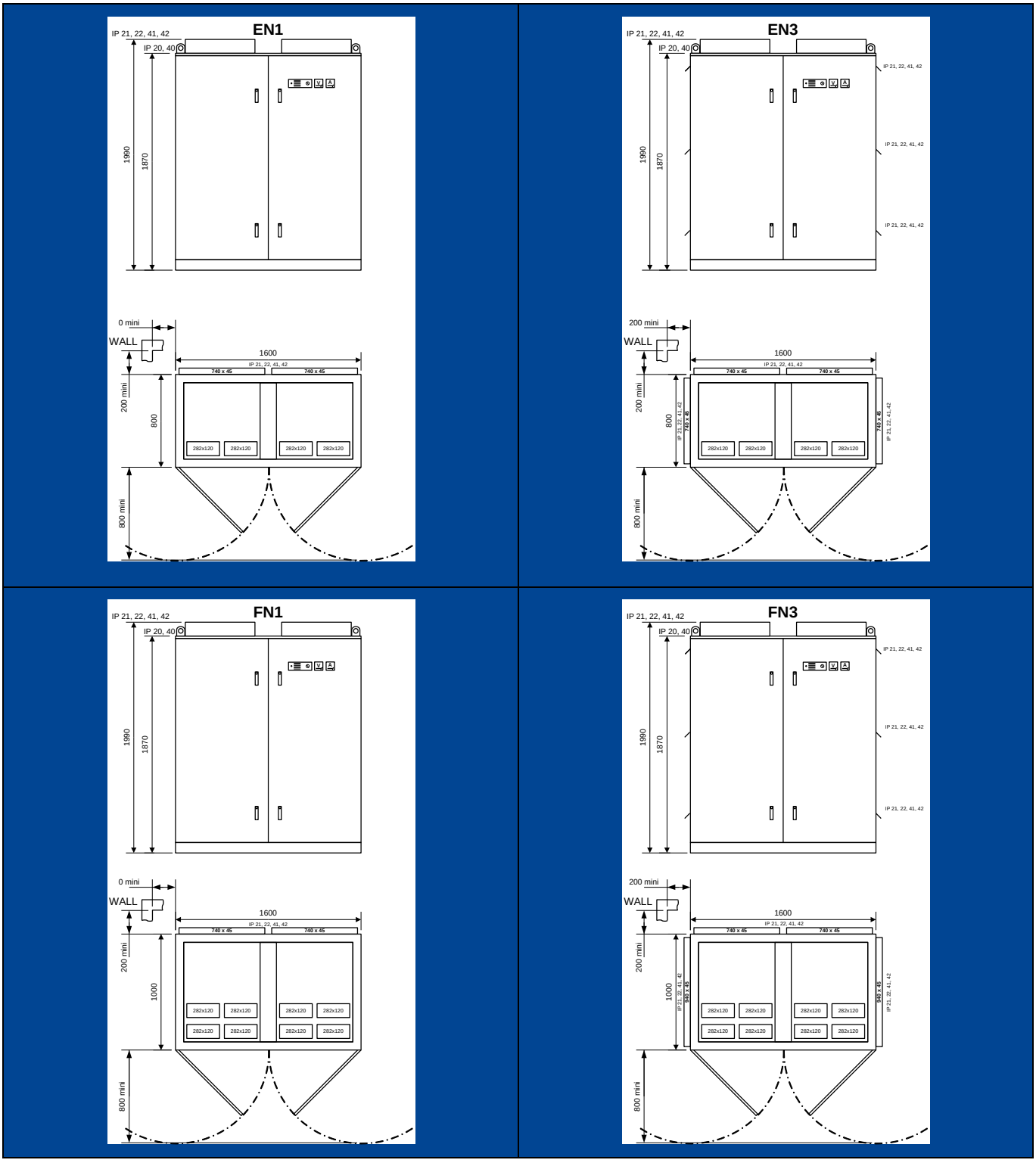


Figure 9: Battery Monitoring System screenshot

12 General arrangement drawings




EN1
IP 21, 22, 41, 42
IP 20, 40
1990
1870
0 mini
WALL
1600
740 x 45
200 mini
800
282x120
800 mini
EN3
IP 21, 22, 41, 42
IP 20, 40
1990
1870
200 mini
WALL
1600
740 x 45
200 mini
800
282x120
800 mini
FN1
IP 21, 22, 41, 42
IP 20, 40
1990
1870
0 mini
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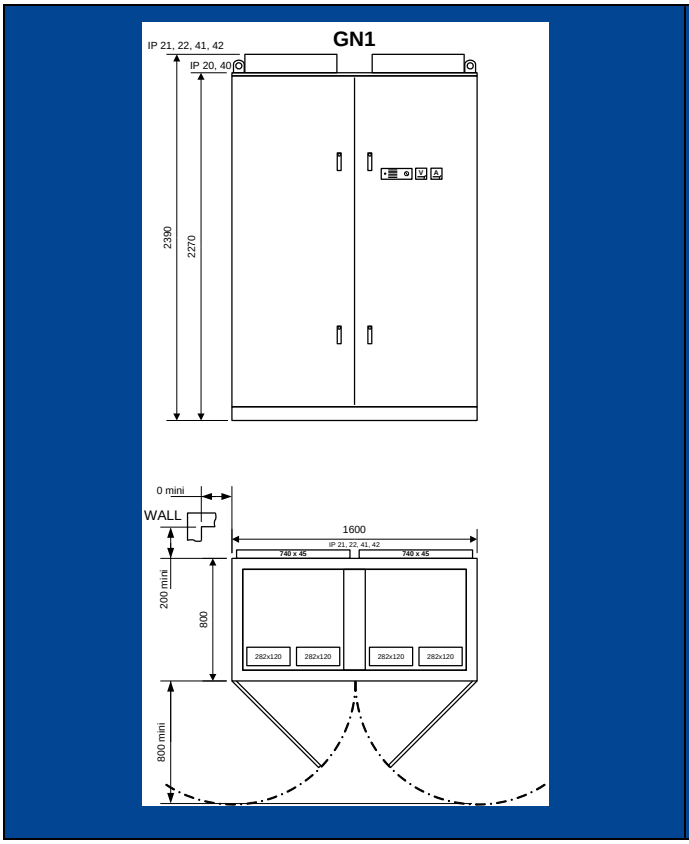
GN1
IP 21, 22, 41, 42
IP 20, 40
2390
2270
0 mini
WALL
1600
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740 x 45
740 x 45
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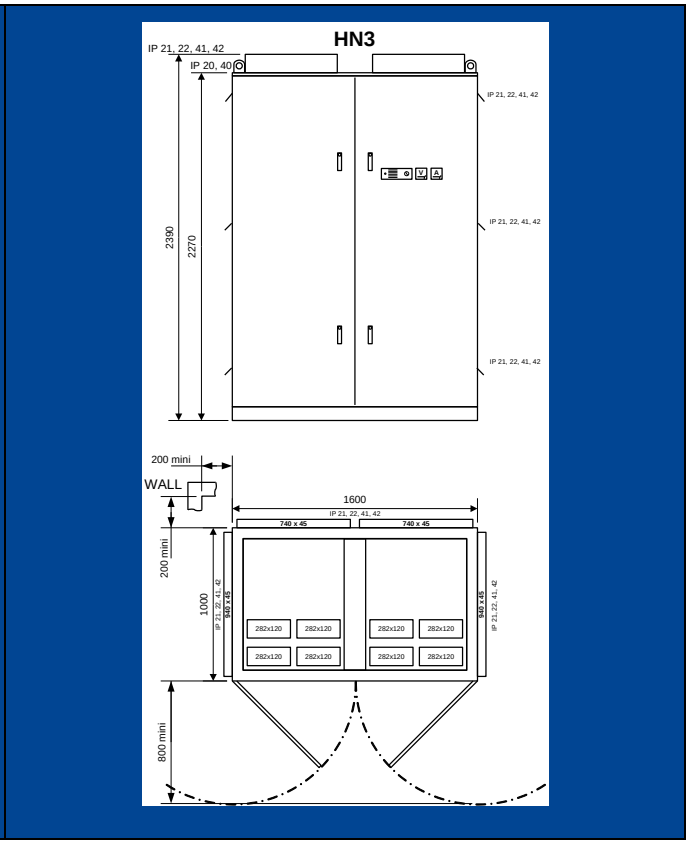
800
282x120
282x120
282x120
282x120
800 mini


HN3
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IP 20, 40
2390
2270
IP 21, 22, 41, 42
IP 21, 22, 41, 42
IP 21, 22, 41, 42
200 mini
WALL
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IP 21, 22, 41, 42
740 x 45
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282x120
800 mini

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