Chloride™
Power to Protect

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Chloride® NP90Z

3-phase input – 6 Pulses - 3-phase output

Chloride® NP90Z

Uninterruptible Power Supply System
3-phase input – 6 Pulses - 3-phase output

1 Scope

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

The Nuclear AC UPS 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 AC UPS range shall have the CE mark in accordance with the Safety and EMC Directives 2006/95/EC and 2004/108/EC.
The Nuclear AC UPS 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 UPS system as shown in Figure 1. The system operates on an analogue controlled thyristors charger and analogue controlled IGBTs inverter. By adding system components, such as safety and disconnecting devices, it is possible to set up elaborated systems ensuring complete AC load protection.

3.1. The system

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

- Increased AC power quality
- Full compatibility with all types of loads
- Power blackout protection (for systems associated with battery)
- 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 UPS uses today's most reliable topology: the double conversion. It converts AC power from an AC source in to DC power to charge a battery and reconverts it into AC power to provide a clean and reliable AC output to power the AC load.

3.2. Models available

The Nuclear AC UPS 33 range includes several kVA ratings output models as specified in paragraph 9. It is of the three-phase output type.

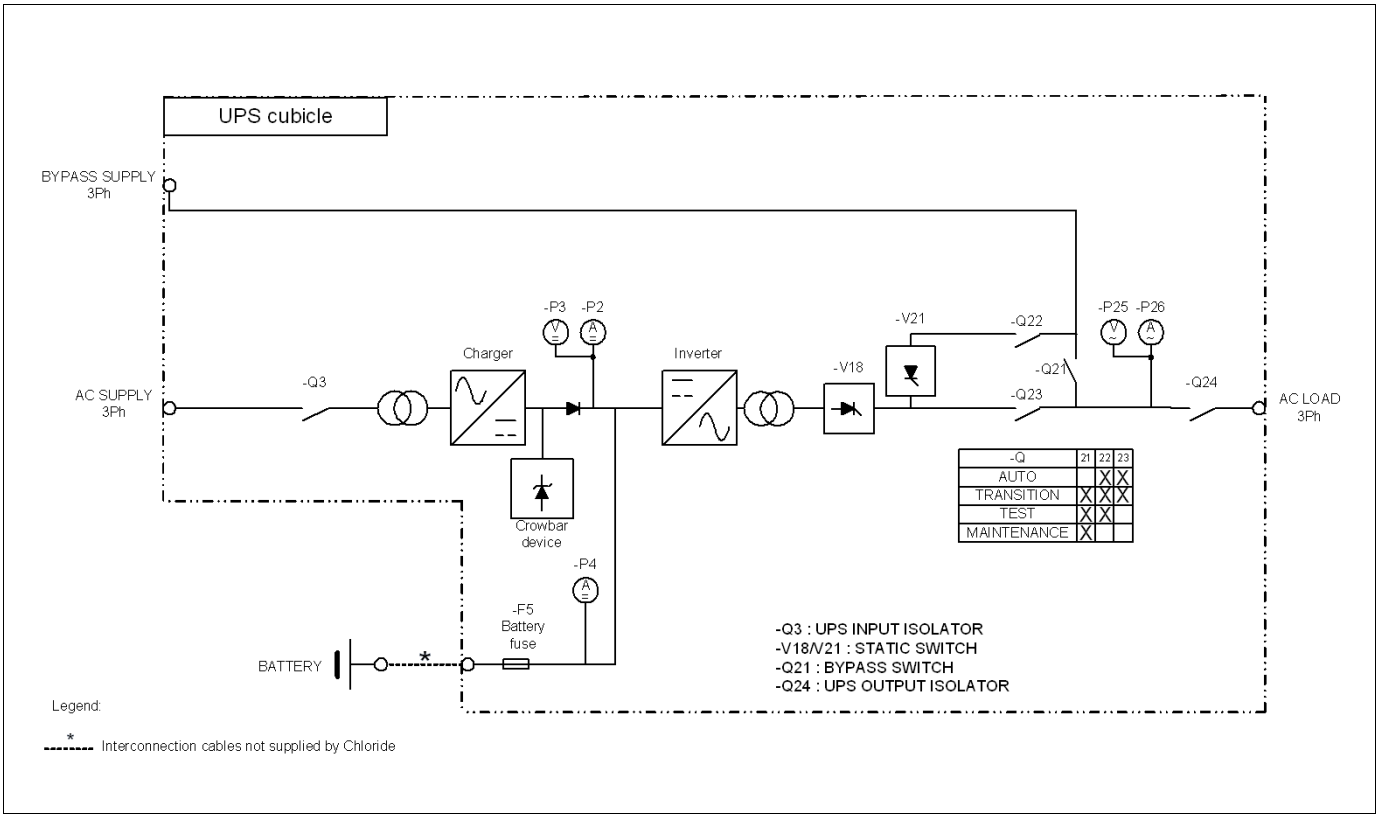


Figure 1: NUCLEAR AC UPS single line diagram

4 System description

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

4.1. General description

The three-phase current taken from the AC source is converter 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 DC current taken from the rectifier is converted to a sinusoidal and regulated AC voltage by an IGBTs inverter (Insulated Gate Bipolar Transistor), using PWM (Pulse Width Modulation). This means that the analogue control board drives the IGBTs so that the DC input voltage is divided into pulsed voltage to generate a low distortion sinewave AC output voltage with good transient response voltage regulation.
A transformer is provided at the output of the inverter bridge.

4.2. Components

The UPS consists of the following major components:

- One input isolator
- One main transformer
- 6-Thyristors bridge rectifier / battery charger
- IGBTs bridge inverter
- One output transformer
- Electronic static switches
- Manual bypass switch
- Two control units, each based on one analogue control board
- Control and visualisation devices (meters, LEDs).

4.3. Operating modes

The Nuclear AC UPS operates as follow:

4.3.1. Normal operation

The critical AC load is continuously supplied by the UPS inverter. The rectifier-charger derives power from the AC source and converts it into DC power for the inverter whilst simultaneously maintaining the battery in a fully charged and optimum operational condition (floating mode).

The inverter converts the DC power into clean and regulated AC power to supply the critical load through the static transfer switch. The power loading can reach up to 110% of the inverter nominal rating without considering the inverter in overload conditions (when reserve supply is not available).

While supplying the load, the inverter analogue control unit monitors the reserve supply signal and ensures that the inverter bridge tracks the reserve supply frequency. Thus, any automatic transfer to the reserve supply (e.g. end of autonomy) is frequency synchronised and does not cause an interruption to the load.

4.3.2. Overload operation

The UPS inverter is considered in overload conditions when the load is beyond 105% of the inverter nominal rating and reserve supply is available.

Two cases are considered:
Case 1: Reserve supply is available:
Upon overload detection by the UPS inverter (above 105% of the inverter nominal rating), the static switch automatically transfers the load to reserve supply. The static switch automatically switches back the load to inverter 8 seconds after the UPS inverter is back to normal conditions.

The reserve supply withstands overload as shown on Figure 2.

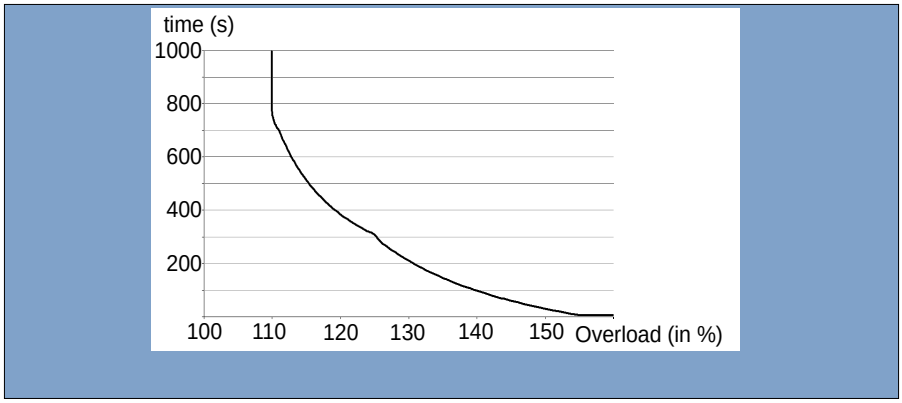


Figure 2: Reserve supply overload withstanding curve

Case 2: Reserve supply is not available:

- Upon overload detection by the UPS inverter (above 110% and up to 150% of the inverter nominal rating):
  - The system initiates a timer for a 10 minutes period.
  - The AC load remains powered by the UPS inverter for this 10 minutes period.
  - Upon expiration of the 10 minutes delay, the UPS inverter shuts down.
- Upon overload detection by the UPS inverter (above 150% of the inverter nominal rating):
  - The UPS inverter keeps powering the AC load for 10 seconds after which it automatically shuts down.

This overload operation mode is shown in Figure 3.

4.3.3. Input supply failure

Upon fault of the input AC source, the rectifier-charger stops while the load remains supplied by the battery via the UPS inverter.

Upon Mains input fault detection, the inverter immediately draws its power from the associated battery without switching. While the inverter is powered by the battery, indication is provided of the discharging status.

When reaching the end of battery autonomy, an alarm occurs and the static switch immediately switches the load onto reserve supply, without interruption. If for any reason, the reserve supply is not present or faulty and the battery is no longer available, the UPS automatically shuts down.

4.3.4. Battery 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.
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 Boost mode is manually cancelled by the operator on the charger control board CC6P to return to Floating mode.

4.3.6. Maintenance bypass operation

If for any reason the UPS has to be taken out of service for maintenance or repair, the Nuclear UPS is provided with a manual bypass switch. The bypass switch enables a load transfer to reserve supply without power interruption for the load. Bypass isolation is then complete, all serviceable components such as fuses, power modules etc. are isolated.

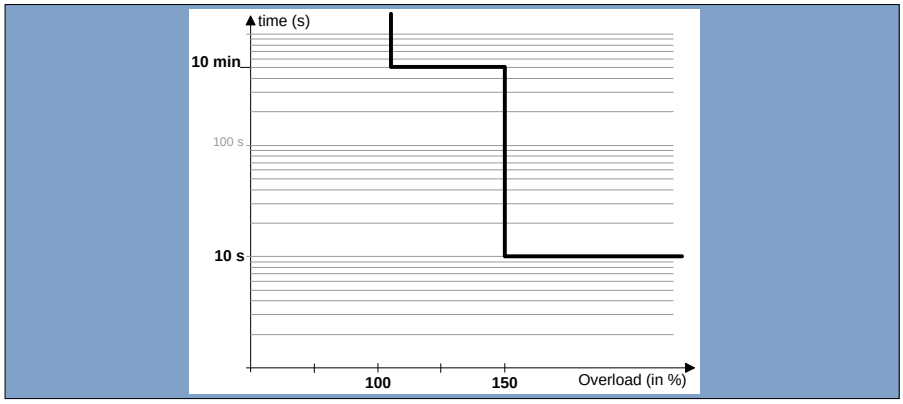


Figure 3: Nuclear AC UPS overload curve

The transfer/retransfer is based on the make-before-break principle in order to secure the critical load: the transfer / retransfer operation is automatically accomplished by paralleling and synchronising the inverter output to the reserve supply, before closing or opening the bypass switch as appropriate.

4.4. Input supply accidental condition (Forsmark type)

4.4.1. 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%.

4.4.2. Chloride Crowbar device

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
- 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).

4.4.3. Inverter behaviour

The inverter bridge is designed to cope with the consequence on DC bus of a Forsmark accidental input supply failure. In such cases, the inverter keeps delivering the nominal and regulated output voltage (Uout), despite the DC input fluctuation (Udc) due to Forsmark effect (see Figure 4).

4.4.4. Static switch behaviour

The static switch of our nuclear range is designed for worst case. This means it is designed to keep supplying the load, no matter the events on the Mains power supply:

- If, for any reason, the inverter has to switch off, the static switch will automatically transfer the load to the reserve supply, even if the reserve supply network is out of specified tolerances.
- Upon restoration of Mains power supply, the inverter will automatically restart and the static switch will automatically switch the load back onto the inverter.

NOTE
The static switch is designed to ensure full safety to the load: It is specifically designed to always switch the load onto the available power (even if this available power is out of specified tolerance).

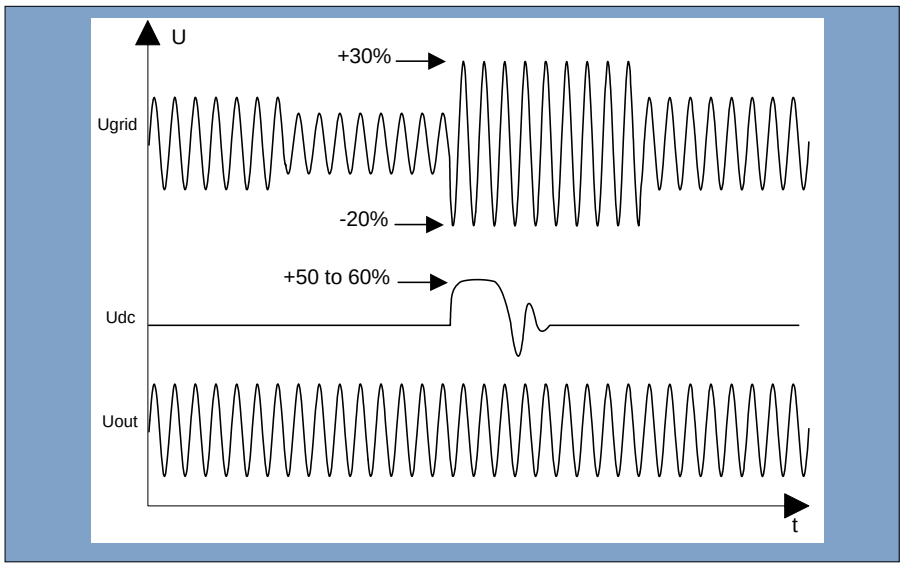


Figure 4: Forsmark case

4.5. Electrical features

4.5.1. Total harmonic distortion of input voltage

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

4.5.2. Rectifier current limitation

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

4.5.3. 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 Boost mode, the battery current is limited to 0,05C (Pb) or 0,1C (NiCd).

4.5.4. Over voltage protection

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

4.5.5. Output voltage harmonic distortion

The inverter provides harmonic neutralisation and filtering to limit the total harmonic distortion on the voltage to less than 3% with a linear load. For reference non-linear load, the total harmonic distortion complies with IEC62040-1-2.

4.5.6. Inverter short-circuit capacity

The inverter short-circuit capacity of Nuclear AC UPS is detailed in Figure 5.

NOTE:

Higher short circuit capability can also be offered upon request, such as the combination of the following:

- **6 x In /100 ms**
- **3.2 x In / 10 s**

Please note that such configurations may change the overall dimensions of the equipment.
Contact us for further details.

4.5.7. Static Switch short-circuit capacity

The electronic static switch is capable of supporting the window of short-circuit currents as shown on Figure 6.

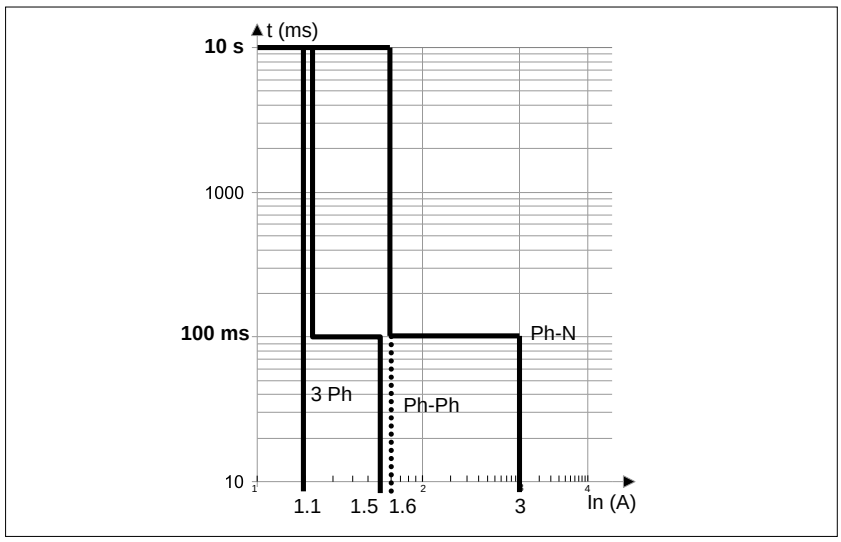


Figure 5: Nuclear AC UPS inverter short circuit capacity

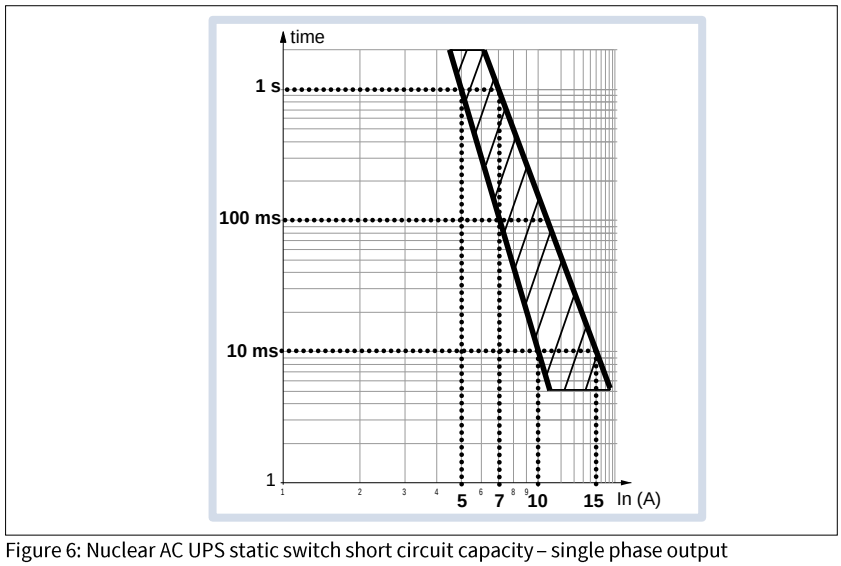


Figure 6: Nuclear AC UPS static switch short circuit capacity – single phase output

5 Advanced Battery Care

The Nuclear AC UPS 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 (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 AC 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.

6 Monitoring and control interfaces

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

6.1. Light emitting diodes (LEDs)

The UPS includes 22 external Light Emitting Diodes (LEDs) to indicate the overall system operation status. LEDs operation is described in Figure 7. These LEDs shall interact with the active mimic diagram displayed on the graphical display.

6.2. On/off switches

The charger and the inverter can be independently and manually started and stopped via the front panel switches S1 and S2 (see Figure 8)

6.1. Selector switch S21

The phase selector switch S21 on the front face of the equipment allows selecting the output measured values to be read via the meters (see Figure 8).

6.2. Measurements reading

5 analogue 72x72 measuring units (P2, P3, P4, P25 and P26) are available as standard on the front panel of the equipment. These allow the user to visualise the charger output values, the battery current as well as the inverter output AC values – see Figure 8.

LED colour	Description
CHARGER PART:	
Red	Charger fault
Red	Charger high voltage
Red	Charger low voltage
Yellow	Floating mode
Yellow	Equalisation mode
Yellow	Boost mode
INVERTER PART:	
Green	Load on Inverter
Yellow	Inverter not available
Red	Maintenance
Red	Bypass fault
Red	Inverter unsynchronised
Red	Overload / Inverter in current limit (Memorised)
Red	Inverter fault (S2 off to reset)
Red	Inverter AC overvoltage (Memorised)
Red	Inverter bridge fault (memorised)
Red	Inverter over temperature (memorised)
Red	DC High voltage
Red	Imminent shutdown
Red	End of discharge
Red	*Spare*
Red	*Spare*
Red	*Spare*

Figure 7: Nuclear AC UPS – Light Emitting Diodes (LED) description

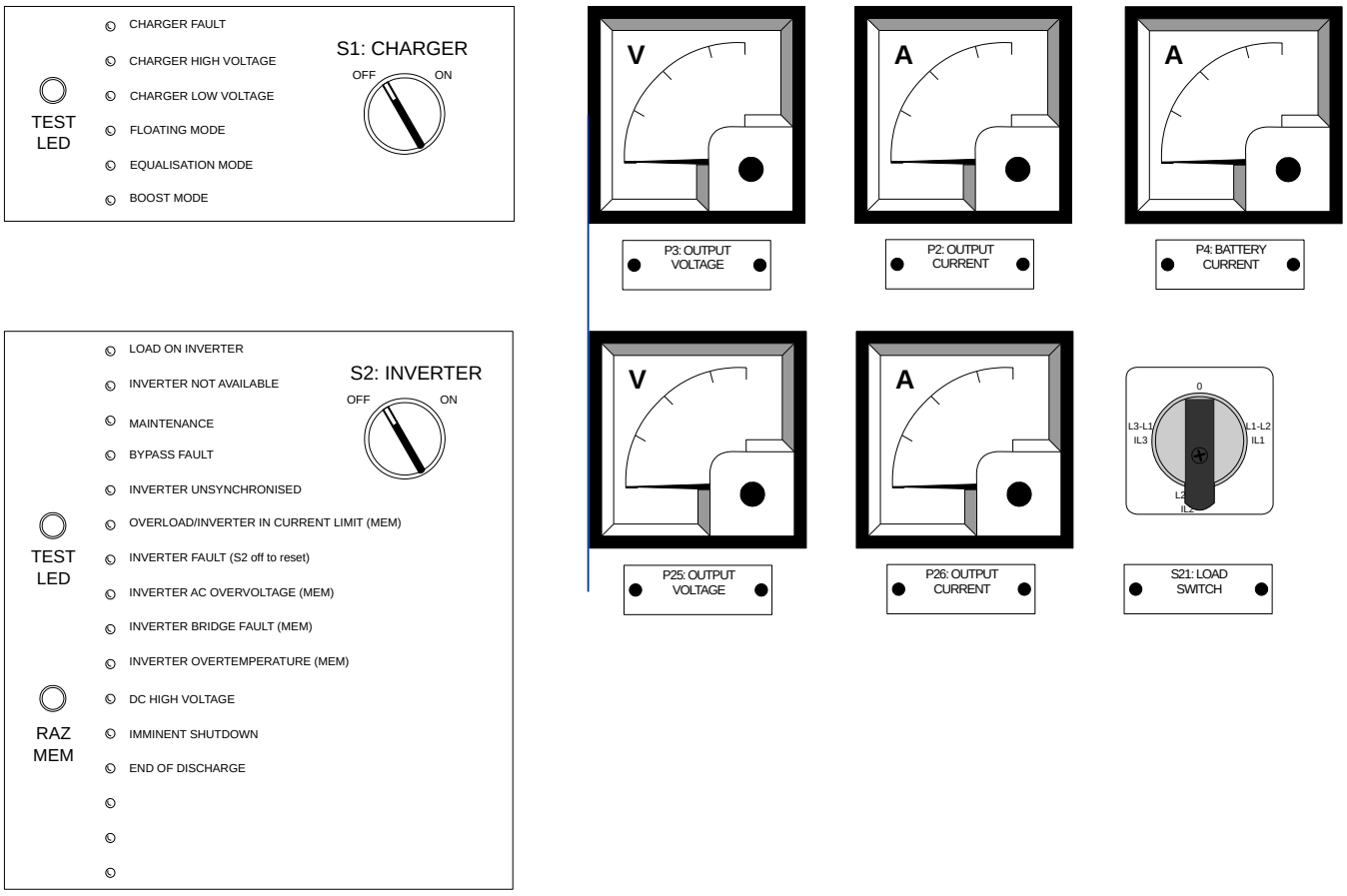


Figure 8: Nuclear AC UPS 33 – Local human-machine interface.

6.3. Remote signalling and control signal

6.3.1. Logic outputs for remote indications

The Nuclear AC UPS 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:

UPS general alarm
Charger fault
Inverter fault
Reserve supply fault
Load on reserve
Imminent shutdown

6.3.2. Logic inputs

The Nuclear UPS range allows the signalisation of specific alarms from the customer's environment and eventually takes the appropriate action on the AC 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
Boost /commissioning mode
Battery room ventilation system failure

7 Mechanical data

7.1. Enclosure

The Nuclear AC UPS 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 AC UPS range 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

Fan-assisted air cooling is standard on the Nuclear AC UPS range.

The cooling air entry is in the base and the air exit at the top of the device. 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 in option.

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. Specific component identification by engraved traffolyte labels can also be offered as option.

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 AC UPS 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 AC UPS 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 UPS is capable of operating permanently from 0° to 40°C.

8.2. Relative humidity

The UPS 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 AC UPS 31 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-pulses 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
DC voltage ripple in float (disconnected battery)	(% rms)	1
Rectifier-charger current limitation (in floating, charge or boost)		I nominal

Inverter output

Nominal output voltage		See tables on the following pages
Nominal output frequency		50 / 60 [factory setting selectable]
Overload at cos phi = 0.8	(%)	150 (10 min)
Short circuit capacity	(%)	300 (100 ms) / 160 (10 s) Option: 600 (100ms) / 320 (10 s)
Isolating transformer		Standard
Voltage stability (for 100% load variation):		
• Static	(%)	+/- 1% (+/-2% for paralleled systems)
• Dynamic	(%)	+/- 2% (+/-3% for paralleled systems)
Frequency response	(Hz/s)	1 (0.1 for inverters in parallel)
Frequency stability:		
• with own oscillator	(%)	+/- 0.05
• with reserve supply synchronisation	(%)	+/- 3 [adjustable]
Harmonic voltage distortion:		
• with 100% linear load	(%)	3
• with 100% non linear load	(%)	Complies with IEC 62040-1-2
Output crest factor admissible		3/1 (up to 6/1 upon request)

Reserve supply input

Reserve input voltage	(V)	See tables on the following pages
Reserve input voltage tolerance	(%)	+/- 15 [adjustable from +/-5% to +/-20%]
Reserve input frequency	(Hz)	50 / 60 [factory setting selectable]
Reserve input frequency tolerance	(%)	+/- 3 [adjustable from +/-0.2% to +/-5%]

System data

External protection degree		IP 20
Internal protection degree		IP 20
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)	-20 to +70
Maximum relative humidity (non condensing)	(%)	<90
Operating altitude		1000 m (without system derating)

Data for 3 x 400 VAC output / 120 VDC (110 VDC) intermediate circuit

Input voltage: 400 VAC [380, 415] three phase

Intermediate voltage: 120 VDC [110 VDC]

Output voltage: 400 VAC [380, 415] three phase

Ratings	(kVA)	5	7.5	10	15	20	25	30	40	50
UPS input										
Nominal input voltage, frequency, tolerances		See page 14								
Maximum current consumption at full load (°)	(A)	14	23	29	45	70	70	90	112	140
Recommended type for UPS input protection		D curve (circuit breakers) or gL (fuses)								
Rectifier-charger output										
Nominal voltage	(V)	120								
Output voltage in floating	(V)	136.2								
Max DC current	(A)	50	80	100	160	250	250	320	400	500
Battery										
Battery output power	(W)	4762	7143	9524	14118	18823	23529	28235	37647	46512
UPS output										
Nominal output voltage AC	(V)	400 [380, 415] – 3-phase + neutral								
Nominal output current(*)	(A)	7	11	14	22	29	36	43	58	72
Reserve static switch										
Nominal voltage AC	(V)	400 [380, 415] – 3-phase + neutral								
Recommended type for reserve input protection		D curve (circuit breakers) or gL (fuses)								
UPS System data										
Heat dissipation system(**)		F	F	F	F	F	F	F	F	F
UPS system losses(*)	(W)	1291	1937	2582	3514	4460	5575	6691	8921	10556
UPS system efficiency(***)	(%)	74	75	76	76	78	78	78	78	79
UPS system noise	(dBA)	62	62	62	70	70	71	71	71	73
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	800	800	800	1200	1200	1200	1200	1200	1600
Depth	(mm)	800	800	800	800	800	800	800	800	800
Footprint	(m^2)	0.64	0.64	0.64	0.96	0.96	0.96	0.96	0.96	1.28
Mass(****)	(kg)	460	510	540	640	750	830	890	970	1090
Drawing code (see page 29)										
Code for general arrangement		BNu0	BNu0	BNu0	CNu0	CNu0	CNu0	CNu0	CNu0	ENu0

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (60 cells) operated at U_{float}=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.

-Full customized technical specification is provided at the bidding stage of project.

-(*) at full load (cos phi 0.8), battery in floating, and at 3x400 VAC nominal output voltage.

-(**) F: Fan cooling.

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

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

-(°) at inverter full load (cos phi 0.8), battery in recharge, low input voltage level (400Vac -10%) and with charger input power factor 0.85.

Data for 3 x 400 VAC output / 240 VDC (220 VDC) intermediate circuit

Input voltage: 400 VAC [380, 415] three phase

Intermediate voltage: 240 VDC [220 VDC]

Output voltage: 400 VAC [380, 415] three phase

Ratings	(kVA)	15	20	25	30	40	50	60	80	100
UPS input										
Nominal input voltage, frequency, tolerances		See page 14								
Maximum current consumption at full load (°)	(A)	42	53	65	83	104	130	165	206	257
Recommended type for UPS input protection		D curve (circuit breakers) or gL (fuses)								
Rectifier-charger output										
Nominal voltage	(V)	225								
Output voltage in floating	(V)	258.8								
Max DC current	(A)	80	100	125	160	200	250	320	400	500
Battery										
Battery output power	(kW)	13953	18605	22988	27586	36782	45977	54545	71111	87912
UPS output										
Nominal output voltage AC	(V)	400 [380, 415] – 3-phase + neutral								
Nominal output current(*)	(A)	22	29	36	43	58	72	87	116	144
Reserve static switch										
Nominal voltage AC	(V)	400 [380, 415] – 3-phase + neutral								
Recommended type for reserve input protection		D curve (circuit breakers) or gL (fuses)								
UPS System data										
Heat dissipation system(**)		F	F	F	F	F	F	F	F	F
UPS system losses(*)	(W)	3004	4005	4456	5347	7129	8912	9416	10854	12539
UPS system efficiency(***)	(%)	80	80	81	82	82	82	84	86	86
UPS system noise	(dBA)	63	64	65	68	70	71	71	73	73
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	800	800	800	800	1200	1200	1600	1600	1600
Depth	(mm)	800	800	800	800	800	800	800	800	800
Footprint	(m^2)	0.64	0.64	0.64	0.64	0.96	0.96	1.28	1.28	1.28
Mass(****)	(kg)	600	670	730	800	940	1030	1100	1330	1480
Drawing code (see page 29)										
Code for general arrangement		BNu0	BNu0	BNu0	BNu0	CNu0	CNu0	ENu0	ENu0	ENu0

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (114 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.

-Full customized technical specification is provided at the bidding stage of project.

-(*) at full load (cos phi 0.8), battery in floating, and at 3x400 VAC nominal output voltage

-(**) F: Fan cooling

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

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

-(°) at inverter full load (cos phi 0.8), battery in recharge, low input voltage level (400Vac -10%) and with charger input power factor 0.85.

Data for 3 x 400 VAC output / 400 VDC intermediate circuit

Input voltage: 400 VAC [380, 415] three phase

Intermediate voltage: 400 VDC

Output voltage: 400 VAC [380, 415] three phase

Ratings	(kVA)	40	50	60	80	100	120
UPS input							
Nominal input voltage, frequency, tolerances		See page 14					
Maximum current consumption at full load (°)	(A)	109	140	175	216	277	343
Recommended type for UPS input protection		D curve (circuit breakers) or gL (fuses)					
Rectifier-charger output							
Nominal voltage	(V)	384					
Output voltage in floating	(V)	435.8					
Max DC current	(A)	125	160	200	250	320	400
Battery							
Battery output power	(kW)	35165	43478	52174	69565	86956	104348
UPS output							
Nominal output voltage AC	(V)	400 [380, 415] – 3-phase + neutral					
Nominal output current(*)	(A)	58	72	87	116	144	173
Reserve static switch							
Nominal voltage AC	(V)	400 [380, 415] – 3-phase + neutral					
Recommended type for reserve input protection		D curve (circuit breakers) or gL (fuses)					
UPS System data							
Heat dissipation system(**)		F	F	F	F	F	F
UPS system losses(*)	(W)	5409	6253	7504	9227	11533	12696
UPS system efficiency(***)	(%)	86	86	86	87	87	88
UPS system noise	(dBA)	70	71	73	73	73	74
Height	(mm)	1870	1870	1870	1870	1870	1870
Width	(mm)	1200	1200	1600	1600	1600	1600
Depth	(mm)	800	800	800	800	800	1000
Footprint	(m^2)	0.96	0.96	1.28	1.28	1.28	1.60
Mass(****)	(kg)	910	1030	1200	1350	1490	1660
Drawing code (see page 29)							
Code for general arrangement		CNu0	CNu0	ENu0	ENu0	ENu0	FNu0

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (192 cells) operated at U_{float}=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.

-Full customized technical specification is provided at the bidding stage of project.

-(*) at full load (cos phi 0.8), battery in floating, and at 3x400 VAC nominal output voltage.

-(**) F: Fan cooling.

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

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

-(°) at inverter full load (cos phi 0.8), battery in recharge, low input voltage level (400Vac -10%) and with charger input power factor 0.85.

Data for 3 x 220 VAC output / 120 VDC (110 VDC) intermediate circuit

Input voltage: 400 VAC [380, 415] three phase

Intermediate voltage: 120 VDC [110 VDC]

Output voltage: 220 VAC [190, 208] three phase

Ratings	(kVA)	5	7.5	10	15	20	25	30	40	50
UPS input										
Nominal input voltage, frequency, tolerances		See page 14								
Maximum current consumption at full load (°)	(A)	14	23	29	45	70	70	89	112	140
Recommended type for UPS input protection		D curve (circuit breakers) or gL (fuses)								
Rectifier-charger output										
Nominal voltage	(V)	120								
Output voltage in floating	(V)	136.2								
Max DC current	(A)	50	80	100	160	250	250	320	400	500
Battery										
Battery output power	(kW)	4762	7143	9524	14118	18823	23529	28235	37647	46512
UPS output										
Nominal output voltage AC	(V)	220 [190, 208] – 3-phase + neutral								
Nominal output current(*)	(A)	13	20	26	39	52	66	79	105	131
Reserve static switch										
Nominal voltage AC	(V)	220 [190, 208] – 3-phase + neutral								
Recommended type for reserve input protection		D curve (circuit breakers) or gL (fuses)								
UPS System data										
Heat dissipation system(**)		F	F	F	F	F	F	F	F	F
UPS system losses(*)	(W)	1291	1937	2582	3514	4460	5575	6691	8921	10556
UPS system efficiency(***)	(%)	74	75	76	76	78	78	78	78	79
UPS system noise	(dBA)	61	62	62	68	70	70	71	71	73
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	800	800	800	1200	1200	1200	1200	1200	1600
Depth	(mm)	800	800	800	800	800	800	800	800	800
Footprint	(m^2)	0.64	0.64	0.64	0.96	0.96	0.96	0.96	0.96	1.28
Mass(****)	(kg)	470	510	550	640	760	830	890	980	1100
Drawing code (see page 29)										
Code for general arrangement		BNu0	BNu0	BNu0	CNu0	CNu0	CNu0	CNu0	CNu0	ENu0

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (114 cells) operated at U_{float}=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.

-Full customized technical specification is provided at the bidding stage of project.

-(*) at full load (cos phi 0.8), battery in floating, and at 3x220 VAC nominal output voltage.

-(**) F: Fan cooling.

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

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

-(°) at inverter full load (cos phi 0.8), battery in recharge, low input voltage level (400Vac -10%) and with charger input power factor 0.85.

Data for 3 x 220 VAC output / 240 VDC (220 VDC) intermediate circuit

Input voltage: 400 VAC [380, 415] three phase

Intermediate voltage: 240 VDC [220 VDC]

Output voltage: 220 VAC [190, 208] three phase

Ratings	(kVA)	15	20	25	30	40	50	60	80	100
UPS input										
Nominal input voltage, frequency, tolerances		See page 14								
Maximum current consumption at full load (°)	(A)	43	53	66	83	104	130	165	206	257
Recommended type for UPS input protection		D curve (circuit breakers) or gL (fuses)								
Rectifier-charger output										
Nominal voltage	(V)	225								
Output voltage in floating	(V)	258.8								
Max DC current	(A)	80	100	125	160	200	250	320	400	500
Battery										
Battery output power	(kW)	13953	18605	22988	27586	36782	45977	54545	71111	87912
UPS output										
Nominal output voltage AC	(V)	220 [190, 208] – 3-phase + neutral								
Nominal output current(*)	(A)	39	52	66	79	105	131	157	210	262
Reserve static switch										
Nominal voltage AC	(V)	220 [190, 208] – 3-phase + neutral								
Recommended type for reserve input protection		D curve (circuit breakers) or gL (fuses)								
UPS System data										
Heat dissipation system(**)		F	F	F	F	F	F	F	F	F
UPS system losses(*)	(W)	3167	4005	4719	5347	7129	8912	9416	10854	12539
UPS system efficiency(***)	(%)	80	80	80	82	82	82	84	86	86
UPS system noise	(dBA)	63	64	65	68	70	71	71	73	73
Height	(mm)	1870	1870	1870	1870	1870	1870	1870	1870	1870
Width	(mm)	800	800	800	800	1200	1200	1600	1600	1600
Depth	(mm)	800	800	800	800	800	800	800	800	800
Footprint	(m^2)	0.64	0.64	0.64	0.64	0.96	0.96	1.28	1.28	1.28
Mass(****)	(kg)	610	670	730	800	940	1040	1110	1340	1510
Drawing code (see page 29)										
Code for general arrangement		BNu0	BNu0	BNu0	BNu0	CNu0	CNu0	ENu0	ENu0	ENu0

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (114 cells) operated at U_{float}=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.

-Full customized technical specification is provided at the bidding stage of project.

-(*) at full load (cos phi 0.8), battery in floating, and at 3x220 VAC nominal output voltage

-(**) F: Fan cooling

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

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

-(°) at inverter full load (cos phi 0.8), battery in recharge, low input voltage level (400Vac -10%) and with charger input power factor 0.85.

Data for 3 x 220 VAC output / 400 VDC intermediate circuit

Input voltage: 400 VAC [380, 415] three phase

Intermediate voltage: 400 VDC

Output voltage: 220 VAC [190, 208] three phase

Ratings	(kVA)	40	50	60	80	100	120
UPS input							
Nominal input voltage, frequency, tolerances		See page 14					
Maximum current consumption at full load (°)	(A)	109	140	175	216	277	343
Recommended type for UPS input protection		D curve (circuit breakers) or gL (fuses)					
Rectifier-charger output							
Nominal voltage	(V)	384					
Output voltage in floating	(V)	435.8					
Max DC current	(A)	125	160	200	250	320	400
Battery							
Battery output power	(kW)	35165	43478	52174	69565	86956	104348
UPS output							
Nominal output voltage AC	(V)	220 [190, 208] – 3-phase + neutral					
Nominal output current(*)	(A)	105	131	157	210	262	315
Reserve static switch							
Nominal voltage AC	(V)	220 [190, 208] – 3-phase + neutral					
Recommended type for reserve input protection		D curve (circuit breakers) or gL (fuses)					
UPS System data							
Heat dissipation system(**)		F	F	F	F	F	F
UPS system losses(*)	(W)	5409	6253	7504	9227	11533	12696
UPS system efficiency(***)	(%)	86	86	86	87	87	88
UPS system noise	(dBA)	70	71	73	73	73	74
Height	(mm)	1870	1870	1870	1870	1870	1870(°°)
Width	(mm)	1200	1200	1600	1600	1600	1600(°°)
Depth	(mm)	800	800	800	800	800	1000(°°)
Footprint	(m^2)	0.96	0.96	1.28	1.28	1.28	1.60(°°)
Mass(****)	(kg)	920	1030	1210	1360	1520	1690(°°)
Drawing code (see page 29)							
Code for general arrangement		CNu0	CNu0	ENu0	ENu0	ENu0	FNu0(°°)

NOTA:

-These data are typical and are valid in the following conditions: Sealed lead acid battery (192 cells) operated at U_{float}=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.

-Full customized technical specification is provided at the bidding stage of project.

-(*) at full load (cos phi 0.8), battery in floating, and at 3x220 VAC nominal output voltage

-(**) F: Fan cooling

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

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

-(°) at inverter full load (cos phi 0.8), battery in recharge, low input voltage level (400Vac -10%) and with charger input power factor 0.85

-(°°) external bypass cabinet mandatory and not included in this description.

10 Options

9.1. Main electrical options

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

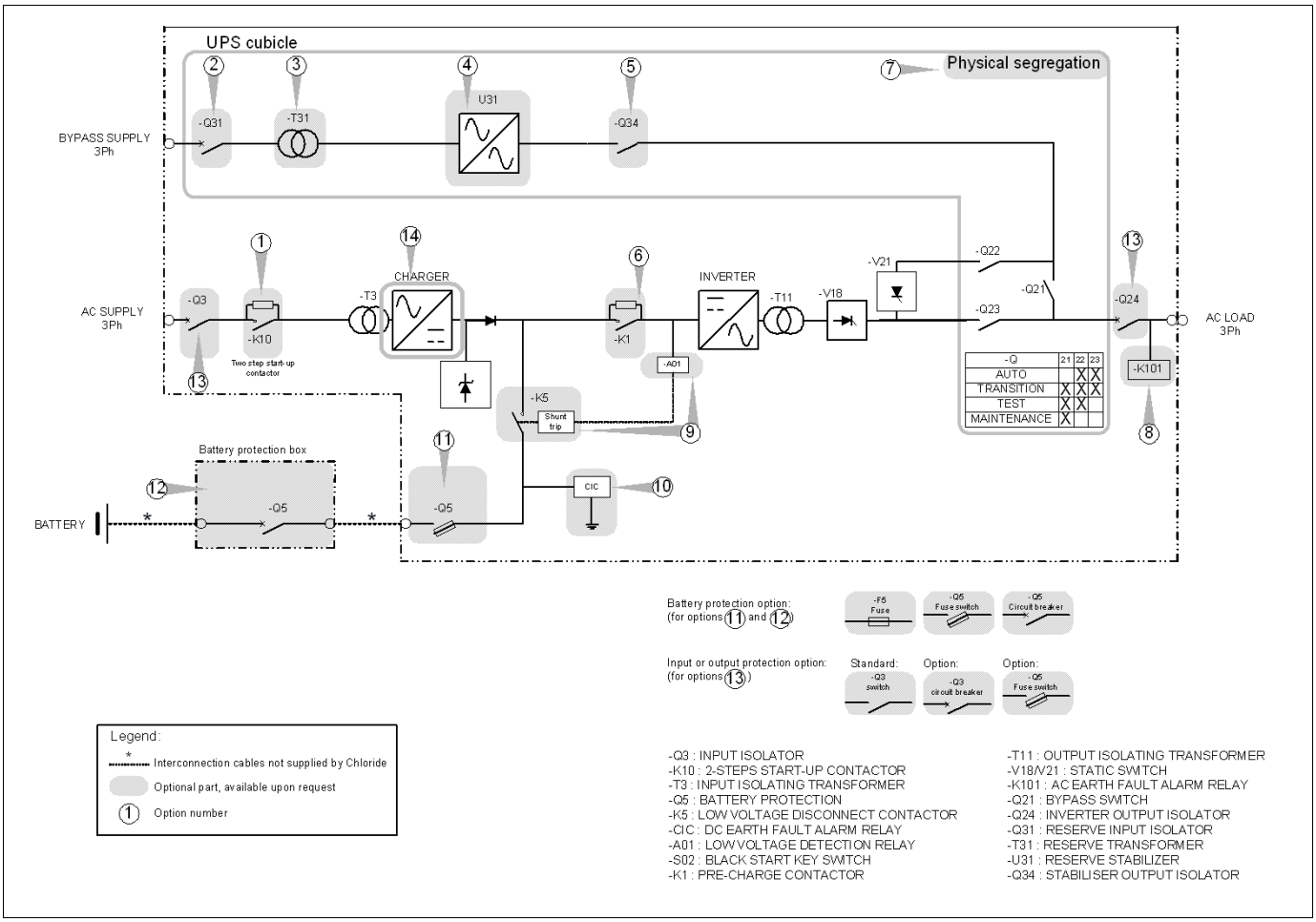


Figure 9: Nuclear AC UPS – overview of electrical options

Option No.	Option name	Function / description
①	Two-steps 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. The device uses a timing relay to firstly magnetise the input transformer through resistors. The contactor is then switched to close position to allow starting up the charger part of the UPS. *Please note that the rectifier dimensions mentioned in this document may not be maintained with this option.*
②	Reserve supply circuit breaker	Protect the reserve supply input by a 4-pole circuit breaker.
③	Reserve supply transformer	Provide full galvanic isolation between the input and the output of the UPS. This transformer is of the type 3-phase input / 3-phase output. *This option may affect the overall dimensions of the system.*
④	Reserve supply stabiliser	Adjust the reserve supply voltage. The reserve supply voltage adjustment ensures the output voltage is within the tolerance accepted by the connected AC load. The stabiliser can be of the electronic type or electro-mechanical type. *This option may affect the overall dimensions of the system.*
⑤	Stabiliser output isolator	Isolate the output of the stabiliser to be able to safely maintain it. This isolator is usually a fully rated switch. By opening the reserve input circuit breaker and this isolator, it is possible to completely isolate the reserve stabilizer.
⑥	Inverter capacitors automatic pre-charge	Pre-charge the inverter capacitors to avoid high circulating current when starting up the inverter. The capacitors pre-charge device uses a parallel resistor to firstly supply the DC capacitors during a pre-set time. The contactor is then switched to close position to start-up the inverter.
⑦	Physical segregation	Isolate physically the reserve supply from the UPS System. The reserve bypass supply can be physically apart from the main parts of the UPS system to increase people's safety when maintaining the UPS system. This option is achieved by cabling the reserve supply components (e.g. circuit breaker, transformer, stabilizer) in a separate By-Pass cabinet. *This option affects the overall dimensions of the system.*
⑧	AC earth fault alarm	Monitor the insulation resistance on the AC output circuit. Used in conjunction with the isolation transformer, this option is made of an electronic circuit CIC (or equivalent). It is fitted into the UPS 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.
⑨	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.

⑩	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 UPS 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 -).
Option No.	**Option name**	**Function / description**
⑪	Battery protection	Prevent any short-circuit that could occur on the battery circuit and therefore prevent the battery cables from fire risks. This option is either fitted into the UPS cabinet or externally (battery cabinet or battery protection box). It can not be used with the option N°12. 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.
⑫	External battery protection	Protect the battery circuit as for option 11, but can not be used in conjunction with option N°11. 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.
⑬	Input / output protections	Protect and isolate the input and the output of the UPS system. 3 types of protections are made available: – Switch: the standard configuration includes a fully rated switch 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.
⑭	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.

9.2. Environment-related options

9.2.1. External cubicle protection

According to IEC 60529 (Degrees of protection provided by enclosures-IP Code), it is possible to protect the UPS 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.

9.2.2. 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.

9.2.3. Specific ambient operation conditions

- Specific temperature conditions: Upon request, the Nuclear inverter 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.

9.2.4. 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.

9.2.5. 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.

9.3. Other options

9.3.1. Top cable entry

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

NOTE
This option affects the overall dimensions of the system.

9.3.2. Internal lighting

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

9.3.3. 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.

9.4. Monitoring options

9.4.1. 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.

9.4.2. LCD Touch screen

Figure 10: Touch screen panel screenshot

The LCD touch screen solution is available to locally and remotely monitor the Nuclear UPS range. This microprocessor-based device is fully independent from the UPS control system, thus keeping the AC 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 inverter.
This touch screen panel offers an industry level of durability as it is designed to cope with industrial environmental conditions.

9.4.3. Battery Monitoring

The battery 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.

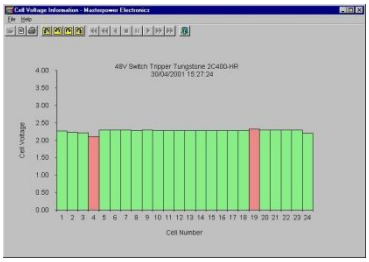
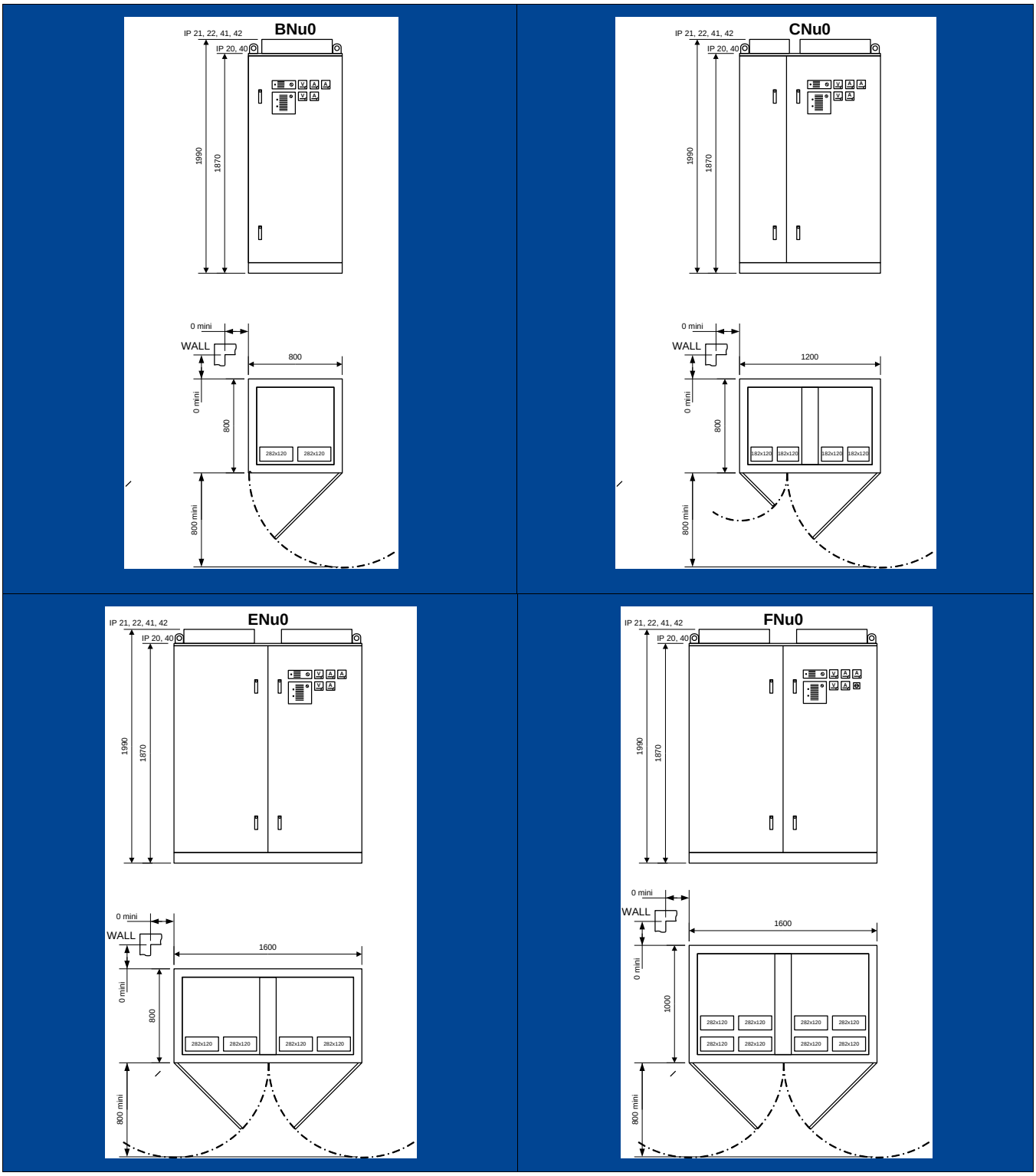


Figure 11: Battery Monitoring System screenshot

11 General arrangement drawings



Notes

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