

# **SIEL UPS TECHNICAL SPECIFICATION SAFEPOWER EVO SERIES**

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## INTRODUCTION

This technical specification describes the Siel “SAFEPOWER EVO” UPS series manufactured by Siel SpA – Via I° Maggio 25 – Trezzano Rosa (Milan).

These UPS units are identified by codes with first two letters UG.....

This technical specification is also applicable to non-standard products based on the “Safepower EVO” series, as specified in the machine documents relating to the specific UPS units.

This series comprises a range of appliances with technologically uniform standards that go from 20kVA up to 1MVA.

They are true double-conversion UPS units equipped with inverters with output transformers which fully separate the battery voltage from the power to the load, thus ensuring that it is absolutely impossible for the DC voltage from the battery to reach protected appliances, should a failure occur. The input stage comprises two sturdy thyristor bridges which combine very high reliability with low emissions of high-frequency interference, thus avoiding all possibility of interference even with appliances which have a very low level of electromagnetic immunity.

All the units of this series have all disconnecting switches built in and are functionally complete, including the rectifier, inverter and static switch sections.

(Only the 1MVA appliance does not feature the disconnecting switches on board the machine, but if necessary housed in a special outside cabinet).

Appliances up to 40kVA may be supplied with batteries incorporated.

Of the UPS to which this technical specification refers, both the versions for single operation and the version for parallel operation exist; in any case, a parallel connection UPS is also able to operate correctly as a single apparatus; additionally, all sizes may be supplied both in twelve- and six-phase versions.

## APPLICABLE REGULATIONS

The UPS units of the “Safepower EVO ” series are CE marked and as such they comply with the relevant product regulations; more specifically:

### Standard

EN62040-1-2:	Uninterruptible Power Supply (UPS) Part 1-2: General and safety requirements for UPS used in restricted access locations
IEC62040-1-2:	Uninterruptible Power Supply (UPS) Part 1-2: General and safety requirements for UPS used in restricted access locations
(EN50091-1-2:	Uninterruptible Power Supply systems (UPS) Part 1-2: General and safety requirements for UPS units used in restricted-access locations
EN50091-2:	Uninterruptible Power Systems (UPS) Part 2: Electromagnetic compatibility (EMC) requirements
IEC62040-2:	Uninterruptible Power Systems Part 2: Electromagnetic compatibility (EMC) requirements
EN62040-3:	Uninterruptible Power Supply systems (UPS) Part 3: Specific performance methods and test requirements
IEC62040-3:	Uninterruptible Power Systems Part 3: Protection requirements and test methods
(EN50091-3:	Uninterruptible Power Systems (UPS) Part 3: Protection requirements and test methods)

The appliances are designed and manufactured in conformity with UNI EN ISO 9001:2000 standard, as certified by Sincert certification N.005.

## DESCRIPTION OF SYSTEM

The UPS described in this technical specification are a result of projects, technologies and advanced electronic components.

Its primary function is to guarantee the load is continuously supplied with or without the mains voltage. The supply output is of high quality voltage and frequency, suitable to supply the most sophisticated and delicate load.

### **Double-conversion UPS offer the following:**

Increased power quality

Power blackout protection

Full noise rejection

Full compatibility with all types of loads

- To meet the needs of any installation, thanks to the huge number of options available

- To guarantee high efficiency in all load situations

### **Block diagram (Figure 1).**

The equipment consists of the following units:

- A RECTIFIER SWITCH COMPONENT (S1) which enables the rectifier to be disconnected from the power supply.

- Rectifier fuses (1) which are used for quick disconnection of the rectifier from the mains, in case of a rectifier fault.

- One rectifier RF FILTER (2), which reduces the high frequency disturbances within the limits defined by European Standard EN 62040-2 (EN 50091-2).

- One RECTIFIER/BATTERY CHARGER (3) which converts the mains three-phase alternating voltage into direct voltage.

- One IGBT STATIC INVERTER (4) which converts direct voltage into high quality alternating voltage for feeding of important loads.

- A TRANSFORMER (5) that completely separates the load from the battery DC current (10).

- A BATTERY (10) providing the energy required to operate the inverter in case of line voltage failure (the battery switch (SB) must be included in the battery cabinet or battery premises).

- One STATIC SWITCH (6) which, when the inverter is overloaded or locked, transfers the load to the mains ensuring that the load is continuously supplied.

- One OUTPUT SWITCH S2 which can completely disconnect the UPS from the load.

- One S4 RESERVE LINE SWITCH COMPONENT enabling reserve line disconnection from the static switch.

This switch also has FUSES (9) to protect the semiconductors of the static switch from output short-circuits.

- One S3 manual BY-PASS consisting of a disconnecting switch component which enables the load to be powered directly, excluding the UPS through the other switches. The manual by-pass is not included in UPSs suited for in-parallel operation and must be fitted externally as a general system bypass.

The rectifier/battery charger (3) changes the mains voltage into a regulated and filtered direct voltage, suitable to re-charge the battery and keep it charged. In the meantime the rectifier also supplies the necessary voltage for the operation of the inverter. The inverter (4) (type IGBT with PWM modulation) takes voltage from the rectifier and, through the transformer (5), supplies the loads with an alternating voltage featuring very low distortion and constant frequency and amplitude.

If the mains fails, the rectifier stops and the batteries (10) supply the necessary power to make the inverter work until the batteries are discharged or the mains is restored. This situation is maintained until batteries are low or until mains power is restored.

A special circuit stops inverter operation when the battery power reaches dangerously low levels. Inverter stop power (end-of-discharge power) varies according to the discharge current so as to prevent any damage being caused to the elements.

When the mains is restored, the rectifier starts working again, recharging the batteries and feeding the inverter.

The rectifier starts up gradually (soft-start circuit) to avoid any over current when the equipment starts.

If the UPS has maintenance-free batteries, the recharge occurs with limited current until the floating voltage (also called maintenance voltage) is reached.

Maintenance voltage varies according to battery temperature (if the UPS is supplied with inside battery or if the battery compartment features a second heat probe).

If the UPS is connected to vented-type lead acid batteries, a higher voltage is reached (boost charge voltage) which is only maintained until the battery is completely recharged. Then the voltage returns to the floating value.

The charge criteria are defined in the I-U specification of Standard DIN 41773.

Thanks to the technology adopted, the efficiency of the apparatus remains very high, already starting with fairly low loads; this provides considerable energy saving (without sacrificing the characteristics of double conversion operation) in normal operating conditions and when several appliances are operating in parallel.

The static switch permits supplying the load from mains in case of strong inverter overloads or inverter fault. Once the abnormal condition is over, the load is automatically supplied by the inverter.

If a reserve mains - separated from the rectifier mains - is not available, it is necessary to connect the terminals of both input mains in parallel.

All the operating conditions are locally signalled both through a luminous (mimic) functional diagram (Fig. 5) and messages on the control panel (Fig. 4).

The signals are sent through the "customer interface board" (Fig. 6) as described in paragraph «Description of the remote signalling systems».

The Bypass manual disconnecting switch (S3 in figure 1) is used to carry out maintenance on the equipment without interrupting the supply to the load which keeps on being supplied by the reserve mains (IN2).

In this case, the UPS can be completely switched off and disconnected from the installation through the special S1, S2 and S4 disconnecting switches, so that operations on the equipment can be carried out in complete safety.

Obviously, when the load is fed by the manual By-pass, it is not protected against any mains outages.

Since the manual bypass circuit must feed the load as if there were no UPS, this circuit is not protected and as such, suitable protection shall be provided in the plant. In the case of in-parallel apparatus, the manual bypass must be external to the UPS as shown in Fig. 11.

No battery disconnect switch is envisaged because this is fitted inside the battery cabinet; if such a cabinet cannot be fitted, a box must be installed near the batteries with disconnect switch and fuses or automatic switch.

The UPS is provided with an electronic device (EPO), which can simultaneously stop operation of the Rectifier, Inverter and Static switch, thus removing power from the load in case of an emergency.

This device, though stopping operation of all UPS functions does not physically disconnect the apparatus from the public mains and battery, consequently the switch-off command must be

provided by the system to the UPS together with other disconnections required by applicable regulations.

The integrity of the batteries is controlled periodically (normally every week) by provoking an intentional small battery discharge and making sure this occurs properly. It should be noted that the discharge is not determined by causing an intentional mains power break (which, in case of battery inefficiency could prove dangerous for correct load supply), but rather by varying the voltage at which the rectifier stabilises. This way, even in the case of totally faulty batteries, power continuity to the load is in any case assured. Moreover, after a battery discharge (intentional or due to a blackout), the time needed to recharge the battery is checked and if this is too long, an alarm is generated.

In the event of the UPS unit featuring a twelve-phase rectifier bridge, the current distortion reflected towards the mains is reduced by 29% (total-controlled six-phase rectifier), to 7 or 11% depending on the request.

This result can be obtained through specific magnetic components generating two triads of specially phased voltages (30°) feeding two six-phase rectifying bridges.

The result is that the current absorbed by the network is the sum of the currents absorbed by the two bridges; this way, the resulting current has a very low degree of distortion because its wave pattern successfully approximates the sinusoidal pattern.

In all other respects, a UPS fitted with a twelve-phase bridge functions in exactly the same way as a six-phase bridge.

When even lower input current distortions ( $\leq 5\%$ ) are required, the equipment may be fitted with an extra filter to correct the input current phase.

Moreover, UPSs with capacities from 500kVA to 1MVA can also be supplied in a version with a 24-pulse rectifier bridge that, without the addition of extra filters, naturally guarantees a harmonic distortion of the current lower than 5% (the technical specifications of these UPSs are given in technical specification SP117 which integrates this document).

The version with the 24-pulse rectifier bridge may be supplied for UPSs with lower capacities on request (for further information, please contact Siel SpA).

### **Interactive mode of operation**

The rectifier/battery charger (3) changes the mains voltage into a regulated and filtered direct voltage, suitable to re-charge the battery and keep it charged. In the meantime the rectifier also supplies the necessary voltage for loadless inverter operation.

In the meantime, the load is fed by the mains through the static switch (6).

IGBT-type inverter (4), with Pulse-Width Modulation (PWM), is constantly synchronised at the mains voltage to minimise load disturbance in case of power outage.

In case of power outage, the static switch supplies the load from the inverter; power necessary for inverter operation is supplied by batteries (10), since the rectifier stopped when the power went off. This situation is maintained until batteries are low or until mains power is restored.

A special circuit stops the inverter when the battery voltage reaches very low levels (so low that the batteries could become damaged).

For this reason the end of discharge voltage is changed in function of the inverter current.

Before the inverter stops, a near low battery signal is produced.

When the mains power is restored, the rectifier restarts operating and recharges the batteries, while the load is again fed by the mains.



Thanks to the technologies used, the efficiency of the apparatus remains very high during operation with mains; in fact the only leaks are determined by the static switch and by loadless inverter operation.

With regard to the description of battery recharging, signals, E.P.O. circuit and twelve-phase bridge, refer to the previous paragraph “Description of operation in ON-line mode”.

The switch from ON-line mode to Interactive mode and vice-versa can be done (by trained personnel) directly in the field by means of a special command, without replacing any electronic boards.

### **Parallel operation (Figure 11)**

In the case of in-parallel operation, the units are interconnected so the outputs of all the machines are connected together (naturally, each UPS can be disconnected from parallel by means of the output disconnection switch S2).

This way it is possible to increase the output power and/or the reliability of power to the load. In fact, with  $n$  machines in parallel, an output power of  $n$  times the rated power of the single machine ( $P_n$ ) can be achieved; furthermore, when the load absorbs a power equal to  $(n-1) P_n$ , if a machine breaks down, the system does not stop (increase of reliability of power to load).

In order to coordinate the operation of several units in parallel, the UPS exchange a whole series of data by means of a network of optical fibres. This way, maximum immunity is achieved to electrical disturbances.

The parallel Siel does not require the exchange of any electrical signal.

Without going into operating details (for more details, the Siel staff are at your disposal) suffice it to say that the inverters are kept carefully synchronised so as to prevent exchanges of current between the machines.

Even when the load is supplied through static switches (also connected in a parallel redundant configuration), power is correctly partitioned among the machines through suitable partition coils.

To sum up, in the event of an intentional or accidental stop of one of the UPS systems, the load is still supplied by the other units in parallel, provided this is allowed by the total load power. It is even possible, if the system is properly made (Figure 11) to disconnect one UPS completely and if necessary replace it without interrupting load supply.

No in-parallel operation is envisaged in interactive mode.

For more details about in-parallel operation, read the following paragraph (its omission does not prevent understanding the rest of the technical specification).

#### **Detailed analysis of parallel operation**

The UPS units connected in parallel with ON-line operation can, by means of a setting made by means of a dip-switch, operate in two distinct ways:

- 1- Power parallel
- 2- redundancy parallel

##### **1- Power parallel**

By power parallel is meant the situation whereby all the UPS units must operate at the same time in parallel in order to supply all the power needed for the load.

In this situation, in case of an inverter stop, the load has to be powered from the mains, in view of the fact that the power supplied by the remaining inverters is not sufficient.

Consequently, as soon as an inverter stops, the load is powered through the static switch from the emergency mains until all the inverters are working again.

In the event, due to maintenance, of a UPS unit being completely disconnected (disconnected from the mains, from the batteries and from parallel), or placed in test mode after disconnection from parallel (contact Siel), the remaining UPS units continue to power the load from inverter or mains as described previously.

For example: if in a 4-UPS parallel, a machine is completely disconnected (operation performed by trained personnel) it is imagined that the load has been reduced in order to be powered by the 3 inverters still working and consequently the system supplies power to the load through the inverters themselves (if all three are working properly).

In case of stoppage of another inverter, the load is powered from the mains.

The complete disconnection of two UPS units always results in the load being powered from the mains (See table 10)

If the buttons I↔R and Return (Figure 4) are pressed together, we have the manual switchover of the system from inverter to mains and vice versa.

If the inverters are not synchronised with the mains, manual switchover is prevented.

If the load is switched under mains, after 15 sec., conditions permitting (inverter OK, synchronism OK), the load is again supplied from the inverter.

In the event of the "Forced" switch of an operating machine being operated (forced powering of load from mains), the entire system switches to mains and remains there in all cases .

To prevent accidental operation, access to this command is only possible by opening the door of the UPS unit (featuring a key).

The forced button must only be pressed when the machine is synchronised with the mains (green light on and synchronism signal OK) .

Optionally, an external device is available which, by means of a manual control, determines permanent load supply from mains or inverter.

## 2- Redundancy parallel

By redundancy parallel (commonly called n+1) is meant the situation whereby, if an inverter is stopped, the power supplied by the other inverters is in any case sufficient to power the load.

Consequently two or more inverters must stop together to cause the load to switch from inverter to mains; in fact, in this case, the power of the remaining inverters is no longer enough to power the load.

In the event, due to maintenance, of a UPS unit being completely disconnected (disconnected from the mains, from the batteries and from parallel) or placed in test mode after disconnection from parallel (contact Siel), the remaining UPS units continue to power the load from inverter or mains as described above.

For example if in a 4-UPS parallel, a machine is completely disconnected (operation performed by trained personnel) it is imagined that the load can be powered in redundant mode by the 3 machines that are still working.

The complete disconnection of two or more UPS units always results in the load being powered from the mains (See table 10b).

If the buttons I↔R and Return (Figure 4) are pressed together, we have the manual switchover of the system from inverter to mains and vice versa.

If the inverters are not synchronised with the mains, manual switchover is prevented.

If the load is switched under mains, after 15 sec., conditions permitting (inverter OK, synchronism OK), the load is again supplied from the inverter.

In the event of the "Forced" switch of an operating machine being operated (forced powering of load from mains), the entire system switches to mains and remains there in all cases .

To prevent accidental operation, access to this command is only possible by opening the door of the UPS unit (featuring a key).

The forced button must only be pressed when the machine is synchronised with the mains (green light on and synchronism signal OK) .

What has been said above can be summed up in the following reports:

If:

Nrid	is the redundancy number, whose values can be 0 and 1 (0= power parallel)
Ni	is the number of units that can supply the load with the inverter
NUPS	is the number of UPSs constituting the parallel

so the rule for defining load powering is the following:

if

$$N_i \geq NUPS - N_{rid}$$

so the parallel powers the load from inverter.

If instead

$$N_i < NUPS - N_{rid}$$

the parallel powers the load from mains.

It should be noted that if NUPS is less than Nrid, Nrid is set equal to NUPS.

## Equipment

Figure 2 shows the view of the UPS with the front doors closed.

Opening the front door with key only permits access to the input, output and bypass (if fitted) disconnecting switches; a standard feature of the UPS is the key to access this compartment. Figure 3 shows the disconnecting switch compartment for the various types of UPS units.

The switches (Figures 1 and 3) are:

S1 rectifier input disconnection part

S2 UPS output disconnection part

S3 manual bypass (Not envisaged in case of UPS set for parallel)

S4 reserve mains disconnection part

To access the power compartments, open the front doors and open the board support door: this operation can be performed using a simple screwdriver - not provided with the UPS unit..

The upper part of the equipment houses the control, measurement and signalling panel (shown in greater detail in figure 4) and a LED mimic diagram (shown in greater detail in figure 5).

When the front doors are closed, these are the only accessible components which provide useful information and carry out all necessary checks.

Even with the doors complete with key open, the equipment still maintains an insulation standard of IP20, and no live part is accessible.

### **Control, measurement and signalling panel**

The control, measurement and signalling panel on the front of the equipment (Figure 2) is shown in detail in Figure 4 (referred to hereinafter for the sake of brevity as Signalling panel).

The signalling panel includes a liquid crystal display (LCD) with 80 characters, and control keys.

During normal operation, signals cyclically appear to indicate machine operating status.

Some of these signals are repeated on the Functional diagram (Figure 5), where corresponding LEDs light up to provide a quick overview of the operation of the different equipment subassemblies.

The appearance of one or more alarms determines the tripping of the acoustic alarm; in these conditions, only the alarms that are present are displayed.

The acoustic alarm can be muted by means of the specific key.

The messages concerning the alarms are organised as follows: the alarm appears in capital block letters on the top line of the display unit while the bottom line shows the operations to be carried out to reset the alarm.

A detailed description of the signalling panel functions is given below:

**a) Loop view of the UPS status:** the signalling panel displays messages related to the operating status of all main sections of the UPS, at intervals of about 5 seconds.

If one or more alarms trip at the same time, the control logic gives a continuous beep and displays the alarms in progress.

If the operator mutes the acoustic signal using the key provided, the Signalling will again display all the UPS messages together with the alarms in progress.

The following are the alarms and signals displayed on the LCD.

### **Signals**

#### **RECTIFIER**

1) Rectifier on

#### **BATTERY**

2) Battery on float charge

3) Battery on boost charge

4) Battery voltage OK

#### INVERTER

- 5) Inverter on
- 6) Inverter-reserve synchronised
- 7) UPS Master (only when in parallel)

#### STATIC SWITCH

- 8) Load on inverter
- 9) Reserve OK
- 10) Load on reserve

### Alarms

#### RECTIFIER

- 1) Rectifier off
- 2) Rectifier locked
- 3) Rectifier over temperature

#### BATTERY

- 4) Battery pre-alarm
- 5) Wrong battery voltage
- 6) Battery failure
- 7) Battery Overheating
- 8) Battery temperature probe fault

#### INVERTER

- 9) Inverter overload
- 10) Phase R over current
- 11) Phase S over current
- 12) Phase T over current
- 13) Inverter over temperature
- 14) Magnetic units overheating
- 15) Output filter fault
- 16) Inverter stopped
- 17) Inverter output over voltage
- 18) Inverter-Mains not synchronized

#### STATIC SWITCH

- 19) Switching blocked
- 20) Static switch failure
- 21) Stand-by not suitable

#### COMPLETE UPS

- 22) Emergency UPS activated
- 23) Back feed protection
- 24) Manual by-pass inserted (Not for parallel UPS)
- 25) No parallel data exchange (Not envisaged for single UPS units)
- 26) Ambient overheating
- 27) Strongly distorting load
- 28) Preventive maintenance is suggested
- 29) Preventive maintenance needed
- 30) Missing isolation (option)

In normal operating conditions (with no alarms), when the display is switched on, the "UPS normal operation" message is displayed, as well as various other signals.

**b) Manual display of the UPS status:** during its normal operation - described in item a) above - the signalling can be interrupted by the operator to see more quickly all messages related to the status and/or alarms. In particular, it is possible:

- to bring messages forward/back by pushing and releasing keys 2 or 3 together with key 1 as shown in Figure 4.

- to bring messages forward/back at one second intervals by holding down keys 2 or 3 whilst holding down key 1 as shown in Figure 4.

**c) Display of voltage/current values:** there are three keys (2, 3, 4 in Figure 4) which enable the following information to be displayed in real time on the signalling panel:

Six UPS output voltages (Phase/Phase and Phase/Neutral)

Six rectifier input voltages (Phase/Phase and Phase/Neutral)

Six reserve mains voltages (Phase/Phase and Phase/Neutral)

Three UPS output currents

Three rectifier input currents

Apparent power, active power, power factor and crest factor of the UPS output

UPS output frequency

Reserve mains frequency

The voltage, the autonomy percentage (percentage of time left until the battery runs down), the battery current, the battery temperature and the max temperature reached by the batteries

Room temperature and max temperature reached in the room.

**Communication with special software:** the panel firmware implements a communication protocol with programs that operate on computers equipped with a EIA-RS232C serial interface. This communication protocol envisages, at the request of the software with which it dialogues, the transmission of alarms/signals and measurements of the UPS; the partner software of this dialogue can also pilot all the functions envisaged by the front panel of the machine.

Siel offers two software programs, which take advantage of all opportunities given by the communication protocol. These programs, called EDMS and OCSystem3, cater for all possible control and signalling requirements. In particular, EDMS is compatible with virtually all existing hardware platforms, whilst the OCSystem3 software offers ample scope for customisation.

To function properly, computers must have a standard EIA-RS232C connection and a monitor with VGA or higher resolution.

Another option permits monitoring the state of the UPS and performing the shutdown of personal computers, servers and workstations linked to a LAN network.

The option consists in additional hardware which on the one hand links up to the UPS through a serial interface RS232C and permits network linkup by means of an RJ45 connection.

The protocols implemented on this hardware are HTML and SNMP.

This implies that the status of the UPS can be configured and monitored through any web browser with Java and the shutdown can be managed of all the machines linked to this network node.

## Functional diagram

The functional diagram on the front of the appliance is shown in figure 5.

### FUNCTIONAL DIAGRAM

The functional diagram includes the following signalling lamps (LEDs):

LED 1 - Rectifier on

LED 2 - Near low battery pre-alarm

LED 3 - Inverter on

LED 4 - Load on inverter  
LED 5 - Reserve OK  
LED 6 - Load on reserve  
Led 7) By-pass on (Not functional in case of UPS in parallel)

### **Description of the back-feed protection sensor**

#### **Connection**

This type of sensor must be fitted with a four-pole magnetothermal switch, to be supplied by the customer, and connected in series to the backup supply of the UPS.

When a failure on the static switch occurs, this device enables the release coil of the external switch (230 VAC with enabled alarm), thus protecting personnel working on the system from potential risks. The UPS must be connected to the external switch by means of two 4 sqm terminals installed next to the sectioning elements. If required, the UPS can also be fitted with three additional terminals to connect the signals of the back-feed protection board. Said terminals correspond to a normally closed contact (NC), a common contact (C) and a normally open contact (NO) (the tripping of the sensor causes the relay to be "attracted").

#### **Operation**

When the UPS is operated in ordinary mode, the green "R.E. POWER" LED lights on permanently. As soon as the sensor detects a return of power towards the mains, the red "R.E. ALARM" lights and an acoustic warning is enabled, while the relay on the back-feed protection board releases the external switch upstream from the backup supply. To restart the UPS in ordinary mode, it is necessary to press "RESET R.E." and reset the switch.

#### **WARNING**

Pressing "TEST R.E." is equivalent to simulating a return of current towards the mains, which causes the external switch to be released.

### **Remote signalling systems**

All the signals exchanged with the UPS go through a customer interface board (Figure 6).

The customer interface board is equipped with terminals for the EPO circuit and for the battery temperature sensor (the latter on request).

UPS status can be monitored using potential-free relay contacts.

To monitor the conditions of these relays, there are two possibilities:

- one DB9 box-type connector which monitors 4 of them (CN1 in Figure 6)
- one terminal block which monitors all of them.

For more details on the signals available on the DB9 connector and on the terminal boards, read the following paragraph (its omission does not prevent understanding the rest of the technical specification).

#### **Detailed description of the signals available on the CN1 connector and on the terminal boards.**

The DB9 drawer connector (CN1 in Figure 6) is used for connection to a personal computer, provided with special software, which can monitor the UPS status and control its switching off.

Terminal blocks M1, M2 and M3 (Figure 6) also supply further signals and alarms.

#### **Description of connector CN1**

- The CN1 connector is an isolated communication port showing clean contacts; these are normally used by various software applications dedicated to monitoring and controlling the UPS (for further details, contact SIEL S.p.A.).

The closing of a contact is equivalent to the occurrence of the event shown in figure 7. Figure 7 shows the standard connection. Upon request, it is possible to change connections to the various pins through J1 ... J6 jumpers. (In particular, you can order the connection kits to AS 400 and RISC 6000 computers.)

It is possible to switch off the UPS by injecting a 10mA DC current coming in from pin 4 and going out from pin 6.

#### **Description of terminal boards M1, M2 and M3.**

Terminal blocks M1, M2 and M3 are equipped with potential-free contacts (both normally open (NO) and normally closed (NC)) of the most important signals concerning the UPS.



Figure 8 shows relays in the idle position, while signal indications refer to an energised relay.

The signals coming from relays RL1, RL2, RL3 and RL4 (Figure 6) are fixed, while the ones handled by relays between RL5 and RL10 can be customised by using DSW1 dipswitches (figure 6).

Description of DSW1 dipswitches (Figure 8).

This board houses four DSW1 dip-switches which control the microcontroller assembled on the customer interface board.

The four dip-switches have the following functions:

1. – in 1111 condition (all on) all relays are simultaneously and permanently energised.
2. – in 1110 condition (on, on, on, off) all data for the normal operation of relays are acquired (factory setting).
3. - in 1101 condition (on-on-off-on) the meaning of relay 9 becomes “Mains switchover  $\leftrightarrow$  Inverter blocked”
4. - in 1100 condition (on-on-off-off) the meaning of relay 9 becomes the OR logic of all the alarms (to remote trigger a cumulative alarm)
5. - All the other positions keep the relays released.

Therefore, to enable the operation of the terminal block and of CN1 connector, the dip-switches must be set to position 2. 3 or 4.

To verify operation of all the relays, and test the correctness of the connections made on the terminal board, place the dip-switches alternatively in positions 1 and 5 (for instance by alternately operating dip-switch 1 while the others stay in on position).

## Description of communication fibre optics

This board also includes three fibre optic connectors.

Fibre optics are an ideal data transmission media and ensure data can be carried safely, even over long distances in environments with a high level of electrical interference (Industrial applications, close proximity to radio transmitters, signal cables cannot be separated from power cables in system etc.).

For more details about fibre optic transmission, read the following paragraph (its omission does not prevent understanding the rest of the technical specification).

### Detailed description of fibre optics connections.

If data must travel further than the maximum distance (approximately 100m), Siel S.p.A. can provide special repeaters/amplifiers.

The IC11 connector (central connector in Figure 6) is dedicated to interfacing with a remote dedicated mimic panel, which allows the display of the main parameters of the UPS on a small console, even without using a personal computer.

Connectors IC8 and IC9 are used for connection through fibre optics to a personal computer, which has specific software installed that can graphically display all signals and measurements sent by the UPS, keep an accurate history file of events, and control the UPS from the personal computer.

When ordering this software, it is also necessary to purchase its fibre optics and the fibre optics/RS232 converter (available from Siel S.p.A.), which must be installed in close proximity to the personal computer.

Through only one personal computer, where the OCSys3 software is installed, it is possible to simultaneously monitor all UPSs connected in parallel.

Customers wishing to use their own software to capture the signals and measurements provided by the UPS should send a written request to Siel S.p.A., who will then authorise and issue detailed specifications on the communication protocol.

Also in this case, customers should remember to order the fibre optics/RS232 converter.

The remote mimic panel and the personal computer monitoring software program can also be used simultaneously.

The connection is made by simply inserting the optical fibre's mobile male connector in the female connectors on the board until they click together, which indicates that a proper connection has been made.

The IC9 connector receives commands from the personal computer, whilst the IC8 connector transmits data to the personal computer.

The following basic precautions must be taken when connecting and wiring the system:

- 1 – Always match the colours of the mobile and fixed connectors to avoid confusing the receiver and transmitter with consequent transmission failure.
- 2) Do not confuse the remote mimic panel connector (IC11) with the personal computer diagnosis connectors (IC8 and IC9).
- 3 – When laying the fibre optics, avoid creating bends with radii below 10 cm; in such cases the reflection of light inside the fibre no longer occurs properly and communication could break down.

If no mechanical damage was caused while bending the cable, the connection can be restored simply by making a "gentler" curve.

The customer interface board is placed at the bottom right area behind the front air grating (Figure 2).

Even though there are no dangerous potentials on the customer interface board, it is necessary to make all connections with the UPS switched off, and with the mains and the battery disconnected, because the compartment in which the board is located contains live conductors.

## **INSTALLATION**

### **Choosing the installation location**

For a successful UPS installation, the following rules must be observed:

- Although all routine maintenance can be carried out from the front side, it is advisable to leave the space indicated in figure 10 between the rear side of the machine and the wall to allow for any extraordinary maintenance operations to be carried out and/or to provide an adequate circulation of cooling air (Figure 10).
- The area where the UPS is installed must be kept clean and dry to prevent any solid or liquid material from being drawn into the UPS.
- A free space of about 1 m must be kept in front of the UPS to allow all normal and maintenance operations to be carried out (Figure 10).
- The top of the UPS must have a minimum distance from the ceiling of about 1 m to provide adequate ventilation.
- In view of the fact that these appliances, especially in the in-parallel configurations, can reach considerable power ratings, it is a good engineering principal to equip the UPS compartment and/or batteries with an automatic smoke detection system featuring an alarm to stop UPS operation.

### **Visual inspection**

Prior to delivery, every UPS is carefully checked both electrically and mechanically. Always visually check a UPS after delivery for any transit damage, and immediately inform Siel S.p.A. if such damage is evident.

### **Environmental considerations**

There are various environmental aspects to take into consideration, the most important being:

#### Floor capacity

The UPS occupies a small area and a relatively heavy weight (see technical characteristics). It is therefore necessary to position it on a floor having suitable capacity.

If the UPS is assembled on a raised floor, it is important to use a base with pedestals (this base can be provided by Siel upon request).

Cables must be connected from under the floor.

#### Temperature and humidity

The premises where the UPS is to be installed must be able to dispose of the kW dissipated by the machine during operation so as to keep the temperature at between 0°C ÷ 40°C; nevertheless, to achieve utmost reliability and life-span, the temperature of the environment should be around or below 25°C, with a humidity percentage between 0÷90% as shown on the technical specifications table.

More specifically, always remember that battery life is halved by a 10°C increase above 25°C.

### **Handling**

The UPS is designed to be lifted from underneath using a fork-lift truck.

### **Safety Considerations**

To reduce accidents, Health and Safety rules must be observed. Walls, ceilings and floors and everything surrounding the UPS are best not made of inflammable materials; furthermore, the area around the machine should be kept particularly clean so that metal dusts, iron filings or miscellaneous metals are not sucked up inside the UPS as these could cause short circuits.

It is advisable to keep a mobile powder fire extinguisher within easy reach.



For appliances with power above 100kVA, it is a good idea to fit an automatic smoke detection system.

Access to the UPS room should be restricted to machine service and maintenance personnel; the doors of the UPS room (equipped with handle with push opening from inside) must be kept closed and the keys suitably looked after.

All service and maintenance personnel must be trained in emergency procedures.

Periodic tests are advisable to keep technicians trained.

New personnel must be trained before being authorised to operate the UPS.

### **Batteries**

Siel build and supply reliable battery cabinets that do not require maintenance. The use of air-tight lead batteries rather than the "open-vented" batteries, which smell and need specific rooms, makes it possible to install them in cabinets adjacent to the UPS that are aesthetically matched.

If a battery room is used, the installer shall be responsible for following all applicable regulations.

Please remember that battery life is halved following an increase in temperature of 10°C above 25°C.

## OPTIONS

The various options are listed on table 11.

For each option, it is specified whether this can be housed in the existing structural work or whether an additional cabinet is required, whether this must be fitted in a container detached from the UPS, whether it is a software to be loaded on the computer or whether the possibility of fitting it on board the machine is only possible after ad hoc sizing.

Attention must be given to the fact that the table envisages fitting one option at a time in the machine; in the event of several options being adopted, it will be necessary to check from time to time whether these can be housed inside the same cabinet and whether additional containers are required.

### **Option 1: RFI filters**

All the SIEL UPS units comply with European EN 62040-2 (EN50091-2) standard on electromagnetic compatibility.

Filters that comply with more stringent regulations are available on request.

### **Option 2: Input Power factor correction**

A power factor correction circuit can be supplied for the current absorbed by the UPS rectifier at  $\cos\varphi = 0.9$  for those applications where there is no centralised power factor correction.

A dedicated magneto-thermal breaker isolates the power factor correction circuit in the event of breakdown, thus ensuring the reliability of the system remains unaffected.

### **Option 3: Reduction of distortion of input power for six-phase UPS**

As an alternative to the twelve-phase solution, the distortion of the current absorbed by the system from the six-phase bridge by 29 to 10% can be reduced by adding special filters. The use of such filters also permits input power factor correction.

A dedicated magneto-thermal breaker isolates the filter in the event of breakdown, thus ensuring the reliability of the system remains unaffected.

### **Option 4: Reduction of input current distortion for 12-pulse UPSs**

This option makes it possible to lower distortion of the input current from the twelve-pulse bridge from 10% to 7%.

It is possible to achieve even lower levels of distortion by means of option 27 or customized solutions (in the latter case, please contact SIEL S.p.A.)

### **Option 5: Reserve mains isolation transformer**

The UPS unit can be completed with a class H isolation transformer for the reserve mains with electrostatic screen. In this case the load remains totally isolated with respect to the input mains.

### **Option 6: Rectifier input isolation transformer**

The UPS unit can be supplied with a class H isolation transformer for the rectifier input with electrostatic screen. In this case, the battery remains completely isolated with respect to the input mains.

### **Option 7: Rectifier and reserve input isolation transformer**

If the input mains to the rectifier and the reserve mains are joined, the UPS unit can be supplied with a class H isolation transformer that completely separates the inputs from the UPS units. This way the load and battery remain completely isolated with respect to the input mains.

By means of this transformer, it is also possible to adapt the input voltage of the UPS units to non-standard values (also see option 21).

**Option 8: Remote switch for disconnecting the reserve mains in case of a mains power break and UPS output isolation sensor**

The UPS unit can be equipped with an input remote switch and isolation sensor for controlling the system in IT during a mains power break.

**Option 9: Back-Feed to Mains Protection with switch in the UPS**

As a rule, in case of static switch fault, the “Back-Feed Protection” permits the activation of the release coil of an switch mounted in the UPS in order to avoid any danger for people working on the system.

Alternatively, by means of this option, the device may be used to stop UPS operation.

**Option 10: Back-Feed Protection with remote switch**

In case of a static switch fault, this device opens a remote switch so as to avoid any hazard for staff working on the plant.

In the case of options 8 and 10 being envisaged, the remote switch is the same.

**Option 11: UPS output isolation sensor for regular operation in IT**

In the event of an isolation transformer being fitted at the UPS input, the system can be controlled in IT by fitting a special earth phase sensor for signalling first fault.

**Option 12: Restriction of the input current and inhibition of fast charging for operation with generator, sequential rectifier start.**

In case of operation with a generator, an optional circuit can be supplied that restricts the power absorbed by the rectifier to such a value as not to overload the generator and at the same time prevent fast battery charge.

It is also possible to set the sequential start (staggered over time) of several rectifiers in the case of UPS units connected in parallel.

**Option 13: Battery temperature reading kit.**

This Kit is necessary only if the UPS haven't battery inside or if you usen't Siel battery cabinet.

This Kit communicates battery temperature to the UPS in order to change the recharging voltage.

This option can be used only if the battery cabinet is located close to the UPS.

**Option 14: Battery cabinet temperature reading kit, by means of fibre optics.**

By means of this kit, it is possible to communicate the temperature of the battery compartment to the UPS unit, even if this is not close to the UPS.

The transmitter located in the battery compartment must be powered with single-phase 230 V AC current. This voltage need not be continuous because, in the event of a power break, the batteries are not recharged and the recharge voltage correction signal is not used.

In case of interruption of the optic fibres or no power to the transmitter, the correction circuit automatically disengages and the batteries are correctly charged at fixed voltage.

NOTE: The length of the fibres must be indicated in the order: 25-50-75m.

**Option 15: Customer interface board with RS232 serial port**

Besides the features set out in the section entitled Remote Signalling Systems , this board (Figure 6) also includes an additional DB9 connector (female) for data transmission through an RS232 port;

The serial port is fully insulated from the UPS electronic circuitry and designed to interface with any computer with a RS232 port.

The interconnection cable must be of the Nullmodem type, i.e. Terminals 2 and 3 must be switched (this cable can be provided by Siel S.p.A. on request).

The baud rate equals 9600 Bit/sec; the baud rate can only be changed by contacting SIEL service.

Siel provides special software which can graphically display all signals and measurements sent by the UPS, keep an accurate history file of events, and control the UPS from the personal computer.

Customers wishing to use their own software to capture the signals and measurements provided by the UPS should send a written request to Siel S.p.A., who will then authorise and issue detailed specifications on the communication protocol.

All signals provided through RS232 can also be obtained through fibre optics as previously described.

#### **Option 16: Remote mimic panel**

The remote digital mimic panel is similar to the control panel provided on the SAFEPOWER series UPS.

A fibre optic cable is used to connect the digital mimic panel and the control panel; unlike conventional cables, it provides signals with electrical and magnetic insulation, which have considerable advantages in terms of transmission safety and reliability.

The digital mimic panel, like the control panel, includes an 80-character LCD display, a functional LED-diagram and special control keys allow the operator to:

- Silence the acoustic alarm
- Bring signals and alarms forward or backward.
- Read UPS output voltages
- Read UPS output currents and frequency
- Read the voltage and current

Unless otherwise controlled by the operator, the remote mimic panel cyclically displays messages related to the operational status of the main sections of the UPS.

In the event of one or more alarms, the remote mimic panel issues a continuous acoustic alarm to alert the operator of a system malfunction and, through the display, immediately identifies the fault cause.

#### **Option 17: OCSsystem control system**

This software has been developed by Siel to permit the control and management of the UPS units by means of a personal computer. Thanks to this software, up to 4 UPS units can be monitored, including of different powers. The OCSsystem processing system centralises the data from each single machine relating to operating status, running conditions and faults occurring over time.

The data from each UPS are conveyed via optic fibres directly to a computer (which need not necessarily be in the immediate vicinity of the UPS units). The computer processes and displays the status of each machine in real time and updates a historical file.

This system is suitable for operation on Windows platforms and can be easily customised as regards language.

The basic elements of the system are:

- A board inside or outside the PC that receives the signals from the various optic fibres from the UPS units and transforms these into signals suitable for a RS232.
- A software able to control the data of the controlled machines.

#### **Option 18: SMS (Siel Monitoring Software) Control System**

This software permits automatically switching off the computer in the event, due to a prolonged mains power break, of the batteries running low.

The software can be used in a variety of operating systems. The display pages are in English.

The basic elements of the system are:

- A board inside or outside the PC that receives the signals from the various optic fibres from the UPS units and transforms these into signals suitable for a RS232.
- A software able to control the data of the controlled machine.

**Option 19: Connection to SNMP network**

This option permits monitoring the status of the UPS unit and performing shutdown of PC, server and workstation linked to a LAN network.

The option consists in additional hardware which on the one hand links up to the UPS through a serial interface RS232C and permits network linkup by means of an RJ45 connection.

The protocols implemented on this hardware are HTML and SNMP.

This implies that the status of the UPS can be configured and monitored through any web browser with Java and the shutdown can be managed of all the machines linked to this network node.

**Option 20: Teleglobalservice**

By means of this option (remote-assistance apparatus) the UPS can be directly interlinked with the telephone line (specify whether ISDN), thus permitting the exchange of information between the Siel after-sales service and the machine under control.

In case of an alarm, the unit automatically contacts the after-sales service.

Furthermore, the UPS unit can be periodically interrogated by the after-sales service, at intervals to be defined when drawing up the contract, to unload the "historical" file of events.

A report can also be periodically sent on the operating status of the unit.

**Option 21: Power adapter autotransformers**

By means of this option, the input or output powers can be adapted to non-standard values.

Because the power of these components varies according to the difference between input and output voltage, sizing will have to be done from time to time.

**Option 22: UPS used as frequency converter**

By means of this option, the Siel UPS units can be used as frequency converters (input 50Hz-output 60Hz or vice versa).

**Option 23: Second client interface board**

By means of this option, the number of signals from the UPS can be increased.

In particular:

- ❑ The connector CN1 in figure 6 is duplicated (see para. "Detailed description of the signals available on connector CN1 and on terminal boards") with the same signals.
- ❑ The terminal boards M1, M2 and M3 are duplicated (by changing the position of the DipSwitch the set of signals can be changed on the additional board; e.g., the "OR" of the alarms can be added).
- ❑ The optic fibre connector for the remote mimic panel is duplicated (this way two remote mimic panels can be connected).

**Option 24: Second RS232 interface**

By means of this option, the UPS unit can be equipped with a second serial port (on optic fibre or D connector – standard) with independent operation from the standard serial port.

By means of this option, all the main UPS parameters can be accessed.

**Option 25: Single battery for parallel operation**

In case of special plant considerations so requiring, a single battery can be used for several UPS units in parallel (max 4). By means of this option, the rectifiers share out the current in an active way and this flows both towards the battery and towards the inverters.

**Option 26: Incorporated batteries**

UPS units fitted with six-pulse power rectifiers up to 40KVA may be supplied with incorporated batteries; please contact SIEL S.p.A. to define the exact backup time according to the loads effectively powered by the UPS.

All sizes of UPS may be supplied with batteries housed in special cabinets designed to operate with and match the UPS units.

#### **Option 27: 24-pulse rectifier bridge**

When input current distortions of  $\leq 5\%$  are required for UPSs with capacities from 500kVA to 1MVA, an option with a 24-pulse rectifier bridge can be supplied which, without adding extra filters, naturally guarantees a harmonic current distortion lower than 5% (the technical specifications of these UPSs are given in technical specification SP117 which integrates this document).

The version with the 24-pulse rectifier bridge may be supplied for UPSs with lower capacities on request or, as an alternative, it is possible to fit this twelve-pulse equipment with an extra filter to current the input current phase; in this way the input current distortion reaches levels lower than 5% (for further information, please contact Siel SpA)

#### **Option 28: Remote sensing circuit**

In the event of the load being connected to the UPS by means of a particularly long line or by means of an external transformer, the UPS unit (or units in case of parallel system) can be equipped with a special circuit which, by detecting the power voltage near the load, changes the UPS power voltage so that the voltage at the ends of the load remains constant.

The correction signal to the UPS units is sent through optical fibres so as to maximise immunity.

If the sensor fails, the UPS continues to work regularly, although it is no longer able to compensate the voltage supplied to the load.

#### **Option 29: Versions without disconnecting switches**

If the plant includes input, output and bypass switches, you can use a version of UPS Safepower-EVO not featuring internal disconnecting switches.

This option is available for sizes exceeding 160kVA-12F and 200kVA-6F.

To define plant and switches configuration to be used, please contact the technical department of SIEL S.p.A.

### **TECHNICAL SPECIFICATIONS**

**MAXIMUM POWER OF INPUT AND OUTPUT CABLES: TABLE 1**

**RECTIFIER INPUT CHARACTERISTICS TABLE 2**

**RECTIFIER OUTPUT CHARACTERISTICS TABLE 3**

**INVERTER INPUT CHARACTERISTICS TABLE 4**

**INVERTER OUTPUT CHARACTERISTICS TABLE 5**

**STATIC SWITCH SPECIFICATIONS: TABLE 6**

**COMPLETE UPS SPECIFICATIONS: TABLE 7**

**MECHANICAL CHARACTERISTICS: TABLE 8**

**OTHER DATA: TABLE 9**

**PARALLEL: TABLE 10**

**AVAILABLE OPTIONS: TABLE 11**

**EMERGENCY NETWORK FUSES: TABLE 12**

#### **Warning:**

The technical specifications refer to the standard single machine.

The addition of a number of options may significantly change the technical data shown.

For further information, contact Siel S.p.A.

## FORM 1: MAX CURRENT OF INPUT/OUTPUT CABLE

### Form 1A: Size 20 - 160kVA

Size [kVA]	20	30	40	50	60	80	100	120	160
Rectifier input Phase R	49	66	93	109	127	171	215	249	336
Rectifier input Phase S	49	66	93	109	127	171	215	249	336
Rectifier input Phase T	49	66	93	109	127	171	215	249	336
Reserve input Neutral	48	74	96	122	144	192	240	288	383
Reserve input Phase R	32	49	64	81	96	128	160	192	255
Reserve input Phase S	32	49	64	81	96	128	160	192	255
Reserve input Phase T	32	49	64	81	96	128	160	192	255
Output Neutral	48	74	96	122	144	192	240	288	383
Output Phase R	32	49	64	81	96	128	160	192	255
Output Phase S	32	49	64	81	96	128	160	192	255
Output Phase T	32	49	64	81	96	128	160	192	255
+ Battery	52	78	103	129	154	206	257	308	410
- Battery	52	78	103	129	154	206	257	308	410

### Form 1B: Size 200 - 1000kVA

Size [kVA]	200	250	300	400	500	600	800	1000
Rectifier input Phase R	406	493	633	800	1020	1238	1627	1966
Rectifier input Phase S	406	493	633	800	1020	1238	1627	1966
Rectifier input Phase T	406	493	633	800	1020	1238	1627	1966
Reserve input Neutral	477	597	717	954	1193	1431	1907	2384
Reserve input Phase R	318	398	478	636	795	954	1271	1589
Reserve input Phase S	318	398	478	636	795	954	1271	1589
Reserve input Phase T	318	398	478	636	795	954	1271	1589
Output Neutral	477	597	717	954	1193	1431	1907	2384
Output Phase R	318	398	478	636	795	954	1271	1589
Output Phase S	318	398	478	636	795	954	1271	1589
Output Phase T	318	398	478	636	795	954	1271	1589
+ Battery	513	643	636	841	1048	1250	1660	2075
- Battery	513	643	636	841	1048	1250	1660	2075



## FORM 2: RECTIFIER INPUT TECHNICAL DATA

**2a: RECTIFIER INPUT TECHNICAL DATA 20-80kVA 6-PULSE**

Size	kVA	20	30	40	50	60	80
1) Nominal input voltage 3Ph (Note 1)	Vca	400	400	400	400	400	400
2a) Tolerance on voltage (Float charge):							
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	22	33	43	54	64	85
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	29	40	57	68	79	106
8) Max input current @ 400V, without PFC, battery on recharge	Aac	42	58	83	99	115	153
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30	10-30	10-30
10) Efficiency	%	95,7	95,8	95,8	95,8	95,9	96,8
11) THD	%	28	28	28	28	28	28

Note 1: 380Vac - 415Vac: Option

Note 2: 60Hz: Option

Note 3: PFC option (otherwise 0,83)



## FORM 2: RECTIFIER INPUT TECHNICAL DATA

### 2b: RECTIFIER INPUT TECHNICAL DATA 20-80kVA 12-PULSE

Size	kVA	20	30	40	50	60	80
1) Nominal input voltage 3Ph (Note 1)	Vca	400	400	400	400	400	400
2a) Tolerance on voltage (Float charge):							
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	22	33	44	54	65	86
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	30	41	58	68	79	107
8) Max input current @ 400V, without PFC, battery on recharge	Aac	44	60	84	99	115	155
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30	10-30	10-30
10) Efficiency	%	94,4	94,6	94,6	95,5	95,6	95,6
11) THD (Note 4)	%	7	7	7	7	7	7

Note 1: 380Vac - 415Vac: Option

Note 2: 60Hz: Option

Note 3: PFC option (otherwise 0,83)

Note 4: Option (otherwise 9%)

## FORM 2: RECTIFIER INPUT TECHNICAL DATA

### 2c: RECTIFIER INPUT TECHNICAL DATA 100-200kVA 6-PULSE

Size	kVA	100	120	160	200
1) Nominal input voltage 3Ph (Note 1)	Vca	400	400	400	400
2a) Tolerance on voltage (Float charge):					
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	106	125	167	208
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	134	154	209	251
8) Max input current @ 400V, without PFC, battery on recharge	Aac	194	223	302	363
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30
10) Efficiency	%	96,8	98,1	98,1	98,3
11) THD	%	28	28	28	28

Note 1: 380Vac - 415Vac: Option

Note 2: 60Hz: Option

Note 3: PFC option (otherwise 0,83)

## FORM 2: RECTIFIER INPUT TECHNICAL DATA

### 2d: RECTIFIER INPUT TECHNICAL DATA 100-200kVA 12-PULSE

Size	kVA	100	120	160	200
1) Nominal input voltage 3Ph (Note 1)	Vca	400	400	400	400
2a) Tolerance on voltage (Float charge):					
- Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
- Sealed Pb Battery	%	-13 +15	-13 +15	-13 +15	-13 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	107	127	169	210
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	135	156	211	255
8) Max input current @ 400V, without PFC, battery on recharge	Aac	195	226	305	369
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30
10) Efficiency	%	95,6	96,8	96,9	97,0
11) THD (Note 4)	%	7	7	7	7

Note 1: 380Vac - 415Vac: Option

Note 2: 60Hz: Option

Note 3: PFC option (otherwise 0,83)

Note 4: Option (otherwise 9%)

## FORM 2: RECTIFIER INPUT TECHNICAL DATA

### 2e: RECTIFIER INPUT TECHNICAL DATA 250-1000kVA 12-PULSE

Size	kVA	250	300	400	500	600	800	1000
1) Nominal input voltage 3Ph (Note 1)	Vca	400	400	400	400	400	400	400
2a) Tolerance on voltage (Float charge):								
- Pb Battery	%	-13 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15
- Sealed Pb Battery	%	-13 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15	-15 +15
2b) Tolerance on voltage (Without battery discharge) :	%	-20	-20	-20	-20	-20	-20	-20
3) Nominal frequency (Note 2)	Hz	50	50	50	50	50	50	50
4) Frequency range	Hz	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65	45÷65
5) Nominal input power @ Battery on float, without PFC	kVA	263	315	415	516	615	816	1020
6) Medium power factor @ 400, nominal load (Note 3)	cos ø	0,9	0,9	0,9	0,9	0,9	0,9	0,9
7) Max input power @ Battery on recharge, without PFC	kVA	310	398	503	642	779	1024	1238
8) Max input current @ 400V, without PFC, battery on recharge	Aac	448	575	727	927	1125	1479	1787
9a) Time before Start-Up (Option: selectable)	s	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20	0,10, 20
9b) Start-Up time	s	10-30	10-30	10-30	10-30	10-30	10-30	10-30
10) Efficiency	%	97,3	97,3	97,6	97,9	97,9	97,9	97,9
11) THD (Note 4)	%	7	7	7	7	7	7	7

Note 1: 380Vac - 415Vac: Option

Note 2: 60Hz: Option

Note 3: PFC option (otherwise 0,83)

Note 4: Option (otherwise 9%)

### FORM 3: RECTIFIER OUTPUT AND BATTERY TECHNICAL DATA

#### 3a: RECTIFIER OUTPUT: 20/80kVA

SIZE	kVA	20	30	40	50	60	80
1a) Output Voltage (Stationary Battery)							
- Float	Vcc	436	436	436	436	436	436
- Boost	Vcc	475	475	475	475	475	475
1b) Output Voltage (Sealed Battery)							
- Float	Vcc	446	446	446	446	446	446
1c) Output Voltage (Without Battery discharge)	Vcc	396	396	396	396	396	396
2) DC Voltage Range	%	330-500	330-500	330-500	330-500	330-500	330-500
3) Voltage regulation in steady state condition for 100% load variation and/or input voltage	%	±1	±1	±1	±1	±1	±1
4) Voltage ripple (Vrms/Vb x 100)	%	<1	<1	<1	<1	<1	<1
5) Nominal current	Acc	41	61	81	100	120	160
6) Max output rectifier current	Acc	51	71	101	120	140	190
7a) Max battery charging current @ inverter full load	Acc	10	10	20	20	20	30
7b) Max battery charging current	Acc	46	64	91	108	126	171
8) Battery charging current range:							
- min	Acc	2	2	5	5	5	5
- max	Acc	46	64	91	108	126	171
9) Battery charging method		DIN41773					
10) Maximum time to recharge battery		360,720,1440, 2880 min.					

#### BATTERY

SIZE	kVA	20	30	40	50	60	80
1) Recommended N° of Pb cells	N°	198	198	198	198	198	198
2) Nominal voltage	Vcc	396	396	396	396	396	396
3) Float voltage	Vcc	446	446	446	446	446	446
4) N° of Ni-Cd cells	N°	Contact SIEL					
5) End of discharge voltage (Pb Battery)	Vcc	330	330	330	330	330	330
6) End of discharge current	Acc	52	78	103	129	154	206

### FORM 3: RECTIFIER OUTPUT AND BATTERY TECHNICAL DATA

#### 3b: RECTIFIER OUTPUT: 100-200kVA

SIZE	kVA	100	120	160	200
1a) Output Voltage (Stationary Battery)					
- Float	V <sub>cc</sub>	436	436	436	436
- Boost	V <sub>cc</sub>	475	475	475	475
1b) Output Voltage (Sealed Battery)					
- Float	V <sub>cc</sub>	446	446	446	446
1c) Output Voltage (Without Battery discharge)	V <sub>cc</sub>	396	396	396	396
2) DC Voltage Range	V <sub>cc</sub>	330-500	330-500	330-500	330-500
3) Voltage regulation in steady state condition for 100% load variation and/or input voltage	%	±1	±1	±1	±1
4) Voltage ripple (V <sub>rms</sub> /V <sub>b</sub> x 100)	%	<1	<1	<1	<1
5) Nominal current	Acc	200	240	320	399
6) Max output rectifier current	Acc	240	280	380	459
7a) Max battery charging current @ inverter full load	Acc	40	40	60	60
7b) Max battery charging current	Acc	216	252	342	414
8) Battery charging current range:					
- min	Acc	5	5	5	5
- max	Acc	216	252	342	414
9) Battery charging method		DIN41773			
10) Maximum time to recharge battery		360,720,1440, 2880 min.			

#### BATTERY

SIZE	kVA	100	120	160	200
1) Recommended N° of Pb cells	N°	198	198	198	198
2) Nominal voltage	V <sub>cc</sub>	396	396	396	396
3) Float voltage	V <sub>cc</sub>	446	446	446	446
4) N° of Ni-Cd cells	N°	Contact SIEL			
5) End of discharge voltage (Pb Battery)	V <sub>cc</sub>	330	330	330	330
6) End of discharge current	Acc	257	308	410	513

### FORM 3: RECTIFIER OUTPUT AND BATTERY TECHNICAL DATA

#### 3c: RECTIFIER OUTPUT: 250-1000kVA 12 PULSE

SIZE	kVA	250	300	400	500	600	800	1000
1a) Output Voltage (Stationary Battery)								
- Float	V <sub>cc</sub>	436	528	528	528	528	528	528
- Boost	V <sub>cc</sub>	475	576	576	576	576	576	576
1b) Output Voltage (Sealed Battery)								
- Float	V <sub>cc</sub>	446	540	540	540	540	540	540
1c) Output Voltage (Without Battery discharge)	V <sub>cc</sub>	396	480	480	480	480	480	480
2) DC Voltage Range	%	330-500	400-580	400-580	400-580	400-580	400-580	400-580
3) Voltage regulation in steady state condition for 100% load variation and/or input voltage	%	±1	±1	±1	±1	±1	±1	±1
4) Voltage ripple (V <sub>rms</sub> /V <sub>b</sub> x 100)	%	<1	<1	<1	<1	<1	<1	<1
5) Nominal current	Acc	500	495	654	815	972	1290	1612
6) Max output rectifier current	Acc	560	595	754	965	1172	1540	1862
7a) Max battery charging current @ inverter full load	Acc	60	100	100	150	200	250	250
7b) Max battery charging current	Acc	504	536	679	869	1055	1386	1676
8) Battery charging current range:								
- min	Acc	10	10	10	30	30	30	30
- max	Acc	504	536	679	869	1055	1386	1676
9) Battery charging method		DIN41773						
10) Maximun time to recharge battery		360,720,1440, 2880 min.						

#### BATTERY

SIZE	kVA	250	300	400	500	600	800	1000
1) Recommended N° of Pb cells	N°	198	240	240	240	240	240	240
			Note 1	Note 1	Note 1	Nota 1	Nota 1	
2) Nominal voltage	V <sub>cc</sub>	396	480	480	480	480	480	480
3) Tensione di Tampone	V <sub>cc</sub>	446	540	540	540	540	540	540
4) N° of Ni-Cd cells	N°	Contattare SIEL						
5) End of discharge voltage (Pb Battery)	V <sub>cc</sub>	330	400	400	400	400	400	400
6) End of discharge current	Acc	643	636	841	1048	1250	1660	2075

Note 1: 198 el. Battery also available; contact Siel SpA

## FORM 4: INVERTER INPUT TECHNICAL DATA

### 4a: INVERTER INPUT: 20/100kVA

SIZE	kVA	20	30	40	50	60	80
1) Nominal voltage	V <sub>cc</sub>	446	446	446	446	446	446
2) DC Voltage range	V <sub>cc</sub>	330+500	330+500	330+500	330+500	330+500	330+500
3) Pre-alarm end discharge voltage	V <sub>cc</sub>	350	350	350	350	350	350
4) DC current at nominal voltage	Acc	39	58	77	95	114	152
5) Max DC current at end discharge voltage	Acc	52	78	103	129	154	206

### 4b :INVERTER INPUT: 100/200kVA

SIZE	kVA	100	120	160	200
1) Nominal voltage	V <sub>cc</sub>	446	446	446	446
2) DC Voltage range	V <sub>cc</sub>	330+500	330+500	330+500	330+500
3) Pre-alarm end discharge voltage	V <sub>cc</sub>	350	350	350	350
4) DC current at nominal voltage	Acc	190	228	304	380
5) Max DC current at end discharge voltage	Acc	257	308	410	513

### 4c: INVERTER INPUT: 250/1000kVA

SIZE	kVA	250	300	400	500	600	800	1000
1) Nominal voltage	V <sub>cc</sub>	446	540	540	540	540	540	540
2) DC Voltage range	V <sub>cc</sub>	330+500	400-580	400-580	400-580	400-580	400-580	400-580
3) Pre-alarm end discharge voltage	V <sub>cc</sub>	350	430	430	430	430	430	430
4) DC current at nominal voltage	Acc	476	471	622	776	925	1228	1535
5) Max DC current at end discharge voltage	Acc	643	636	841	1048	1250	1660	2075



## FORM 5: INVERTER OUTPUT TECHNICAL DATA

### 5a: INVERTER OUTPUT: 20/80kVA

SIZE	kVA	20	30	40	50	60	80
1) Nominal Power @P.F. 0.8 (Inductive)	kVA	20	30	40	50	60	80
2) Nominal Voltage (Note 1)	V	400	400	400	400	400	400
3) Setting range of output voltage	%	$\geq \pm 5$	$\geq \pm 5$	$\geq \pm 5$	$\geq \pm 5$	$\geq \pm 5$	$\geq \pm 5$
4) Output Voltage Wave Shape		Sinusoidale					
5a) THD @ Linear full Load	%	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max
5b) THD @ Non linear full Load (Note 3)	%	<5	<5	<5	<5	<5	<5
6) Voltage stability in steady state condition for input DC variation and/or 100% load variation	%	$\leq \pm 1$	$\leq \pm 1$	$\leq \pm 1$	$\leq \pm 1$	$\leq \pm 1$	$\leq \pm 1$
7) Voltage stability in dynamic condition for 100% load step variation	%	$\leq \pm 5$	$\leq \pm 5$	$\leq \pm 5$	$\leq \pm 5$	$\leq \pm 5$	$\leq \pm 5$
8) Tempo di ripristino entro $\pm 1\%$	ms	<20	<20	<20	<20	<20	<20
9) Nominal output current @ 400Vac, 0.8 P.F.	A	29	44	58	73	87	116
10) Overload @ 400Vac, 0.8 P.F.	%Pn x 20'	125	125	125	125	125	125
	%Pn x 90"	150	150	150	150	150	150
10a) 3-Phase Short circuit current (<5s) (Note 2)	%	180	180	180	180	180	180
10b) 1-Phase Short circuit current (<5s) (Note2)	%	220	220	220	220	220	220
11) Voltage simmetry @ balanced load	%	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)
12) Voltage simmetry @ 100% unbalanced load	%	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)
13) Phase angle precision							
- balanced load	%	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$
- 100% unbalanced load	%	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$
14) Output frequency (Note1)	Hz	50	50	50	50	50	50
15) Output frequency precision:							
- free running (internal quarz oscillator)	%	$\pm 0,05$	$\pm 0,05$	$\pm 0,05$	$\pm 0,05$	$\pm 0,05$	$\pm 0,05$
- sincronized to mains (selectable)	%	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$
- frequency slew-rate	Hz/s	0,1	0,1	0,1	0,1	0,1	0,1
16) Inverter efficiency @ full nominal load	%	94,7	94,8	95,1	95,3	95,3	95,3

Note1: On demand: 380Vac, 415Vac, 60Hz

Note2: In accordance with EN62040-1 (EN50091-1) (on demand up to 10s)

Note3: In accordance with EN62040-3 (EN50091-3)

## FORM 5: INVERTER OUTPUT TECHNICAL DATA

### 5b: INVERTER OUTPUT: 100/200kVA

SIZE	kVA	100	120	160	200
1) Nominal Power @P.F. 0.8 (Inductive)	kVA	100	120	160	200
2) Nominal Voltage (Note 1)	V	400	400	400	400
3) Setting range of output voltage	%	$\geq \pm 5$	$\geq \pm 5$	$\geq \pm 5$	$\geq \pm 5$
4) Output Voltage Wave Shape	Sinusoidale				
5a) THD @ Linear full Load	%	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max
5b) THD @ Non linear full Load (Note 3)	%	<5	<5	<5	<5
6) Voltage stability in steady state condition for input DC variation and/or 100% load variation	%	$\leq \pm 1$	$\leq \pm 1$	$\leq \pm 1$	$\leq \pm 1$
7) Voltage stability in dynamic condition for 100% load step variation	%	$\leq \pm 5$	$\leq \pm 5$	$\leq \pm 5$	$\leq \pm 5$
8) Tempo di ripristino entro $\pm 1\%$	ms	<20	<20	<20	<20
9) Nominal output current @ 400Vac, 0.8 P.F.	A	145	174	231	289
10) Overload @ 400Vac, 0.8 P.F.	%Pn x 20'	125	125	125	125
	%Pn x 90"	150	150	150	150
10a) 3-Phase Short circuit current (<5s) (Note 2)	%	180	180	180	180
10b) 1-Phase Short circuit current (<5s) (Note2)	%	220	220	220	220
11) Voltage simmetry @ balanced load	%	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)
12) Voltage simmetry @ 100% unbalanced load	%	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)
13) Phase angle precision					
- balanced load	°	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$
- 100% unbalanced load	°	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$	$120^\circ \pm 1^\circ$
14) Output frequency (Note1)	Hz	50	50	50	50
15) Output frequency precision:					
- free running (internal quartz oscillator)	%	$\pm 0,05$	$\pm 0,05$	$\pm 0,05$	$\pm 0,05$
- sincronized to mains (selectable)	%	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$	$\pm 1 \text{ o } \pm 4$
- frequency slew-rate	Hz/s	0,1	0,1	0,1	0,1
16) Inverter efficiency @ full nominal load	%	95,3	95,3	95,3	95,3

Note1: On demand: 380Vac, 415Vac, 60Hz

Note2: In accordance with EN62040-1 (EN50091-1) (on demand up to 10s)

Note3: In accordance with EN62040-3 (EN50091-3)

## FORM 5: INVERTER OUTPUT TECHNICAL DATA

### 5c: INVERTER OUTPUT: 250-1000kVA

SIZE	kVA	250	300	400	500	600	800	1000
1) Nominal Power @P.F. 0.8 (Inductive)	kVA	250	300	400	500	600	800	1000
2) Nominal Voltage (Note 1)	V	400	400	400	400	400	400	400
3) Setting range of output voltage	%	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5	≥± 5
4) Output Voltage Wave Shape		Sinusoidale						
5a) THD @ Linear full Load	%	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max	1Typ <2max
5b) THD @ Non linear full Load (Note 3)	%	<4	<4	<4	<4	<4	<4	<4
6) Voltage stability in steady state condition for input DC variation and/or 100% load variation	%	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1	<± 1
7) Voltage stability in dynamic condition for 100% load step variation	%	<± 5	<± 5	<± 5	<± 5	<± 5	<± 5	<± 5
8) Tempo di ripristino entro ±1%	ms	<20	<20	<20	<20	<20	<20	<20
9) Nominal output current @ 400Vac, 0.8 P.F.	A	361	434	578	722	867	1155	1444
10) Overload @ 400Vac, 0.8 P.F.	%Pn x 20'	125	125	125	125	125	125	125
	%Pn x 90"	150	150	150	150	150	150	150
10a) 3-Phase Short circuit current (<5s) (Note 2)	%	180	180	180	180	180	180	180
10b) 1-Phase Short circuit current (<5s) (Note2)	%	220	220	220	220	220	220	220
11) Voltage symmetry @ balanced load	%	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)	<1 (0,5Typ)
12) Voltage symmetry @ 100% unbalanced load	%	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)	<2 (1 Typ)
13) Phase angle precision								
- balanced load	%	120° ±1°	120° ±1°	120° ±1°	120° ±1°	120° ±1°	120° ±1°	120° ±1°
- 100% unbalanced load	%	120° ±1°	120° ±1°	120° ±1°	120° ±1°	120° ±1°	120° ±1°	120° ±1°
14) Output frequency (Note1)	Hz	50	50	50	50	50	50	50
15) Output frequency precision:								
- free running (internal quartz oscillator)	%	± 0,05	± 0,05	± 0,05	± 0,05	± 0,05	± 0,05	± 0,05
- sincronized to mains (selectable)	%	±1 o ±4	±1 o ±4	±1 o ±4	±1 o ±4	±1 o ±4	±1 o ±4	±1 o ±4
- frequency slew-rate	Hz/s	0,1	0,1	0,1	0,1	0,1	0,1	0,1
16) Inverter efficiency @ full nominal load	%	95,0	95,2	96,0	96,2	96,8	97,2	97,2

Note1: On demand: 380Vac, 415Vac, 60Hz

Note2: In accordance with EN62040-1 (EN50091-1) (on demand up to 10s)

Note3: In accordance with EN62040-3 (EN50091-3)

## FORM 6: STATIC SWITCH TECHNICAL DATA

### 6a: Static Switch 20/80kVA

SIZE		20	30	40	50	60	80
1) Nominal Power	kVA	20	30	40	50	60	80
2) Input/Output Voltage (Note1)	V	400	400	400	400	400	400
3) Acceptance range of Mains Voltage (low and high threshold are adjustable between 3% and 50%)	%	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10
4) Input/Output frequency (Note1)	Hz	50	50	50	50	50	50
5) Power Overload:							
- 30'	%I <sub>N</sub>	150	150	150	150	150	150
- 90s	%I <sub>N</sub>	300	300	300	300	300	300
- 5s	%I <sub>N</sub>	500	500	500	500	500	500
- 2s	%I <sub>N</sub>	680	680	680	680	680	680
- 1s	%I <sub>N</sub>	700	700	700	700	700	700
- 500ms	%I <sub>N</sub>	800	800	800	800	800	800
- 200ms	%I <sub>N</sub>	900	900	900	900	900	900
- 100ms	%I <sub>N</sub>	1000	1000	1000	1000	1000	1000
- 50ms	%I <sub>N</sub>	1100	1100	1100	1100	1100	1100
- 20ms	%I <sub>N</sub>	1200	1200	1200	1200	1200	1200
- 10ms	%I <sub>N</sub>	1400	1400	1400	1400	1400	1400
- 3ms	%I <sub>N</sub>	1500	1500	1500	1500	1500	1500
6) Transfer time:							
- FROM INVERTER TO RESERVE							
a) inverter fault	ms	0,9	0,9	0,9	0,9	0,9	0,9
b) inverter overload or manual control	ms	0	0	0	0	0	0
- FROM RESERVE TO INVERTER							
	ms	0	0	0	0	0	0
7) Efficiency @ full load	%	99,2	99,2	99,2	99,2	99,2	99,2

Note 1: On demand 380Vac, 415Vac, 60Hz

## FORM 6: STATIC SWITCH TECHNICAL DATA

### 6b: Static Switch 100/200kVA

SIZE		100	120	160	200
1) Nominal Power	kVA	100	120	160	200
2) Input/Output Voltage (Note1)	V	400	400	400	400
3) Acceptance range of Mains Voltage (low and high threshold are adjustable between 3% and 50%)	%	+10/-10	+10/-10	+10/-10	+10/-10
4) Input/Output frequency (Note1)	Hz	50	50	50	50
5) Power Overload:					
- 30'	%I <sub>N</sub>	150	150	150	150
- 90s	%I <sub>N</sub>	300	300	300	300
- 5s	%I <sub>N</sub>	500	500	500	500
- 2s	%I <sub>N</sub>	680	680	680	680
- 1s	%I <sub>N</sub>	700	700	700	700
- 500ms	%I <sub>N</sub>	800	800	800	800
- 200ms	%I <sub>N</sub>	900	900	900	900
- 100ms	%I <sub>N</sub>	1000	1000	1000	1000
- 50ms	%I <sub>N</sub>	1100	1100	1100	1100
- 20ms	%I <sub>N</sub>	1200	1200	1200	1200
- 10ms	%I <sub>N</sub>	1400	1400	1400	1400
- 3ms	%I <sub>N</sub>	1500	1500	1500	1500
6) Transfer time:					
- FROM INVERTER TO RESERVE					
a) inverter fault	ms	0,9	0,9	0,9	0,9
b) inverter overload or manual control	ms	0	0	0	0
- FROM RESERVE TO INVERTER					
	ms	0	0	0	0
7) Efficiency @ full load	%	99,3	99,3	99,3	99,3

Note 1: On demand 380Vac, 415Vac, 60Hz

## FORM 6: STATIC SWITCH TECHNICAL DATA

### 6c: Static Switch 250-1000kVA

SIZE	kVA	250	300	400	500	600	800	1000
1) Nominal Power	kVA	250	300	400	500	600	800	1000
2) Input/Output Voltage (Note1)	V	400	400	400	400	400	400	400
3) Acceptance range of Mains Voltage (low and high threshold are adjustable between 3% and 50%)	%	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10	+10/-10
4) Input/Output frequency (Note1)	Hz	50	50	50	50	50	50	50
5) Power Overload:								
- 30'	%I <sub>N</sub>	150	150	150	150	150	150	150
- 90s	%I <sub>N</sub>	300	300	300	300	300	300	300
- 5s	%I <sub>N</sub>	500	500	500	500	500	500	500
- 2s	%I <sub>N</sub>	680	680	680	680	680	680	680
- 1s	%I <sub>N</sub>	700	700	700	700	700	700	700
- 500ms	%I <sub>N</sub>	800	800	800	800	800	800	800
- 200ms	%I <sub>N</sub>	900	900	900	900	900	900	900
- 100ms	%I <sub>N</sub>	1000	1000	1000	1000	1000	1000	1000
- 50ms	%I <sub>N</sub>	1100	1100	1100	1100	1100	1100	1100
- 20ms	%I <sub>N</sub>	1200	1200	1200	1200	1200	1200	1200
- 10ms	%I <sub>N</sub>	1400	1400	1400	1400	1400	1400	1400
- 3ms	%I <sub>N</sub>	1500	1500	1500	1500	1500	1500	1500
6) Transfer time:								
- FROM INVERTER TO RESERVE								
a) inverter fault	ms	0,9	0,9	0,9	0,9	0,9	0,9	0,9
b) inverter overload or manual control	ms	0	0	0	0	0	0	0
- FROM RESERVE TO INVERTER	ms	0	0	0	0	0	0	0
7) Efficiency @ full load	%	99,3	99,3	99,3	99,3	99,3	99,3	99,3

Note 1: On demand 380Vac, 415Vac, 60Hz

## FORM 7: SYSTEM DATA

7a: 20/80kVA

SIZE		20	30	40	50	60	80
1a) AC/AC Efficiency (6-pulse)							
- 100% nominal load	%	89,89	90,1	90,41	90,53	90,66	91,52
- 75% nominal load	%	90,5	90,65	90,75	90,88	91,01	91,99
- 50% nominal load	%	90,08	90,12	90,2	90,34	90,49	91,66
- 25% nominal load	%	85,84	85,86	86,01	86,62	87,24	88,57
2a) Maximum Heat dissipation @ Full Load (6 pulse)	kW	1,8	2,6	3,4	4,2	4,9	5,9
1b) Rendimento CA/CA (Dodecafase)							
- 100% Carico nominale	%	88,72	88,93	89,23	90,32	90,36	90,37
- 75% Carico nominale	%	89,32	89,47	89,57	90,20	90,69	91,41
- 50% Carico nominale	%	88,91	88,95	89,03	89,30	89,84	90,03
- 25% Carico nominale	%	84,72	84,74	84,89	86,63	87,28	87,93
2b) Massima dissipazione a pieno carico (Dodecafase)	kW	2,0	3,0	3,9	4,3	5,1	6,8
3) Noise @ 1 metre as per ISO3746	dBA	60	60	60	60	60	60
4) Air Flow	m <sup>3</sup> /h	1200	1200	1200	1200	1200	1200
5) Operating Temperature	°C	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40
6) Storage Temperature	°C	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70
7) Maximum relative humidity (non condensing):							
(@ 40°C)	%	60	60	60	60	60	60
(@ 25°C)	%	90	90	90	90	90	90
8) Elevation without derating	m	1000	1000	1000	1000	1000	1000
9) Power derating over 1000m each 1000m	%	5					

7b: 100/200kVA

SIZE		100	120	160	200
1a) AC/AC Efficiency (6pulse)					
- 100% nominal load	%	91,63	92,82	92,87	93,01
- 75% nominal load	%	92,34	92,63	93,40	93,31
- 50% nominal load	%	91,25	91,25	91,86	93,05
- 25% nominal load	%	89,65	87,28	87,74	89,22
2a) Maximum Heat dissipation @ Full Load	kW	7,3	7,4	9,8	12,0
1b) AC/AC Efficiency (12pulse)					
- 100% nominal load	%	90,44	91,61	91,66	91,80
- 75% nominal load	%	91,14	91,43	92,19	92,10
- 50% nominal load	%	90,06	90,06	90,67	91,84
- 25% nominal load	%	88,48	86,15	86,60	88,06
2b) Maximum Heat dissipation @ Full Load	kW	8,5	8,8	11,6	14,3
3) Noise @ 1 metre as per ISO3746	dBA	60	60	60	60
4) Air Flow	m <sup>3</sup> /h	1200	2000	3200	3200
5) Operating Temperature	°C	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40
6) Storage Temperature	°C	-20 / 70	-20 / 70	-20 / 70	-20 / 70
7) Maximum relative humidity (non condensing):					
(@ 40°C)	%	60	60	60	60
(@ 25°C)	%	90	90	90	90
8) Elevation without derating	m	1000	1000	1000	1000
9) Power derating over 1000m each 1000m	%	5			

## FORM 7: SYSTEM DATA

7c: 250/1000kVA- 12Pulse

SIZE		250	300	400	500	600	800	1000
1) AC/AC Efficiency								
- 100% nominal load	%	91,80	92,00	93	93,5	94,1	94,5	94,5
- 75% nominal load	%	91,81	92,01	93,5	94,1	94,8	94,8	94,8
- 50% nominal load	%	92,40	92,60	93	93,6	94,3	94,4	94,4
- 25% nominal load	%	89,00	89,20	90	90,3	91	91,2	91,2
2) Maximum Heat dissipation @ Full Load	kW	17,9	20,9	24,1	27,8	30,1	37,2	46,6
3) Noise @ 1 metre as per ISO3746	dBA	70	70	70	78	78	78	78
4) Air Flow	m <sup>3</sup> /h	3200	3200	10000	10000	10000	10000	10000
5) Operating Temperature	°C	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40	0 ÷ 40
6) Storage Temperature	°C	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70	-20 / 70
7) Maximum relative humidity (non condensing):								
(@ 40°C)	%	60	60	60	60	60	60	60
(@ 25°C)	%	90	90	90	90	90	90	90
8) Elevation without derating	m	1000	1000	1000	1000	1000	1000	1000
9) Power derating over 1000m each 1000m	%	5						



## FORM 8: MECHANICAL DATA

e

### 8a: MECHANICAL DATA 20/100kVA -6Pulse

SIZE		20	30	40	50	60	80	100
1) Mechanical Dimensions:								
- Width	mm	550	550	550	550	550	698	698
- Depth	mm	850	850	850	850	850	866	866
- Height	mm	1055	1055	1055	1055	1055	1415	1415
2) Weight (Note 1)	kg	250	275	410	340	380	465	680
3) Protection degree (Note 3)		IP20	IP20	IP20	IP20	IP20	IP20	IP20
4) Colour (RAL scale)								
Frame	RAL	7035	7035	7035	7035	7035	7035	7035
Panels	RAL	7035	7035	7035	7035	7035	7035	7035

Note 1: Weight without batteries

Note 2: Double frame

Note 3: IP31 on demand

### 8b: MECHANICAL DATA 20/80kVA -12Pulse

SIZE		20	30	40	50	60	80
1) Mechanical Dimensions:							
- Width	mm	550	550	550	698	698	698
- Depth	mm	850	850	850	866	866	866
- Height	mm	1055	1055	1055	1415	1415	1415
2) Weight (Note 1)	kg	300	320	350	560	620	680
3) Protection degree (Note 3)		IP20	IP20	IP20	IP20	IP20	IP20
4) Colour (RAL scale)							
Frame	RAL	7035	7035	7035	7035	7035	7035
Panels	RAL	7035	7035	7035	7035	7035	7035

Note 1: Weight without batteries

Note 2: Double frame

Note 3: IP31 on demand

### 8c: MECHANICAL DATA 120/200kVA -6Pulse

SIZE		120	160	200
1) Mechanical Dimensions:				
- Width	mm	1100	1100	1100
- Depth	mm	800	800	820
- Height	mm	1400	1400	1950
2) Weight	kg	820	920	980
3) Protection degree (Note 3)		IP20	IP20	IP20
4) Colour (RAL scale)				
Frame	RAL	7035	7035	7035
Panels	RAL	7035	7035	7035

Note 1: Weight without batteries

Note 2: Double frame

Note 3: IP31 on demand

## FORM 8: MECHANICAL DATA

### 8d: MECHANICAL DATA 100/200kVA -12Pulse

SIZE		100	120	160	200
1) Mechanical Dimensions:					
- Width	mm	1100	1100	1100	1100
- Depth	mm	800	800	820	820
- Height	mm	1400	1400	1950	1950
2) Weight	kg	880	760	1200	1400
3) Protection degree (Note 3)		IP20	IP20	IP20	IP20
4) Colour (RAL scale)					
Frame	RAL	7035	7035	7035	7035
Panels	RAL	7035	7035	7035	7035

Note 1: Weight without batteries

Note 2: Double frame

Note 3: IP31 on demand

### 8e: MECHANICAL DATA 250/1000kVA -12Pulse

SIZE		250	300	400	500	600	800	1000
1) Mechanical Dimensions:								
- Width	mm	1100	1500	1500	2x1350 (Note2)	2x1350 (Note2)	2x1350 (Note2)	2x1350 (Note2)
- Depth	mm	820	1000	1000	1000	1000	1000	1000
- Height	mm	1950	2000	2000	2000	2000	2000	2000
2) Weight	kg	1500	1850	2100	2900	3100	3900	4800
3) Protection degree (Note 3)		IP20	IP20	IP20	IP20	IP20	IP20	IP20
4) Colour (RAL scale)								
Frame	RAL	7035	7035	7035	7035	7035	7035	7035
Panels	RAL	7035	7036	7036	7036	7036	7036	7036

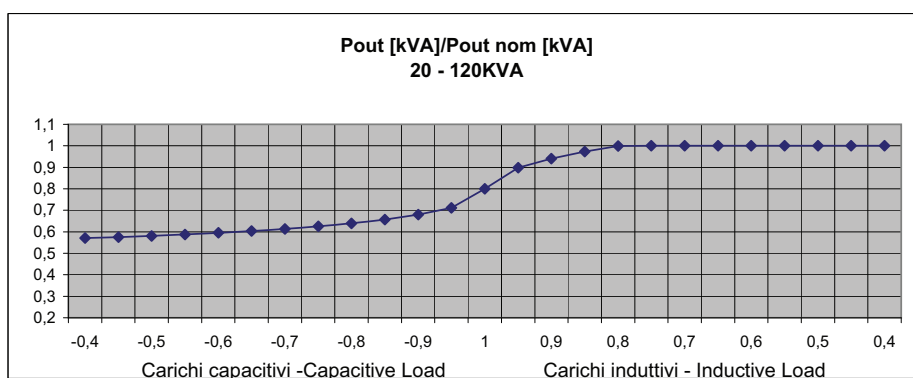
Note 1: Weight without batteries

Note 2: Double frame

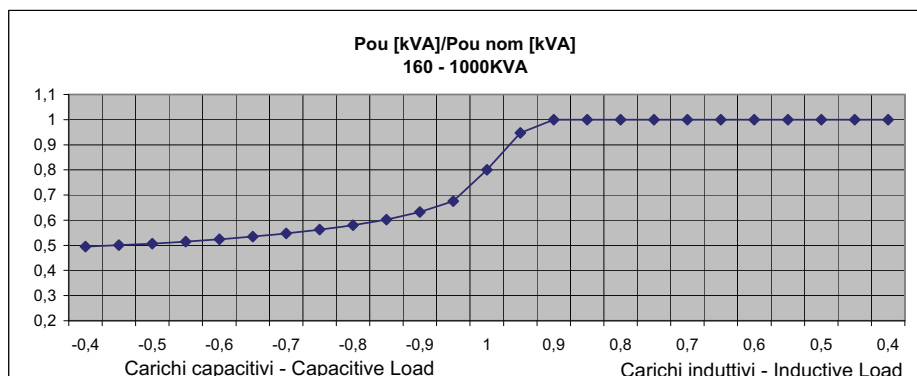
Note 3: IP31 on demand

## FORM 9: Output Power as Function of Cos-phi

Form 9a: Load @ Cos-ph (20-120kVA)		
	Cos-ph	%Pout nom [kVA] %Iout nom [A]
Cap.	-0,6	60
Cap.	-0,7	61
Cap.	-0,8	64
Cap.	-0,9	68
	1	80
Ind.	0,95	90
Ind.	0,9	94
Ind.	0,85	97
Ind.	0,8	100
Ind.	0,7	100
Ind.	0,6	100



Form 9b: Load @ Cos-ph (160 - 1000KVA)		
	Cos-ph	%Pout nom [kVA] %Iout nom [A]
Cap.	-0,6	52
Cap.	-0,7	54
Cap.	-0,8	58
Cap.	-0,9	63
	1	80
Ind.	0,95	95
Ind.	0,9	100
Ind.	0,85	100
Ind.	0,8	100
Ind.	0,7	100
Ind.	0,6	100



## FORM 10a: POWER PARALLEL

### FORM 10a-1: Power parallel of 2 UPS

UPS CONDITION	LOAD SUPPLIED BY:
2 Inverter OK	Inverter
1 o 2 Inverter KO	Mains
1 UPS Disconnect or in test 1 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Mains

N.B.

“Inverter OK”= Inverter working normally with regular output voltage.

“Inverter KO”= Inverter stopped or output voltage out of limits or strong overload.

### FORM 10a-2: Power parallel of 3 UPS

UPS CONDITION	LOAD SUPPLIED BY:
3 Inverter OK	Inverter
1, 2 o 3 Inverter KO	Mains
1 UPS Disconnect or in test 2 Inverter OK	Inverter
1 UPS Disconnect or in test 1 o 2 Inverter KO	Mains
2 UPS Disconnect or in test	Mains

N.B.

“Inverter OK”= Inverter working normally with regular output voltage.

“Inverter KO”= Inverter stopped or output voltage out of limits or strong overload

### TABELLA 10a-3: Parallelo di potenza di 4 UPS

UPS CONDITION	LOAD SUPPLIED BY:
4 Inverter OK	Inverter
1, 2, 3 o 4 Inverter KO	Mains
1 UPS Disconnect or in test 3 Inverter OK	Inverter
1 UPS Disconnect or in test 1, 2 o 3 Inverter KO	Mains
2 o 3 UPS Disconnect or in test	Mains

N.B.

“Inverter OK”= Inverter working normally with regular output voltage.

“Inverter KO”= Inverter stopped or output voltage out of limits or strong overload

## FORM 10b: REDUNTANT PARALLEL

### FORM 10b-1: Reduntant parallel 2 UPS

UPS CONDITION	LOAD SUPPLIED BY:
2 Inverter OK	Inverter
1 Inverter KO	Inverter
2 Inverter KO	Mains
1 UPS Disconnect or in test 1 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Mains

N.B.

“Inverter OK”= Inverter working normally with regular output voltage.

“Inverter KO”= Inverter stopped or output voltage out of limits or strong overload

### FORM 10b-2: Reduntant parallel 3 UPS

UPS CONDITION	LOAD SUPPLIED BY:
3 Inverter OK	Inverter
1 Inverter KO	Inverter
2 o 3 Inverter KO	Mains
1 UPS Disconnect or in test 2 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Inverter
1 UPS Disconnect or in test 2 Inverter KO	Mains
2 UPS Disconnect or in test	Mains

N.B.

“Inverter OK”= Inverter working normally with regular output voltage.

“Inverter KO”= Inverter stopped or output voltage out of limits or strong overload

### FORM 10b-3: Reduntant parallel of 4 UPS

UPS CONDITION	LOAD SUPPLIED BY:
4 Inverter OK	Inverter
1 Inverter KO	Inverter
2, 3 o 4 Inverter KO	Mains
1 UPS Disconnect or in test 3 Inverter OK	Inverter
1 UPS Disconnect or in test 1 Inverter KO	Inverter
1 UPS Disconnect or in test 2 o 3 Inverter KO	Mains
2 UPS Disconnect or in test	Mains

N.B.

“Inverter OK”= Inverter working normally with regular output voltage.

“Inverter KO”= Inverter stopped or output voltage out of limits or strong overload

# **FORM 11: OF AVAILABLES OPTIONS**

OPZ	SIZES																
	20	30	40	50	60	80	100	120	160	200	250	300	400	500	600	800	1000
1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	INT	INT	INT	INT	INT	INT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT	EX
3	INT	INT	INT	INT	INT	INT	INT	INT	EXT	NA	NA	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA	NA	NA	INT	INT	INT	INT	EX	EX	EX	EX	EX
5	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
6	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	INT	INT	EX
7	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
8	INT	INT	INT	INT	INT	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX
9	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
10	INT	INT	INT	INT	INT	INT	INT	INT	EX	EX	EX	EX	EX	EX	EX	EX	EX
11	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
12	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
13	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
14	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
15	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
16	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
17	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
18	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
19	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
20	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
21	INT	INT	ND	ND	ND	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
22	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
23	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
24	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT
25	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX
26	INT	INT	INT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	EX	EX	EX	EX
28	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT	INT

**INT:** Internal UPS

**EX:** External frame

**ND:** Please contact Siel S.p.A. for dimensioning

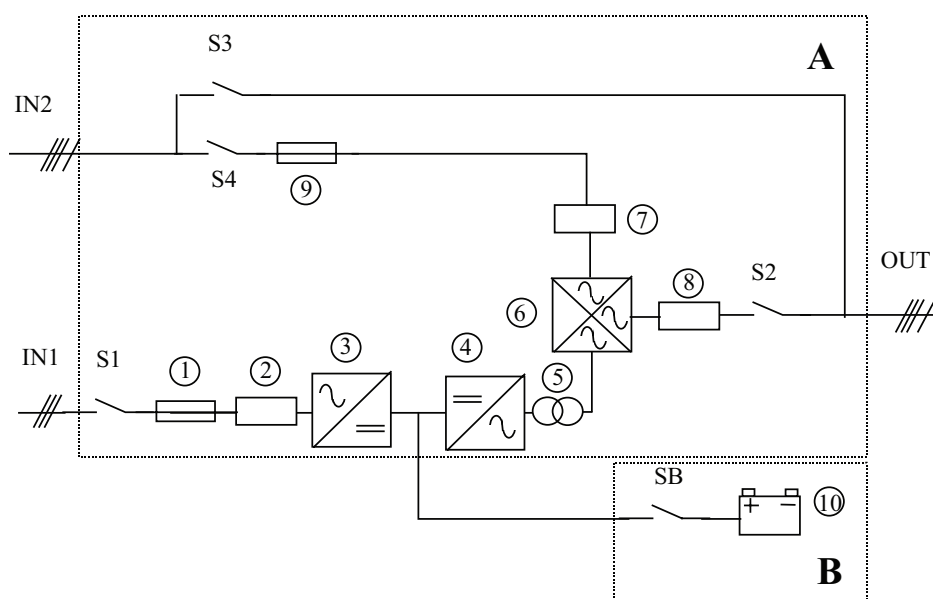
**PC:** PC or network software

**NA:** Not applicable

1	RFI filter for stricter limits that EN50091-2	15	RS232 customer interface
2	Input power factor compensation	16	Remote mimic panel
3	Current input distortion filter 6-pulse	17	OC System monitoring software
4	Current input distortion filter 12-pulse	18	SMS
5	Reserve insulation transformer	19	SNMP
6	Rectifier insulation transformer	20	Teleglobalservice
7	Reserve and rectifier insulation transformer	21	Tension adapter auto transformer
8	Insulation control output + mains contactor	22	UPS used as frequency converter
9	Back-Feed Protection	23	Double customer interface
10	Back-Feed Protection + contactor	24	2-nd RS232
11	Output insulation probe	25	Parallel Centralized Battery
12	Rectifier current limitation for Motor Generator Set	26	Internal Battery (only UPS 6-pulse)
13	Battery temperature probe	27	24-pulse Rectifier
14	Fiber optic insulated battery temperature probe	28	Output Voltage Remote Sensing

**FORM 12: RESERVE MAINS FUSES**

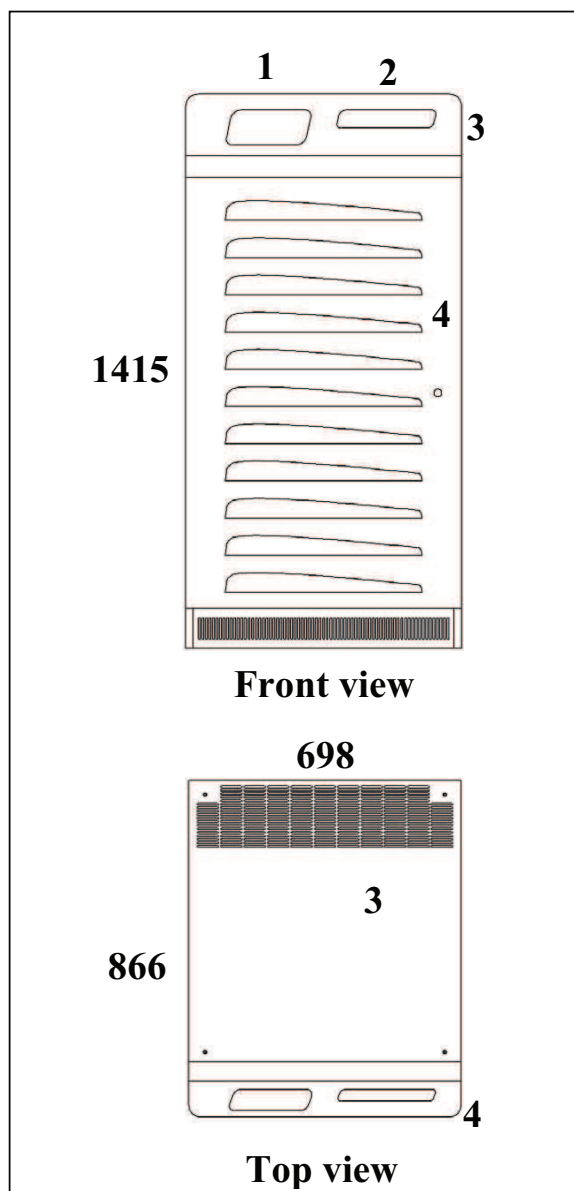
SIZE	FUSE TYPE
20	63A 660VAC FE
30	100A 660VAC FE
40	100A 660VAC FE
50	200A 660VAC FEE
60	200A 660VAC FEE
80	170M1571 Bussman (250A 660V ExtraFast)
100	350FM Bussman (350A 660V ExtraFast)
120	350FM Bussman (350A 660V ExtraFast)
160	350FM Bussman (350A 660V ExtraFast)
200	700 FMM Bussman (700A 660V ExtraFast)
250	700 FMM Bussman (700A 660V ExtraFast)
300	700 FMM Bussman (700A 660V ExtraFast)
400	700 FMM Bussman (700A 660V ExtraFast)
500	2//700 FMM 2 Bussman in parallel (700A 660V ExtraFast)
600	2//700 FMM 2 Bussman in parallel (700A 660V ExtraFast)
800	2//700 FMM 2 Bussman in parallel (700A 660V ExtraFast)



- |            |                            |           |  |
|------------|----------------------------|-----------|--|
| <b>A</b>   | UPS                        | <b>1</b>  | Rectifier fuses                                  |
| <b>B</b>   | External Battery frame     | <b>2</b>  | Rectifier EMI filter                             |
| <b>S1</b>  | Rectifier switch           | <b>3</b>  | Rectifier  |
| <b>S2</b>  | Output switch              | <b>4</b>  | Inverter   |
| <b>S3</b>  | By-pass (Not for parallel) | <b>5</b>  | Isolation transformer between batteries and load |
| <b>S4</b>  | Reserve switch             | <b>6</b>  | Static switch                                    |
| <b>SB</b>  | Battery switch             | <b>7</b>  | Reserve EMI filter                               |
|            |                            | <b>8</b>  | Output EMI filter                                |
|            |                            | <b>9</b>  | Reserve fuses                                    |
|            |                            | <b>10</b> | Battery  |
| <b>IN1</b> | Mains                      |           |  |
| <b>IN2</b> | Reserve mains              |           |  |
| <b>OUT</b> | Out                        |           |  |

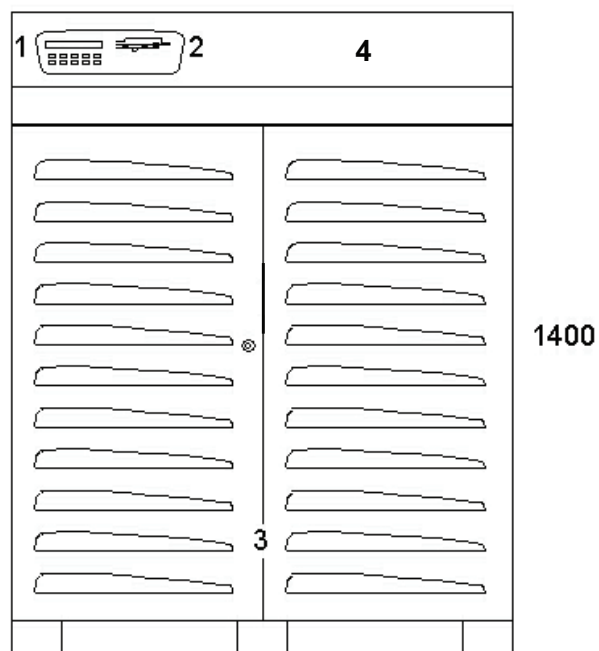






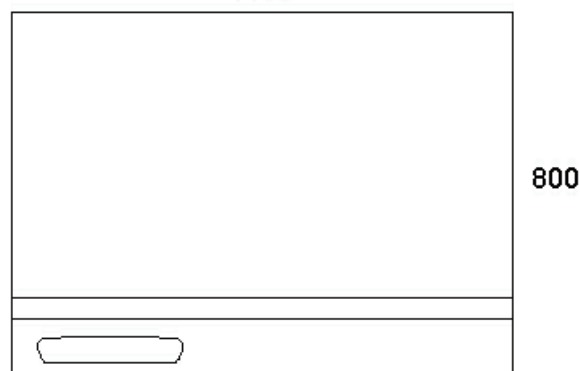
- 1: Control, measurement and signalling panel
- 2: Mimic diagram
- 3: Electronic cubicle
- 4: Input/output switch door.

**Figure 2B: Size 80-100kVA 6-pulse and 50-80kVA 12-pulse**



**Front view**

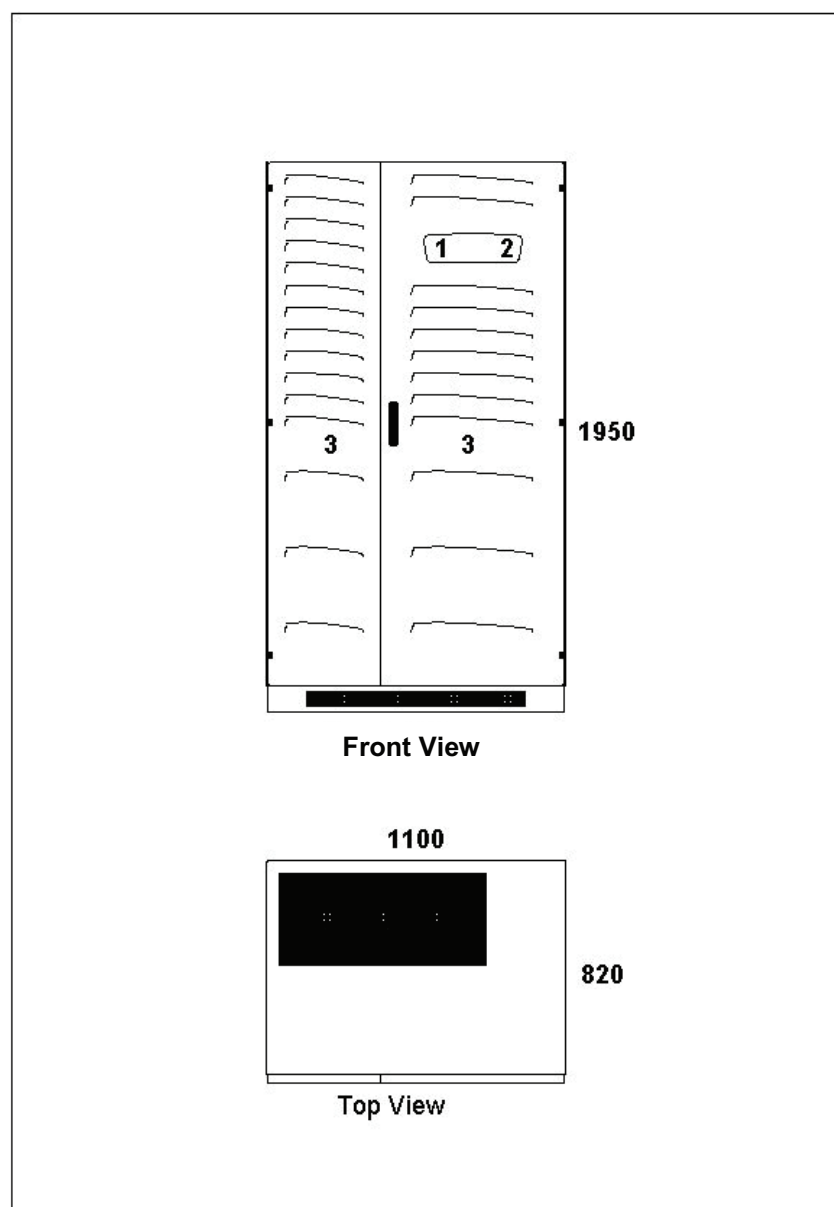
1100



**Top view**

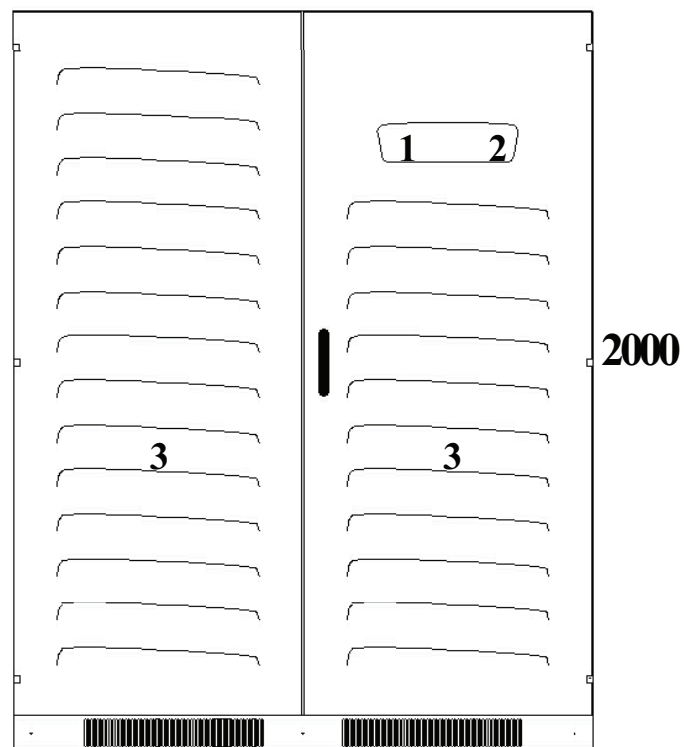
- 1: Control, measurement and signalling panel
- 2: Mimic diagram
- 3: Input/output switch box
- 4: Electronic cubicle

**FIGURE 2C: Size 120-160kVA 6-pulse  
100-120kVA 12-pulse**



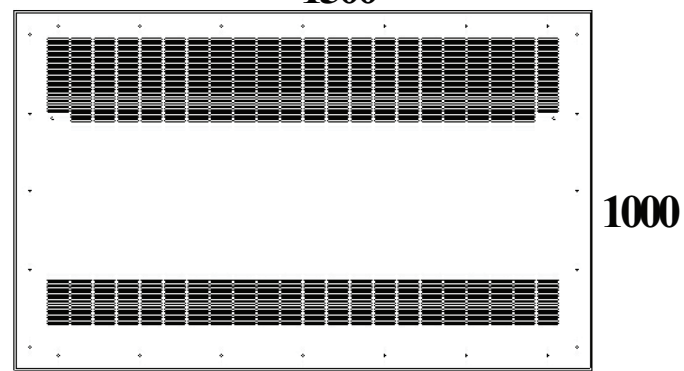
- 1: Control, measurement and signalling panel
- 2: Mimic diagram
- 3: Input/output switch door

**FIGURE 2D: Size 200-250kVA 6-pulse and 160-250kVA 12-pulse**



**Front view**

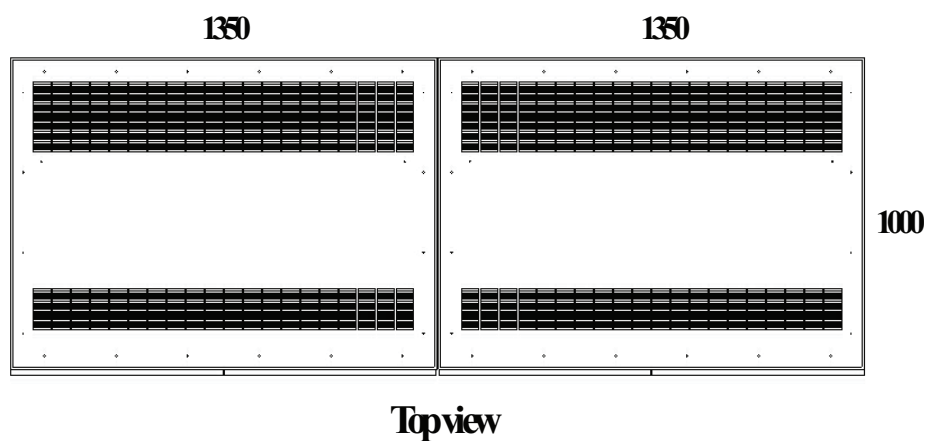
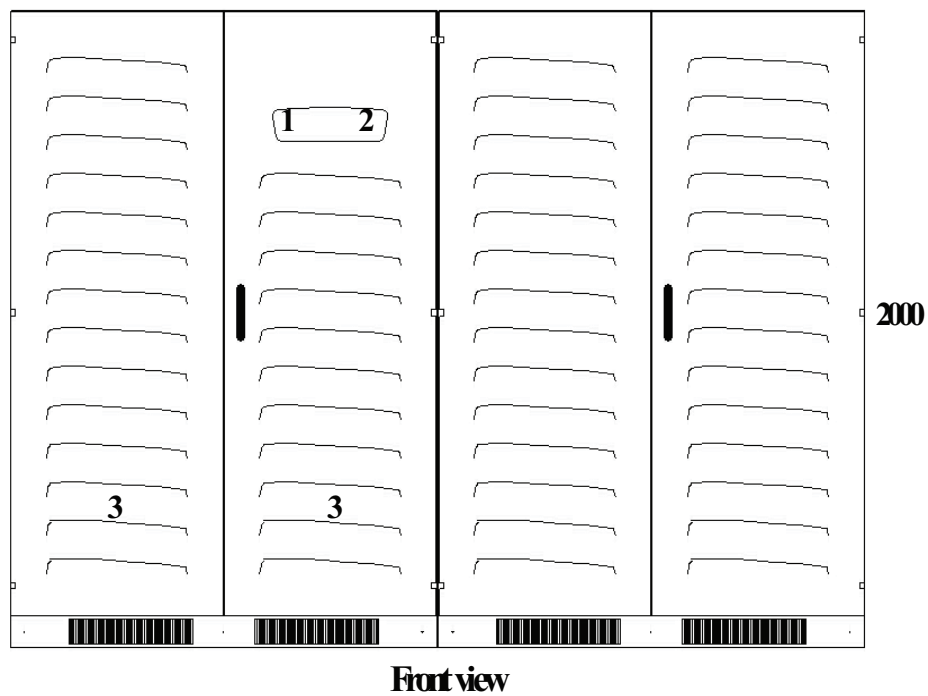
**1500**



**Top view**

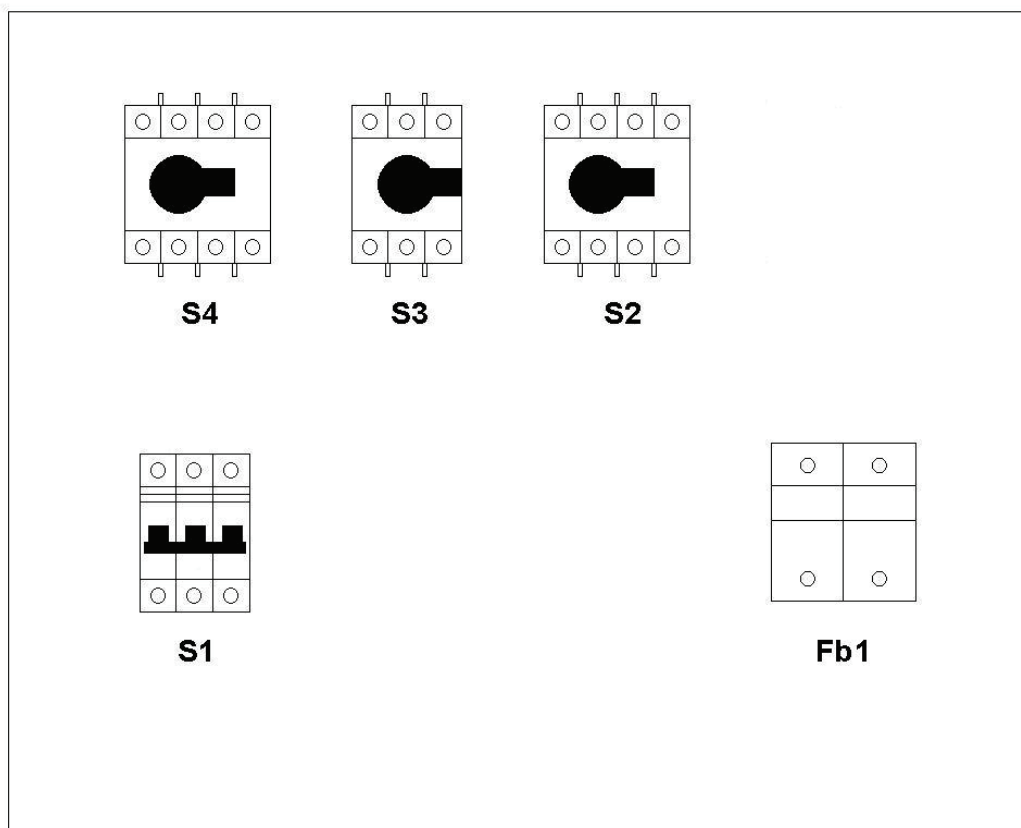
- 1: Control, measurement and signalling panel
- 2: Mimic diagram
- 3: Input/output switch door

**FIGURE 2E: Size 300-400kVA**



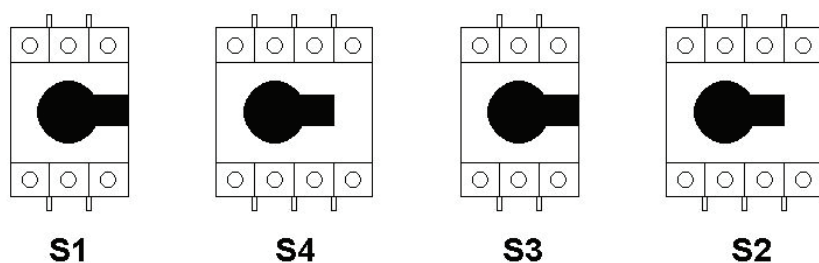
- 1: Control, measurement and signalling panel
- 2: Mimic diagram
- 3: Input-output switch door

**FIGURE 2F: Size 500-1000kVA**



- S1** Mains input switch  
**S2** Output switch  
**S3** By-pass (Not for parallel)  
**S4** Reserve input switch  
**Fb1** Battery fuses

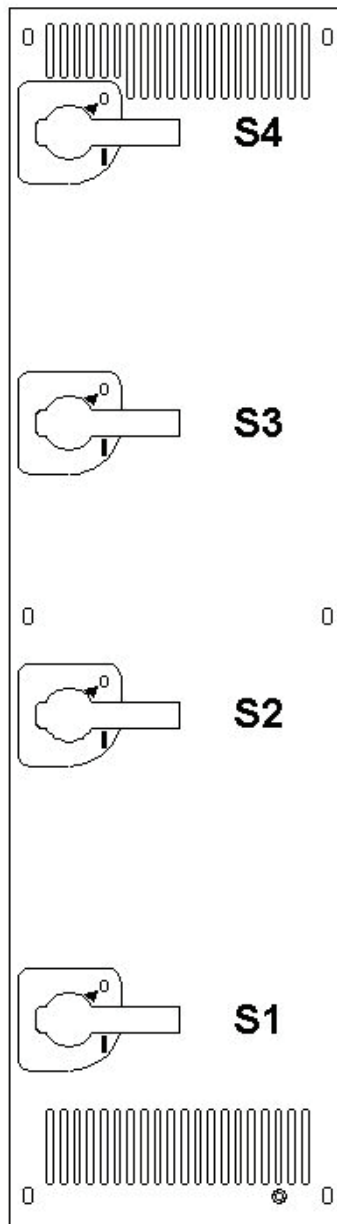
**Figure 3A Size 20-40kVA 6-pulse and 12-pulse**



- S1** Mains input switch
- S2** Output switch
- S3** By-pass (Not for parallel)
- S4** Reserve input switch

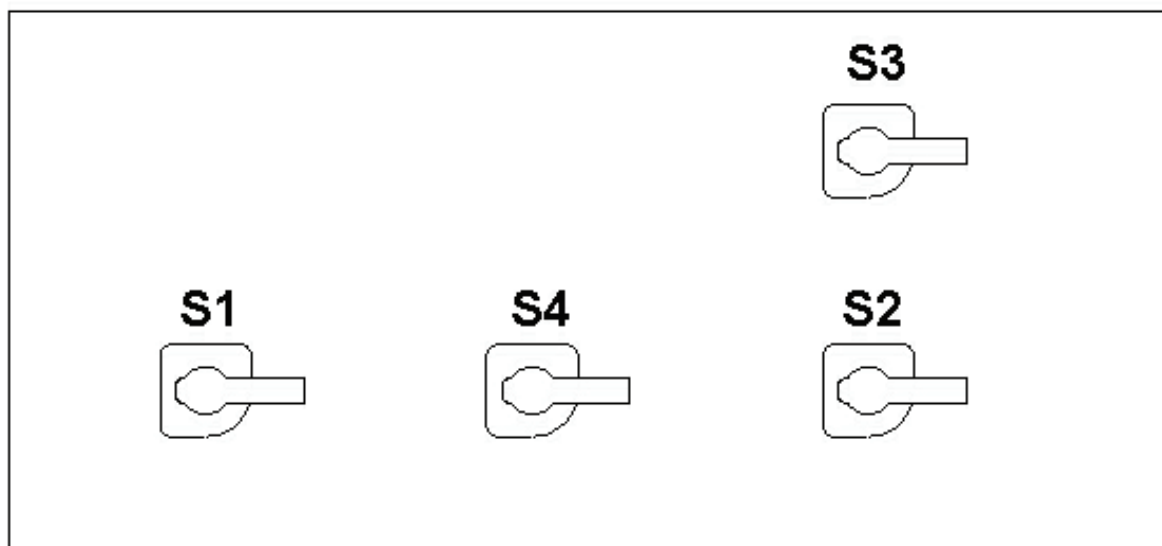
**Figure 3B Size 50-60kVA 6-pulse**





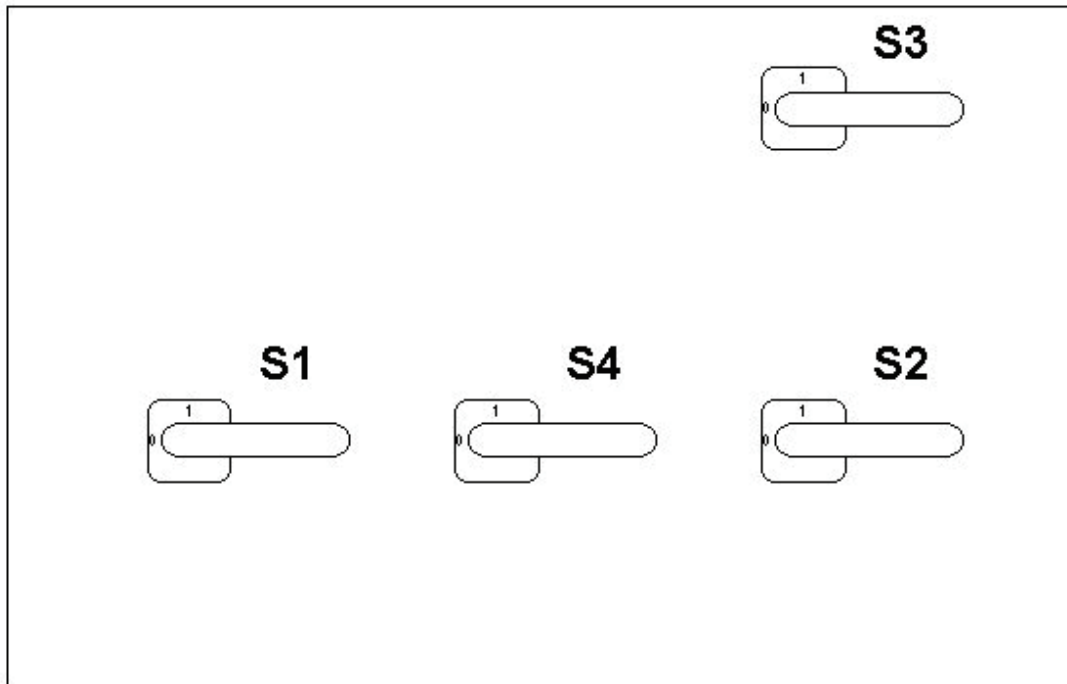
- S1** Mains input switch
- S2** Output switch
- S3** By-pass (Not for parallel)
- S4** Reserve input switch

**Figure 3C Size 80-100kVA 6-pulse and 50-80kVA 12-pulse**



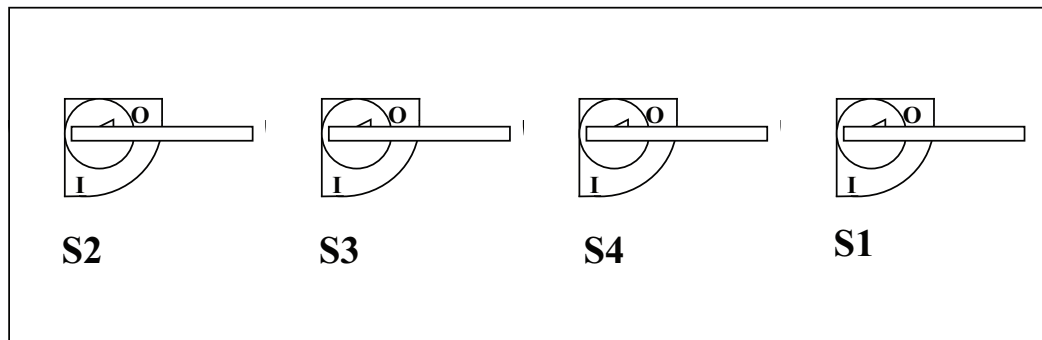
- S1** Mains input switch
- S2** Output switch
- S3** By-pass (Not for parallel)
- S4** Reserve input switch

**Figure 3D Size 120-160kVA 6-pulse and 100-120kVA 12-pulse**



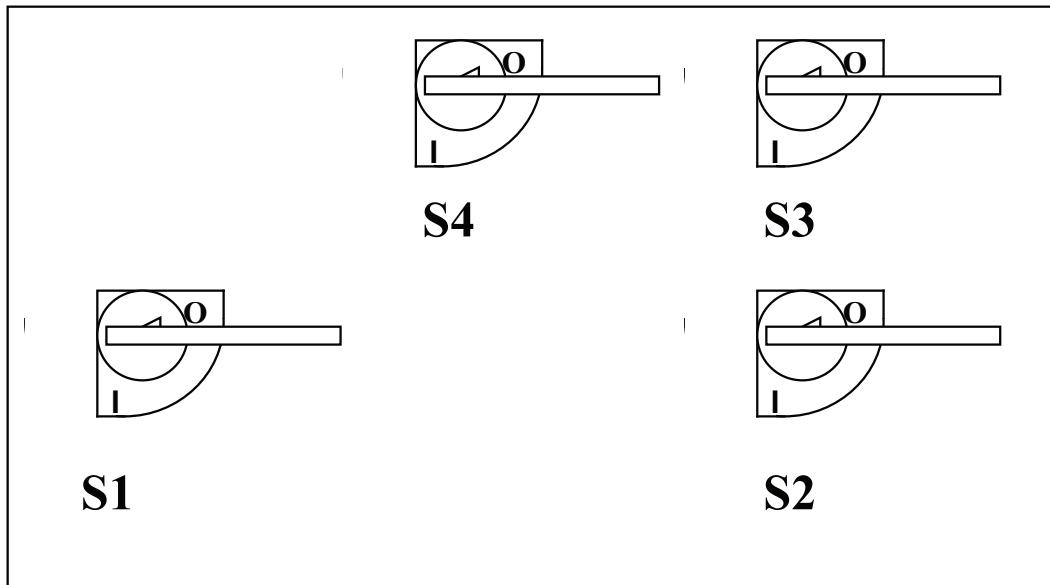
- S1** Mains input switch
- S2** Output switch
- S3** By-pass (Not for parallel)
- S4** Reserve input switch

**Figure 3E Size 200-250kVA 6-pulse and 160-250kVA 12-pulse**



- S1** Mains input switch
- S2** Output switch
- S3** By-pass (Not for parallel)
- S4** Reserve input switch

**Figure 3F: Size 300-400kVA**



- S1** Mains input switch
- S2** Output switch
- S3** By-pass (Not for parallel) (Built in the inverter frame)
- S4** Reserve input switch

**Figure 3G: Size 500-800KVA**

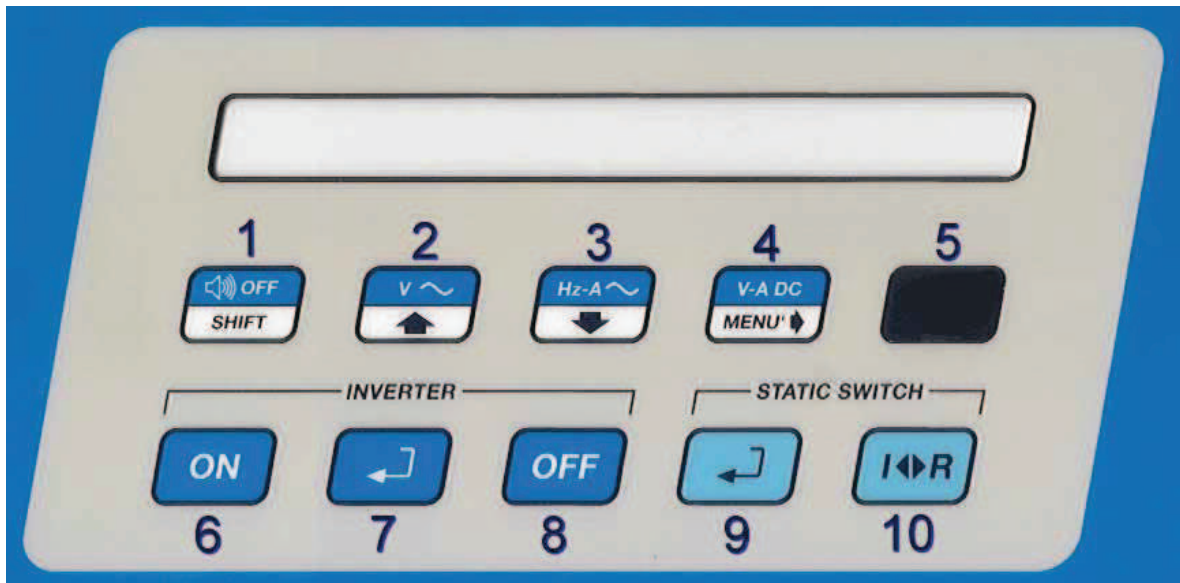


Figure 4A: Size 60-80KVA 12-pulse and 80-100KVA 6-pulse

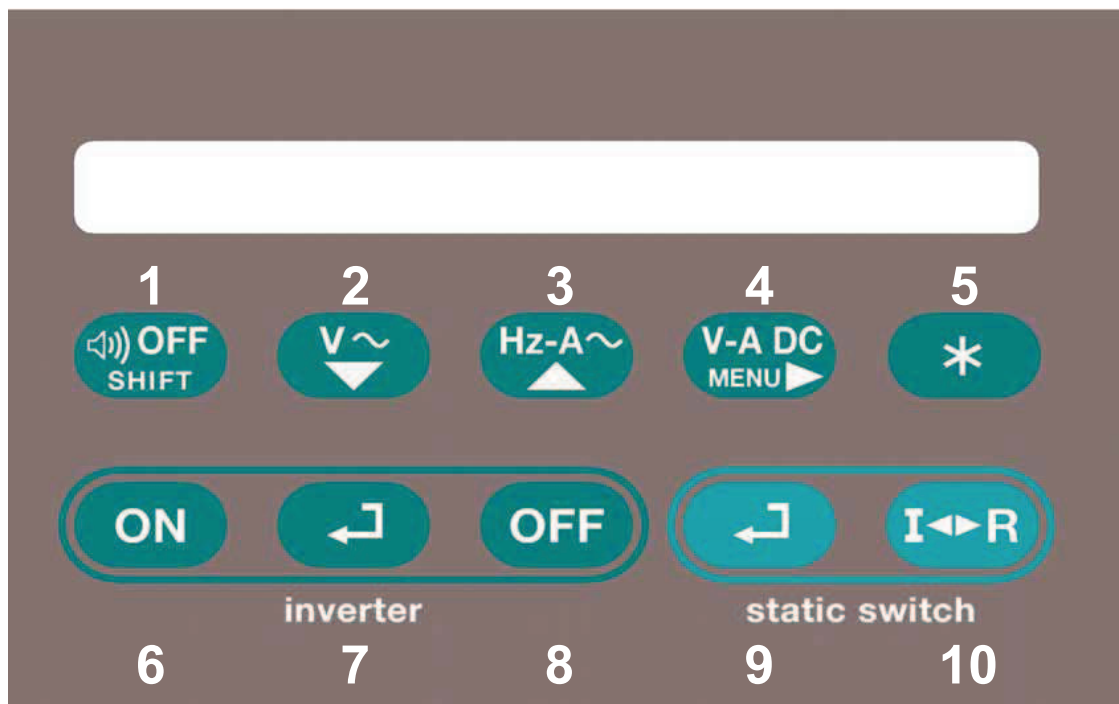


Figure 4B: Different size

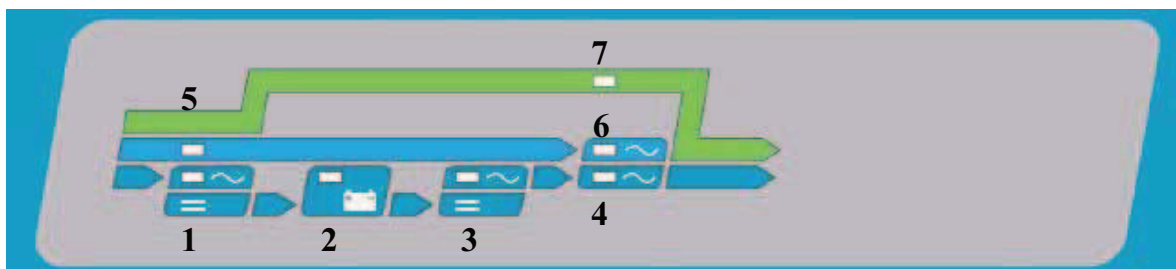


Figure 5A: Size 60-80KVA 12-pulse and 80-100KVA 6-pulse

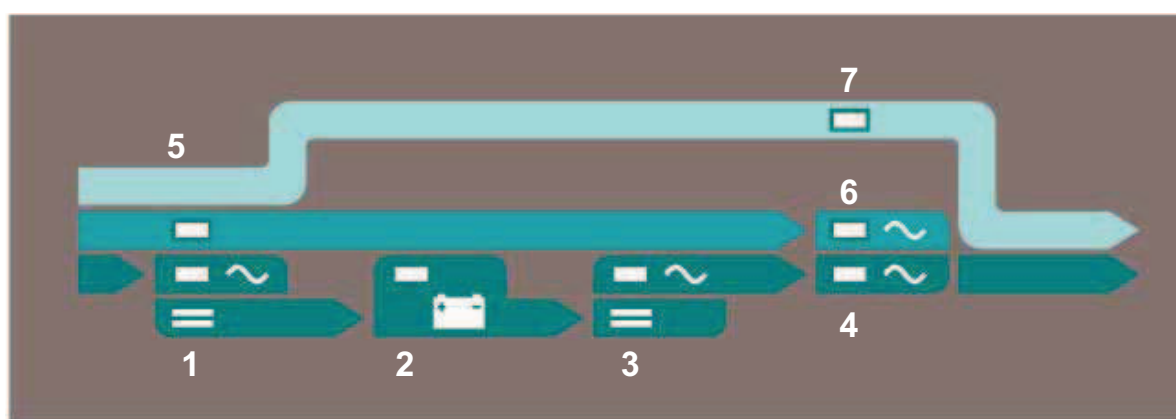
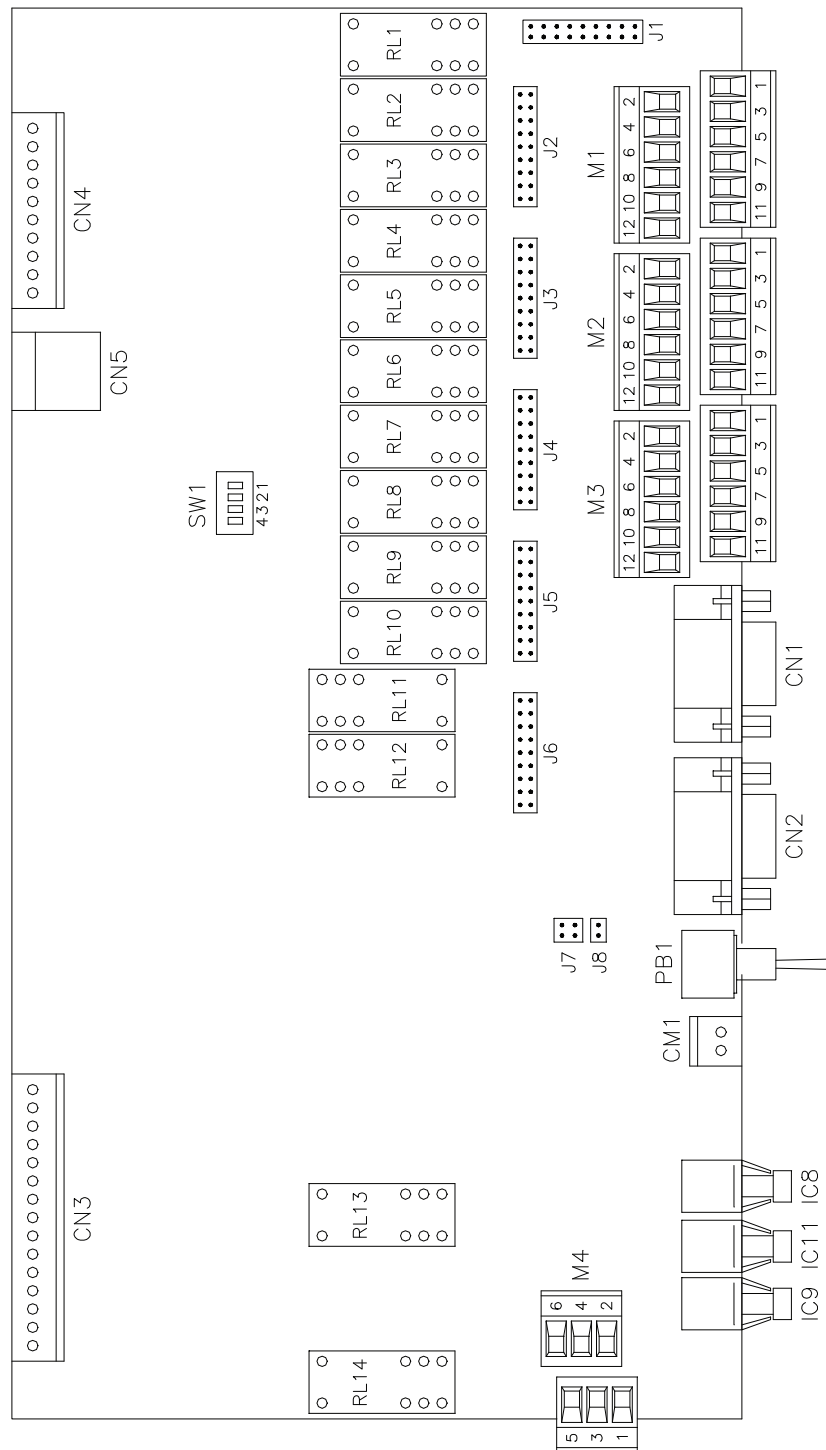
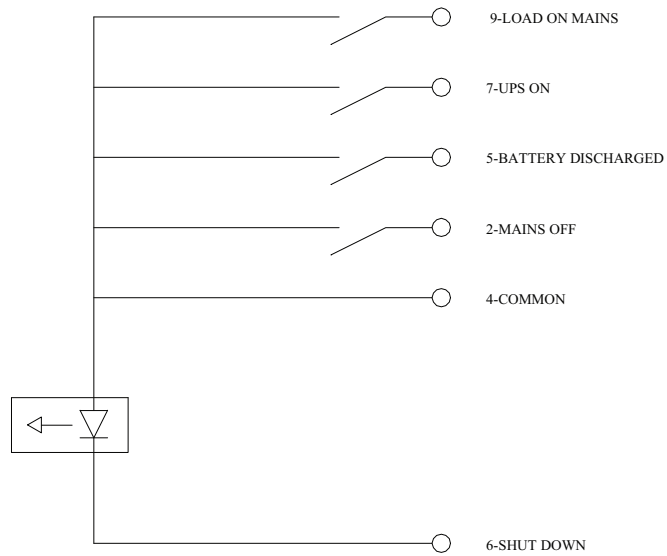
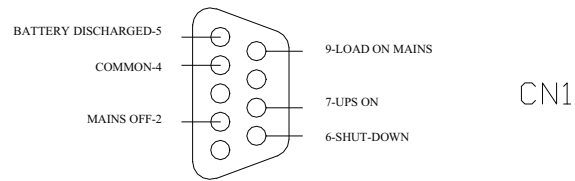
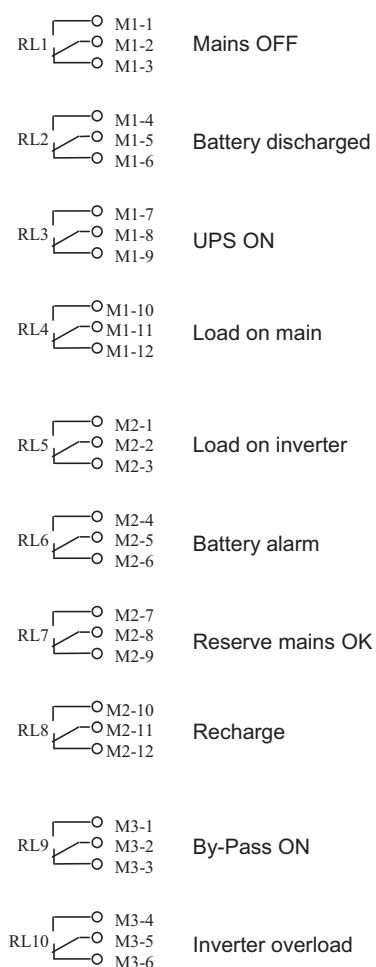


Figure 5B: Different size







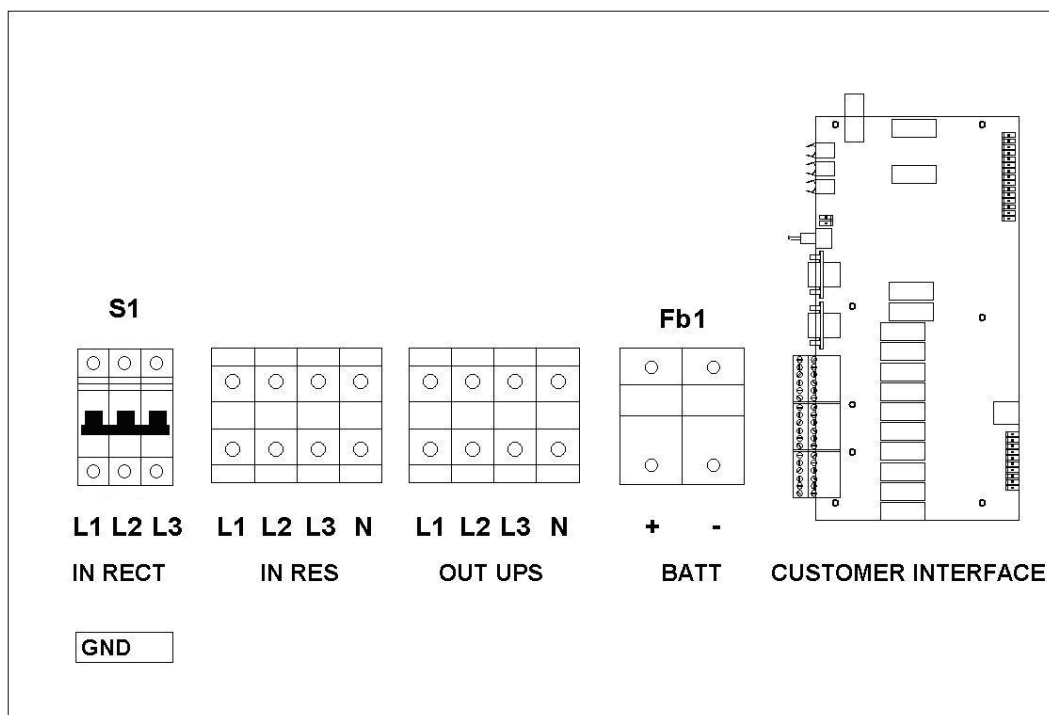


**N.B.: The relays are drawn in the released state**

Dip-Switch SW1					
1	2	3	4	Setting	Description
On	On	On	On	Test	All relays are energised (the contacts are in opposite state of the drawing)
Off	Off	Off	Off	Test	All relays are released (the contacts are in the same state of the drawing)
On	On	On	Off	1 (Standard)	<b>The relays are energised when the signal of drawing occurs</b>
On	On	Off	On	2	<b>RL9 is energised in case of: SWITCHING LOCKED</b> (All the remaining relays as standard)
On	On	Off	Off	3	<b>RL9 is energised in case of: OR OF ALARMS (Type 1)</b> (Rectifier OFF + rectifier over temperature + battery failure + battery discharged + inverter overload + inverter over temperature + phase R,S,T over current + switching locked + static switch failure) (All the remaining relays as standard)
On	Off	On	On	4	<b>RL9 is energised in case of: INVERTER OVERLOAD</b> <b>RL10 is energised in case of: OR OF ALARMS (Type 2)</b> (Mains OFF + battery discharged + inverter OFF + load on mains + reserve line voltage out of limits + inverter overload) (All the remaining relays as standard)
On	Off	On	Off	5	<b>RL8 is energised in case of: INVERTER OVERTEMPERATURE</b> (All the remaining relays as standard)
On	Off	Off	On	6	<b>RL9 is energised in case of: INVERTER/MAINS ARE SYNCHRONIZED</b>
All others position				.....	All relays are released
				8	

Note: By "double customer interface" option it is possible have two different setting at the same time.

Jumper J7 –J8		
Fiber Optic Output	J7 close 1-2	J8 close
RS232 Serial Output	J7 close 1-3 and 2-4	J8 open

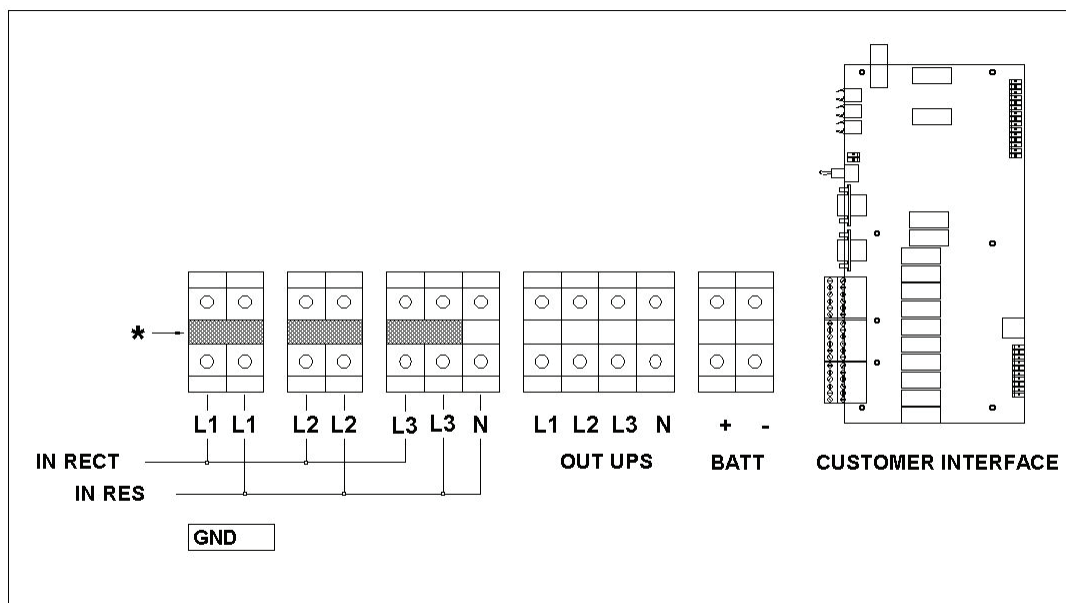


#### CONNECTIONS:

IN RECT = Mains input  
 IN RES = Reserve input  
 OUT UPS = Out UPS  
 BATT = Battery plug-in connector

N = Neutral  
 L1 = Phase L1 ( R )  
 L2 = Phase L2 ( S )  
 L3 = Phase L3 ( T )  
 + = Battery +  
 - = Battery -  
 GND = Ground connection

**Figure 9A: Size 20-40kVA 6-pulse and 12-pulse**



#### CONNECTIONS:

IN RECT = Mains input

IN RES = Reserve input

OUT UPS = Out UPS

BATT = Battery plug-in connector

**\* In the standard configuration, we provide the jumper between the Rectifier and the Reserve input for a single line supply. In case of a double line supply these jumper must be removed.**

N = Neutral

L1 = Phase L1 ( R )

L2 = Phase L2 ( S )

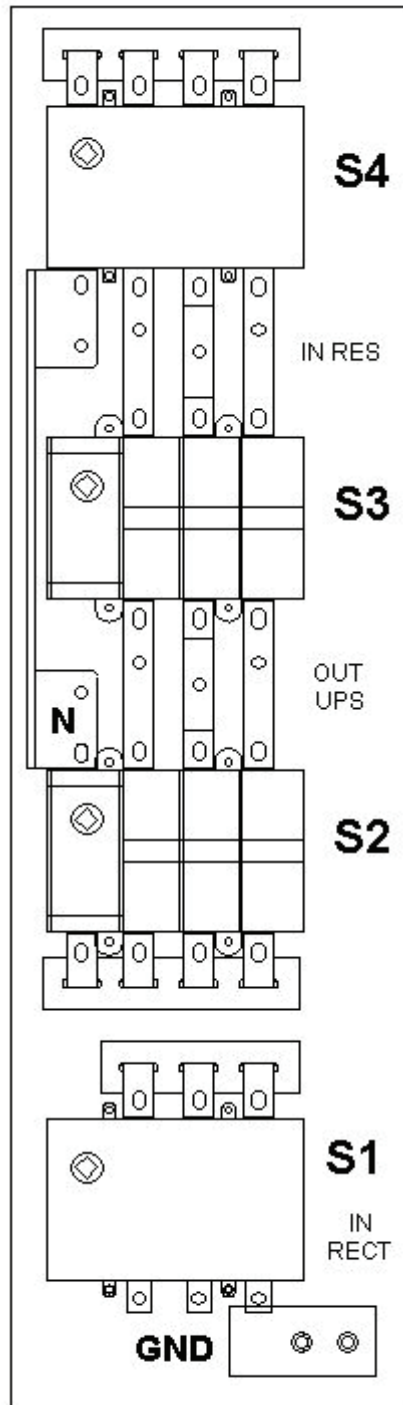
L3 = Phase L3 ( T )

+ = Battery +

- = Battery -

GND = Ground connection

**Figure 9B: Size 50-60kVA 6-pulse**



#### SWITCHES CUBICLE CONNECTIONS

S1= Rectifier switch

S2= Output switch

S3= By-pass (Not for parallel)

S4= Reserve switch

N= Neutral

L1= Phase L1 ( R )

L2= Phase L2 ( S )

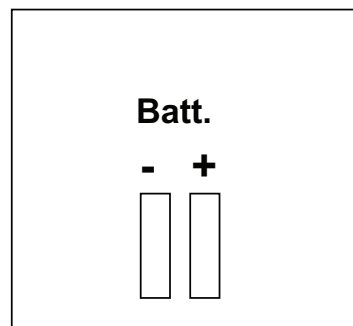
L3= Phase L3 ( T )

IN RES= Reserve input

IN RECT= Mains input

OUT UPS= Out UPS

#### BOTTOM-LEFT CUBICLE CONNECTIONS



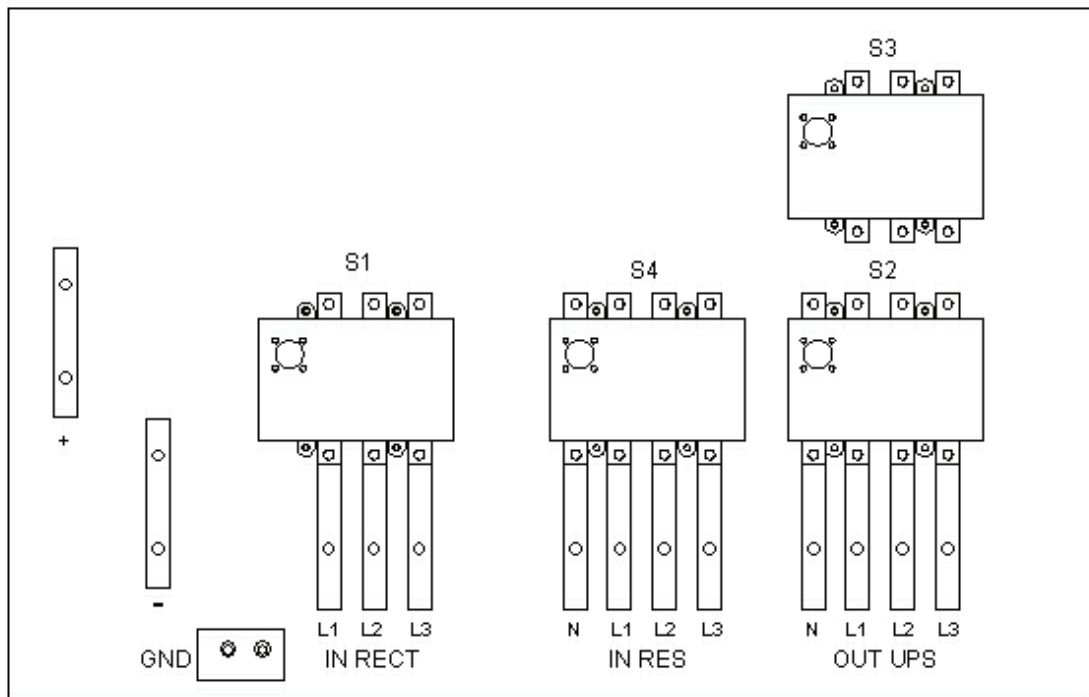
Batt = Battery plug-in connector

+ = Battery +

- = Battery -

GND = Ground connection

Figure 9C: Size 80-100kVA 6-pulse and 50-80kVA 12-pulse



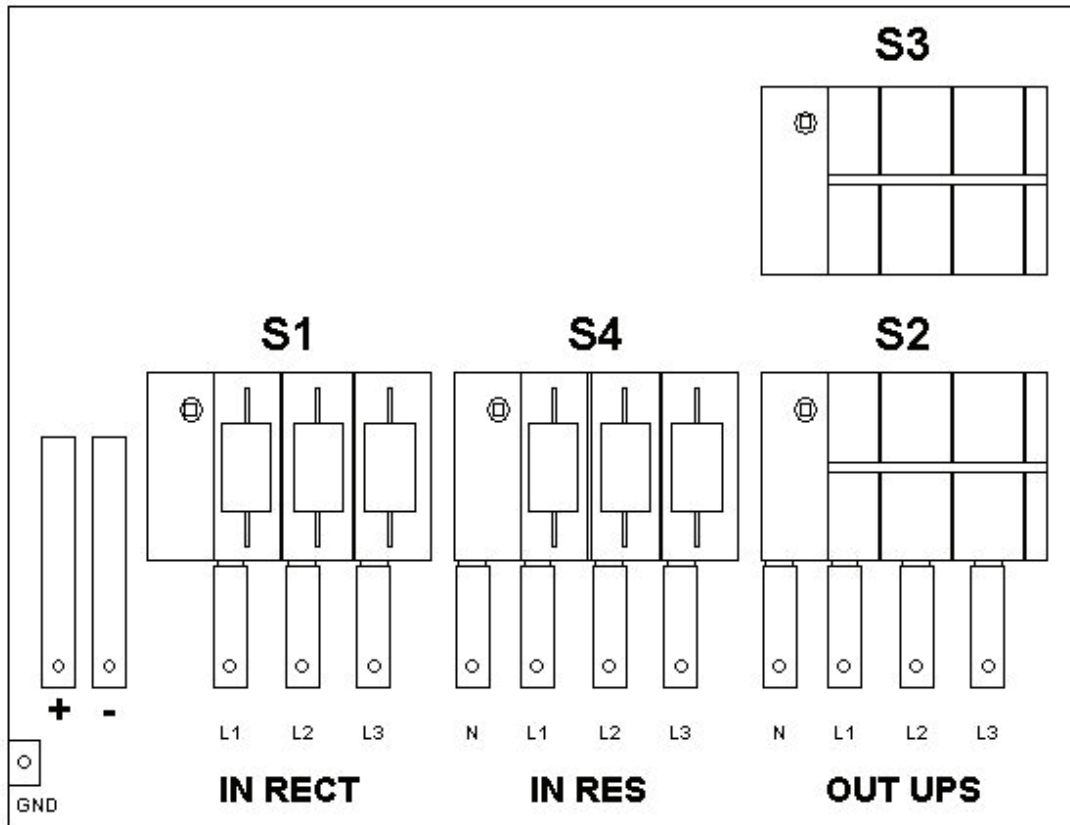
S1= Rectifier switch  
 S2= Output switch  
 S3= By-pass (Not for parallel)  
 S4= Reserve switch

N= Neutral  
 L1= Phase L1 ( R )  
 L2= Phase L2 ( S )  
 L3= Phase L3 ( T )

IN RES= Reserve input  
 IN RECT= Mains input  
 OUT UPS= Out UPS

GND = CONNECTING OF EARTH  
 + = Battery +  
 - = Battery -

**Figure 9D: Size 120-160kVA 6-pulse**  
**100-120kVA 12-pulse**



S1= Rectifier switch  
 S2= Output switch  
 S3= By-pass (Not for parallel)  
 S4= Reserve switch

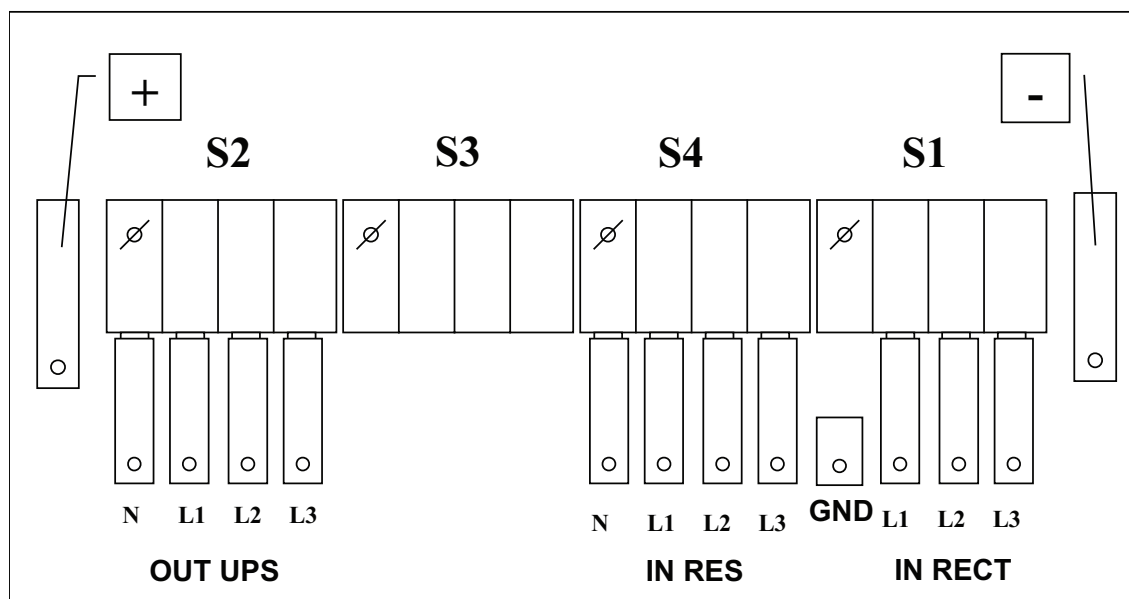
N= Neutral  
 L1= Phase L1 ( R )  
 L2= Phase L2 ( S )  
 L3= Phase L3 ( T )

IN RES= Reserve input  
 IN RECT= Mains input  
 OUT UPS= Out UPS

+ = Battery +  
 - = Battery -

GND = GROUND CONNECTION

**Figure 9E: Size 200-250kVA 6-pulse and 160-250kVA 12-pulse**



S1= Rectifier switch  
 S2= Output switch  
 S3= By-pass (Not for parallel)  
 S4= Reserve switch

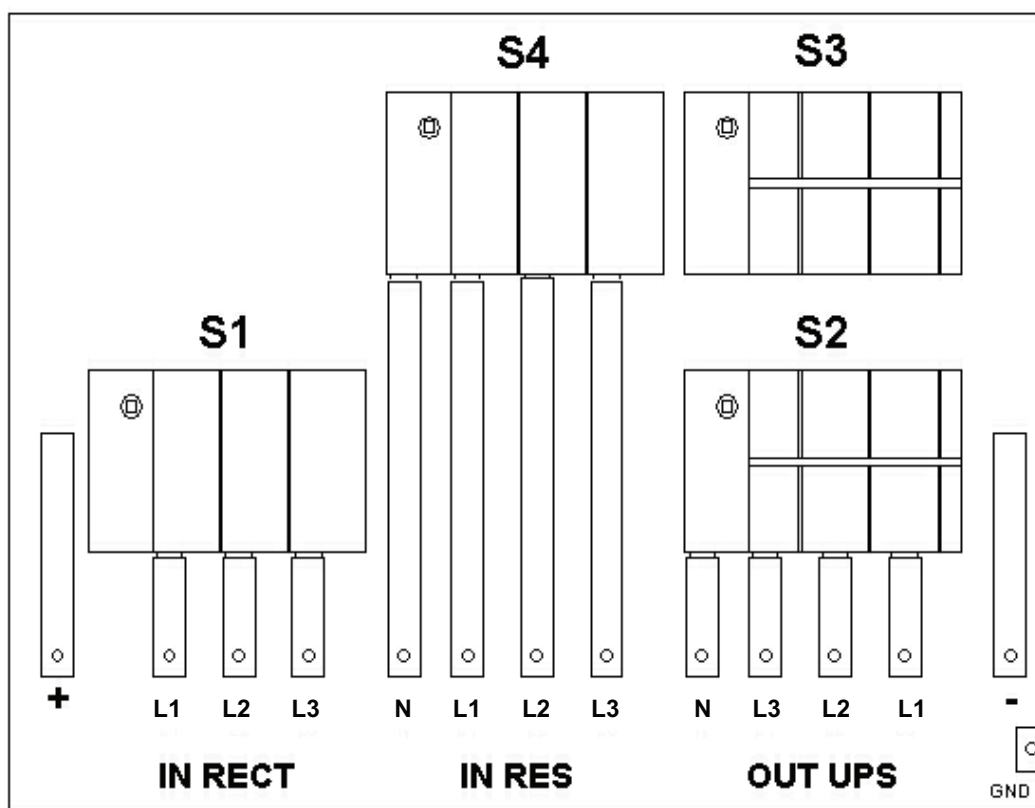
N= Neutral  
 L1= Phase L1 ( R )  
 L2= Phase L2 ( S )  
 L3= Phase L3 ( T )

IN RES = Reserve input  
 IN RECT = Mains input  
 OUT UPS = Out UPS  
 + = Battery + connection  
 - = Battery - connection  
 GND = Ground connection

Note: Only for 400kVA the connection bars are doubled to allow the connection of four wire.

**Figure 9F: Size 300-400kVA**





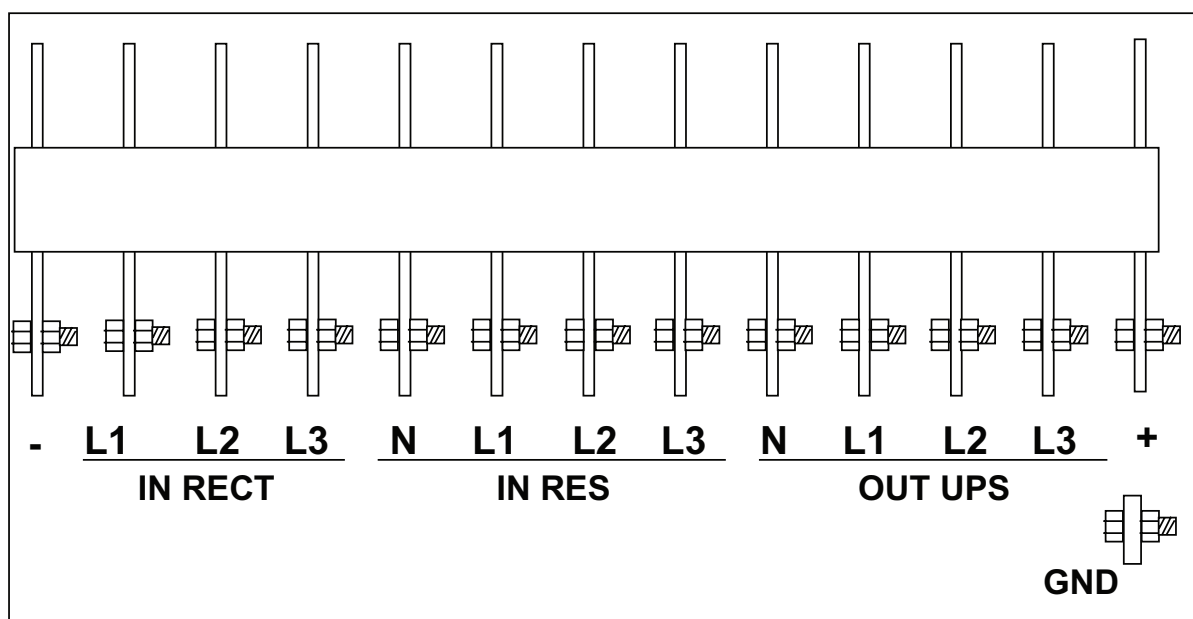
S1= Rectifier switch  
 S2= Output switch  
 S3= By-pass (Not for parallel)  
 S4= Reserve switch

N= Neutral  
 L1= Phase L1 ( R )  
 L2= Phase L2 ( S )  
 L3= Phase L3 ( T )

IN RES = Reserve input  
 IN RECT = Mains input  
 OUT UPS = Out UPS  
 + = Battery + connection  
 - = Battery - connection  
 GND = Ground connection

Note: The connection bars are doubled to allow the connection of four wire.

**Figure 9G: Size 500-800kVA**



N= Neutral

L1= Phase L1 ( R )

L2= Phase L2 ( S )

L3= Phase L3 ( T )

IN RES = Reserve input

IN RECT = Mains input

OUT UPS = Out UPS

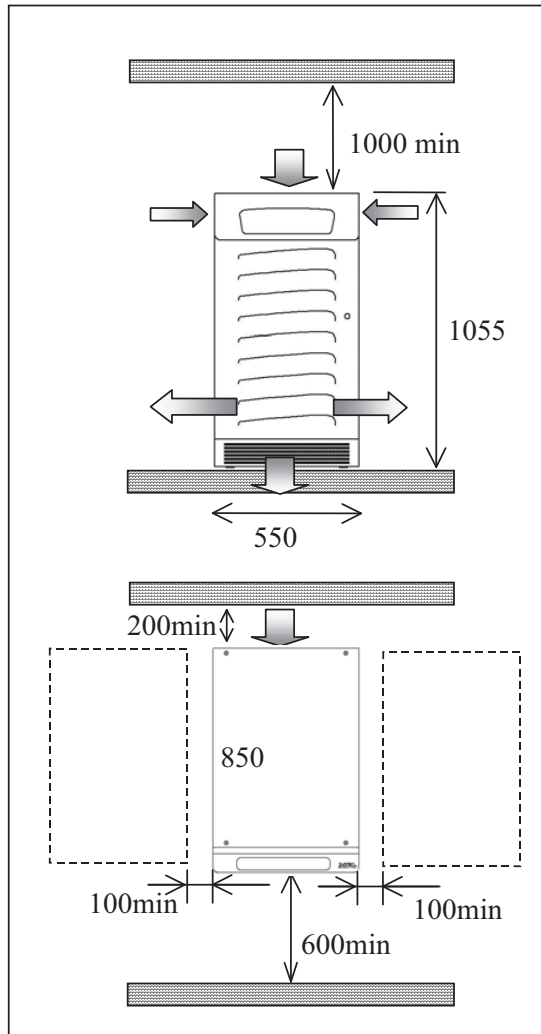
+ = Battery + connection

- = Battery - connection

GND = Ground connection

Note: The connection bars are doubled to allow the connection of four wire.

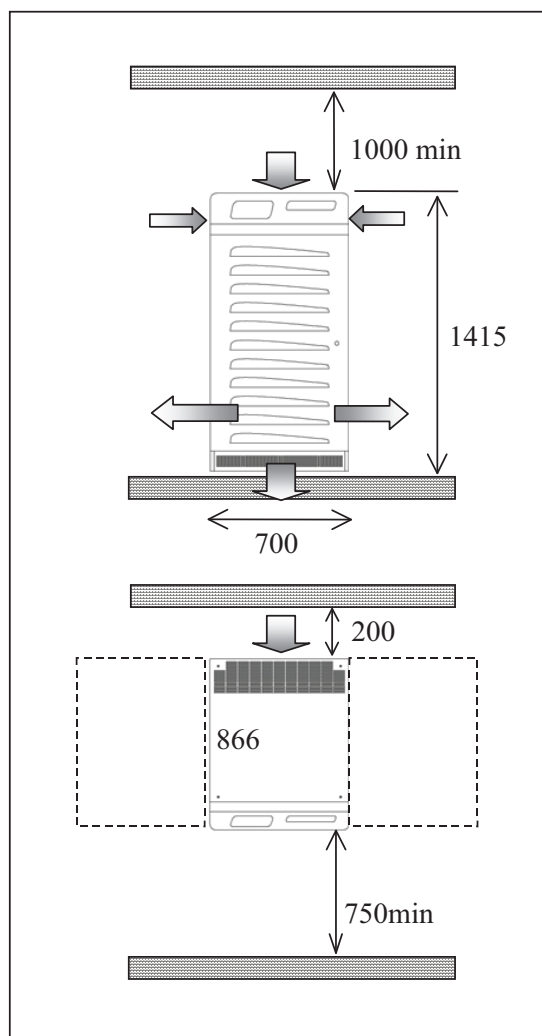
**Figure 9H: Size 1000 kVA**



**Figure 10A: Size 20-60kVA 6-pulse and 20-40kVA 12-pulse without batteries  
Size 20-40KVA 6-pulse with batteries included**

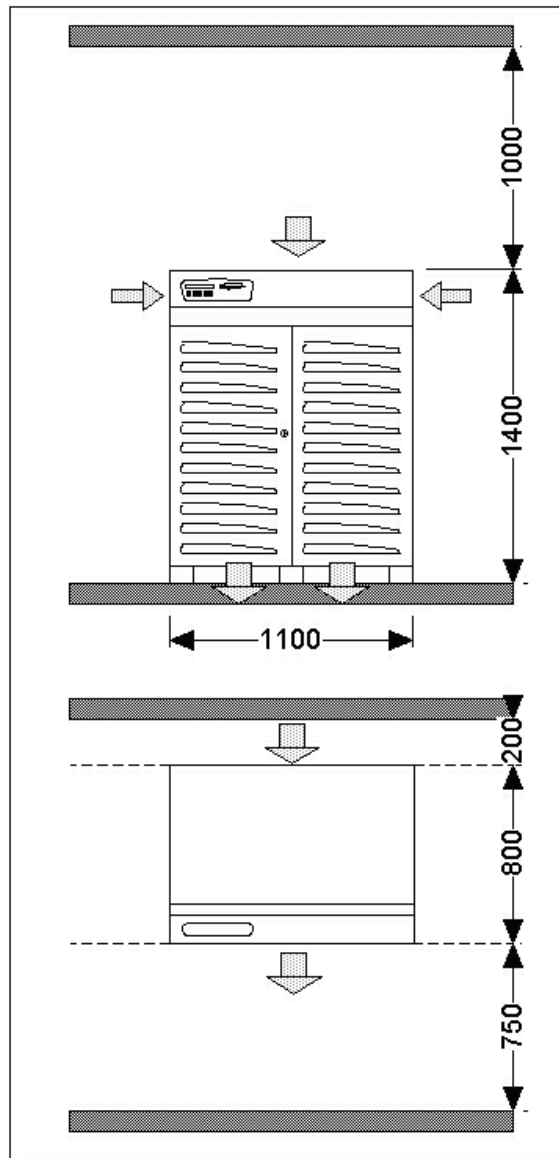
If clearing around the Ups is not sufficient, longer cables must be considered to perform extraordinary maintainance operations.(Castor with brakes are fitted to help moving the Ups).

Soft arrows are indicating the airflow(cooling air intake from the top – outgoing from the bottom)



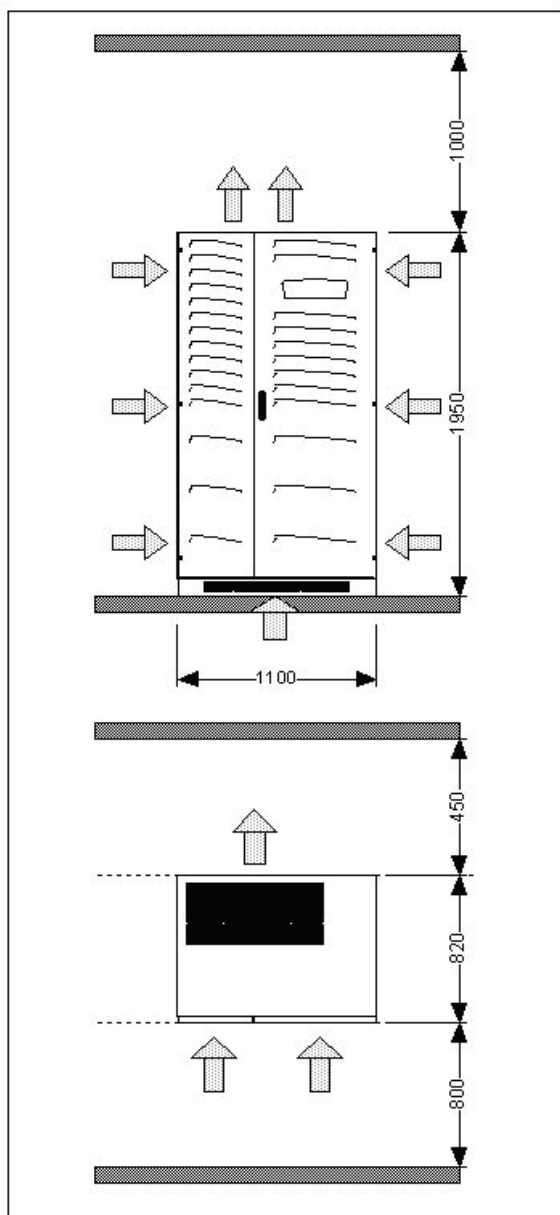
**Figure 10B: Size 80-100kVA 6-pulse and 50- 80kVA 12-pulse**

The UPS can be closed at wall; the 200mm dimensions is only for reference.  
 When it is impossible provide for a sufficient gaps from the wall, a suitable length of cables must be provided to remove the UPS in case of extraordinary repairs.  
 The shaded arrows show the air flow (in order to minimise the dust intake, the cooling air is sucked from top and discharged from bottom side).



**FIGURE 10C: Size 120-160kVA 6-pulse  
Size 100-120kVA 12-pulse**

200mm between UPS and wall must be provided in order to allow the cooling air inlet. When it is impossible provide for a sufficient gaps from the wall, a suitable length of cables must be provided to remove the UPS in case of extraordinary repairs. The shaded arrows show the air flow (in order to minimise the dust intake, the cooling air is sucked from top and discharged from bottom side).



**FIGURE 10D: Size 200-250kVA 6-pulse and 160-250kVA 12-pulse**

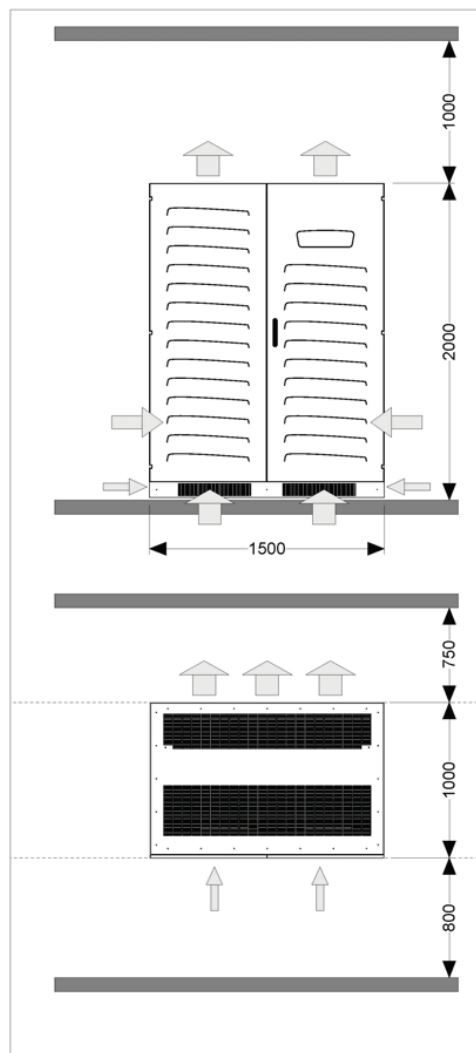
The arrows indicate the air flow.

The air is sucked from the front and from underneath and is released upwards and from the rear.

There is also a small upper suction inlet.

The unit can be used when placed directly on a flat surface although we recommend raising it by approximately 10 cm so that air can circulate freely.

If system requirements make it necessary, under-floor air intake pipes and/or air exhaust pipes can be used. Contact Siel S.p.A. for customization of panelling and formal and explicit approval of the cooling system project.



**FIGURE 10E: Size 300-400kVA**

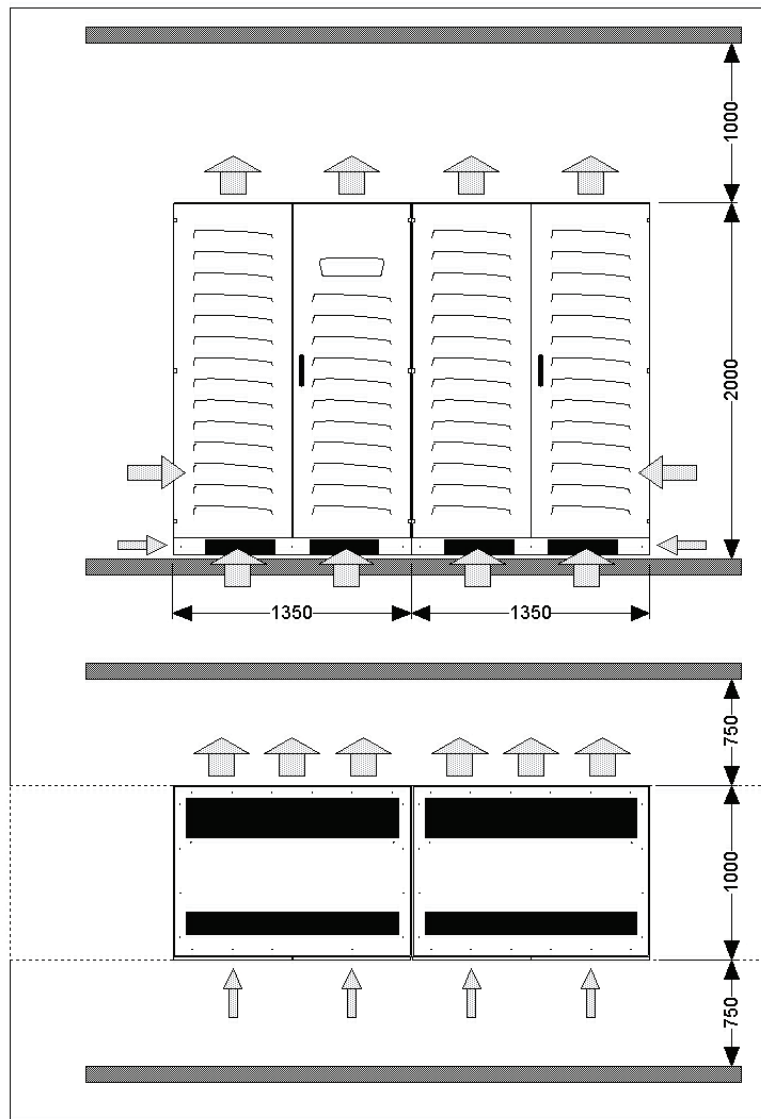
The arrows indicate the air flow.

The air is sucked from the front and from underneath and is released upwards and from the rear.

There is also a small upper suction inlet.

The unit can be used when placed directly on a flat surface although we recommend raising it by approximately 10 cm so that air can circulate freely.

If system requirements make it necessary, under-floor air intake pipes and/or air exhaust pipes can be used. Contact Siel S.p.A. for customization of panelling and formal and explicit approval of the cooling system project.



**FIGURE 10F: Size 500- 1000kVA**

The arrows indicate the air flow.

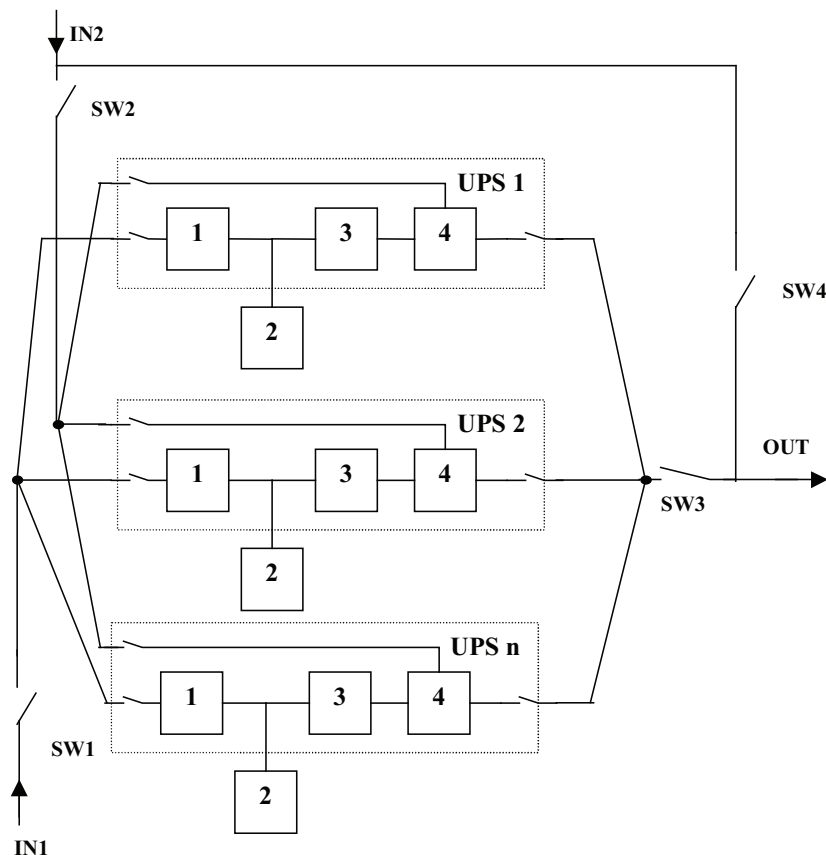
The air is sucked from the front and from underneath and is released upwards and from the rear.

There is also a small upper suction inlet.

The unit can be used when placed directly on a flat surface although we recommend raising it by approximately 10 cm so that air can circulate freely.

If system requirements make it necessary, under-floor air intake pipes and/or air exhaust pipes can be used. Contact Siel S.p.A. for customization of panelling and formal and explicit approval of the cooling system project.



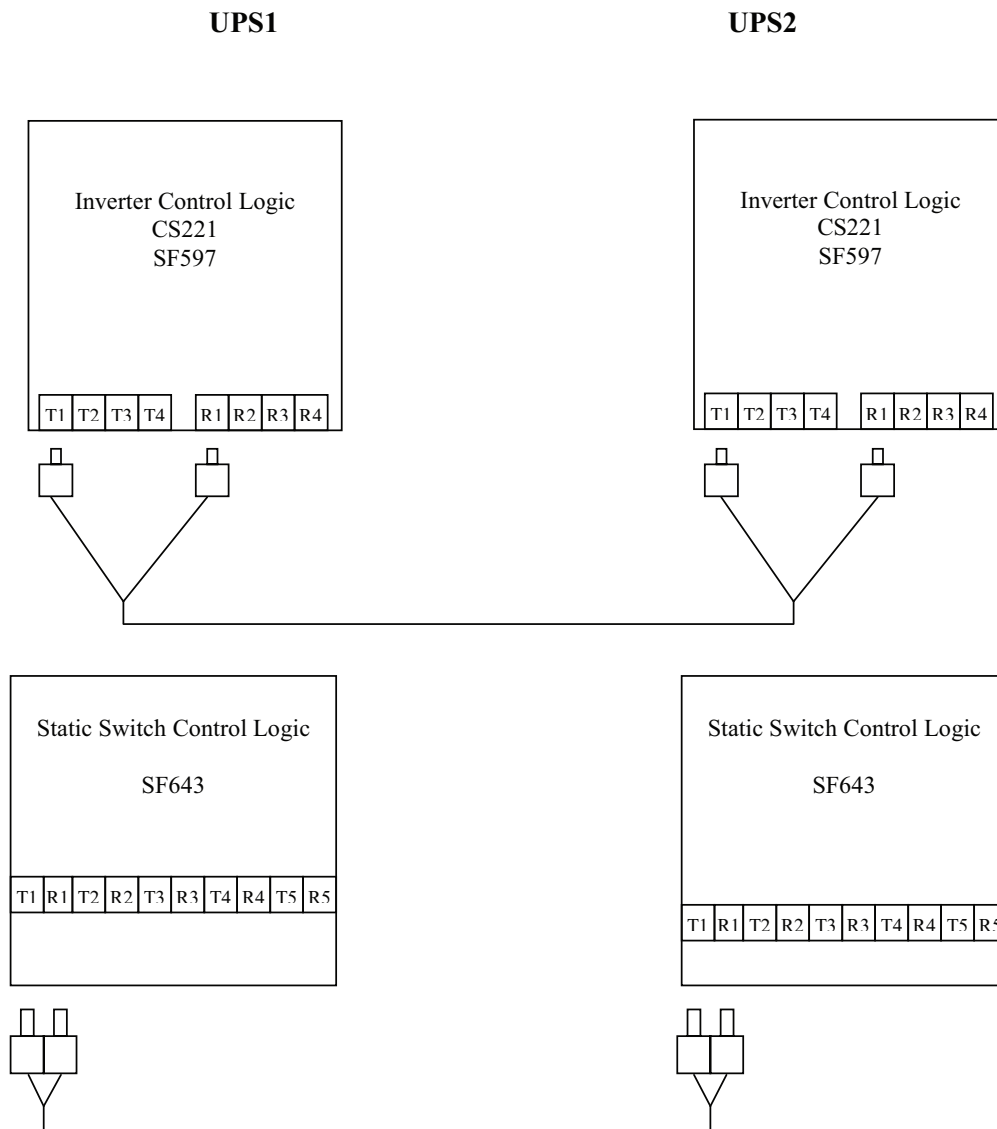


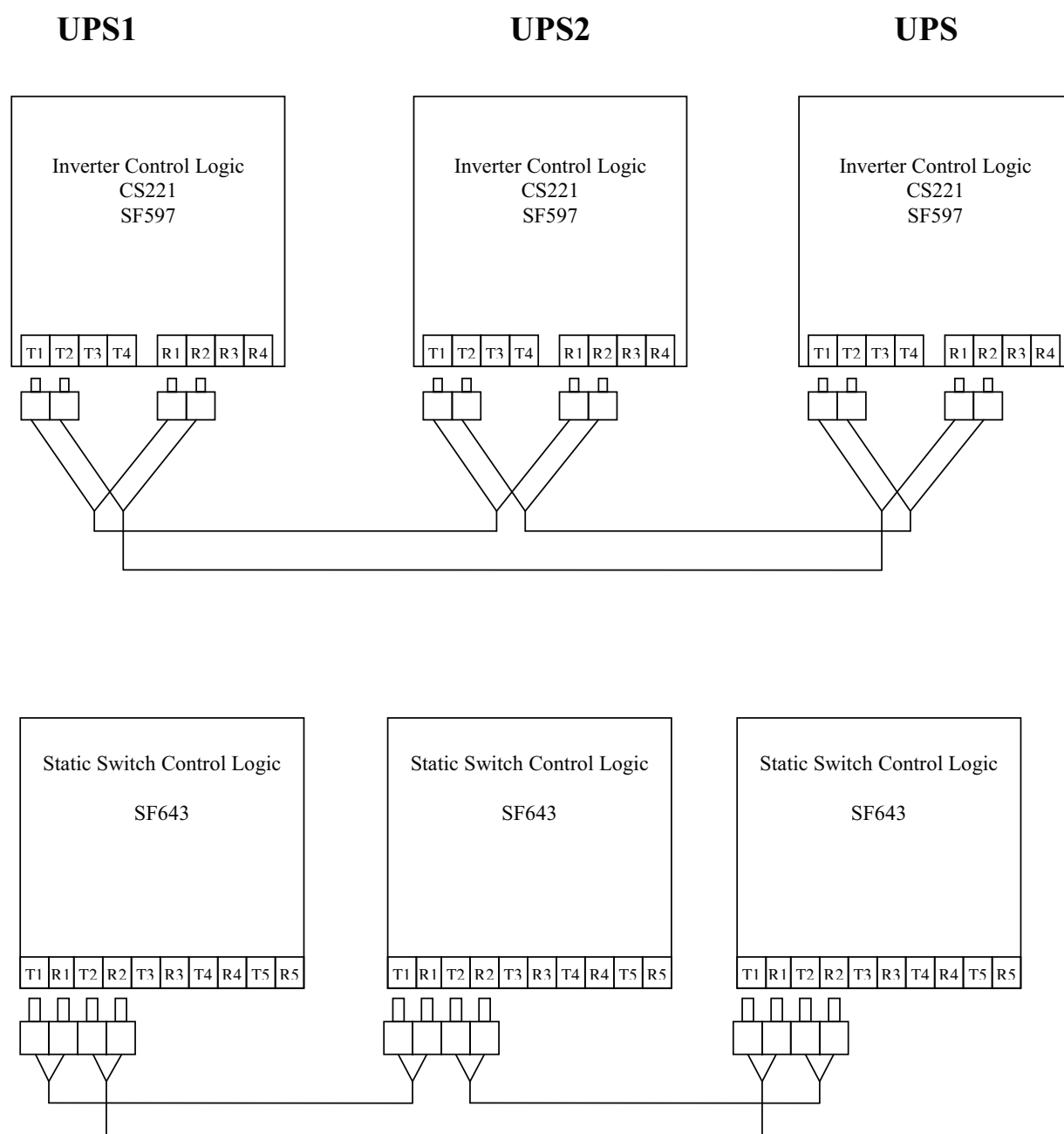
1	RECTIFIER	(Note 4)	IN1	Mains
2	BATTERY	(Note 1, 5)	IN2	Reserve mains
3	INVERTER	(Note 4)	OUT	Out
4	STATIC SWITCH	(Note 4)		
SW1	Mains input switch	(Note 5)	Note 1:	Batteries are always external to UPS
SW2	Reserve input switch	(Note 2, 5)	Note 2:	System switches SW1 .... SW4 can be given by Siel and located
SW3	Output switch	(Note 2, 5)	Note 4:	Normally included
SW4	Manual By-Pass	(Note 2, 5)	Note 5:	Normally not included
			Note 6:	Interconnection cables not normally included

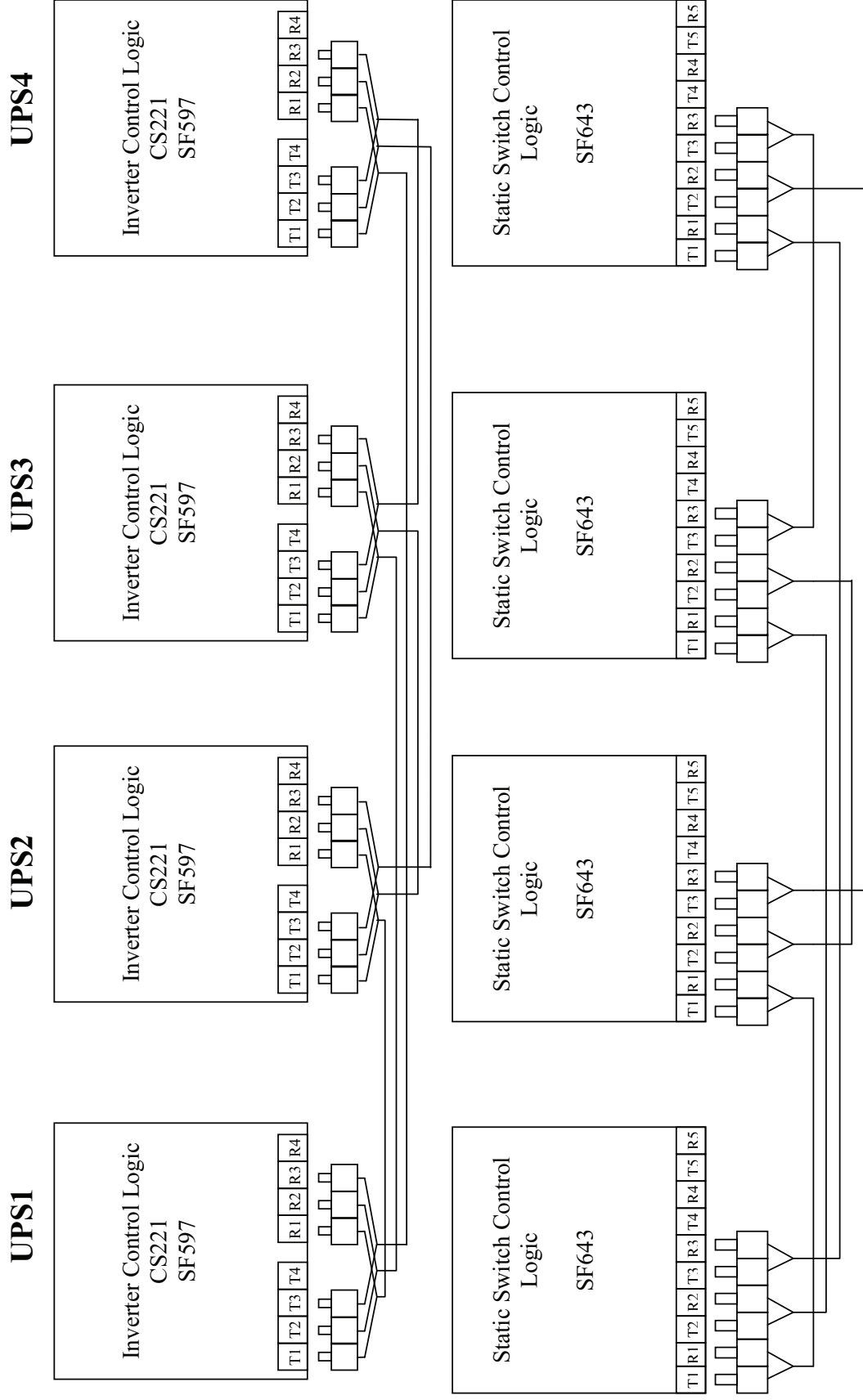
Using this configuration it is possible make the routine maintenance supplying the load (by the inverters connected in parallel) without any interruption.

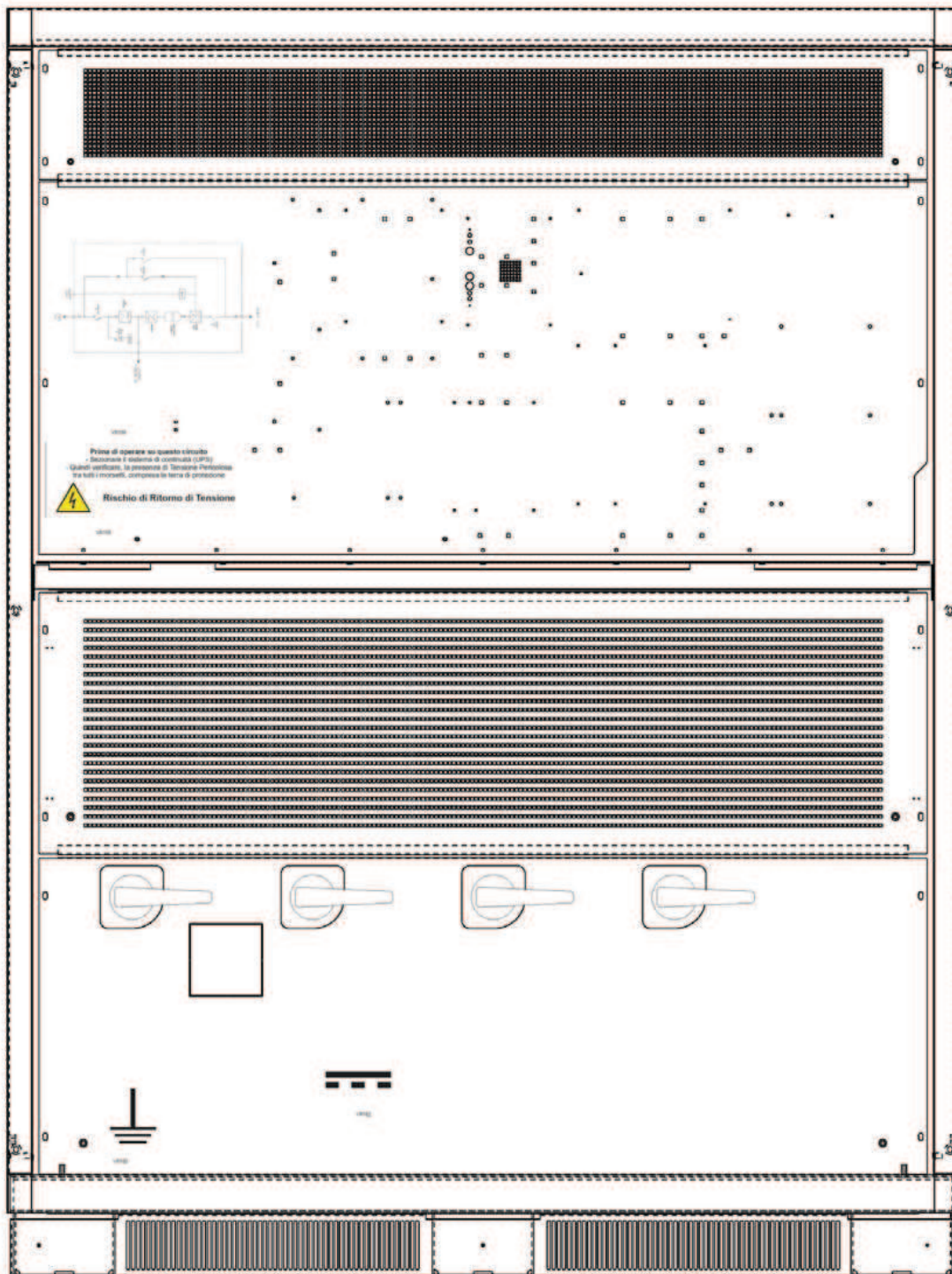
Sometimes, in case of extraordinary repairs, can be necessary to feed the load by the reserve mains (IN2); the switching from the UPS to manual by-pass (SW4), when correctly made, do not cause any voltage failure to load.

When is necessary to design a UPS system able to supply by inverter the load in any situation of maintenance or repairs, please contact the technical department of Siel.

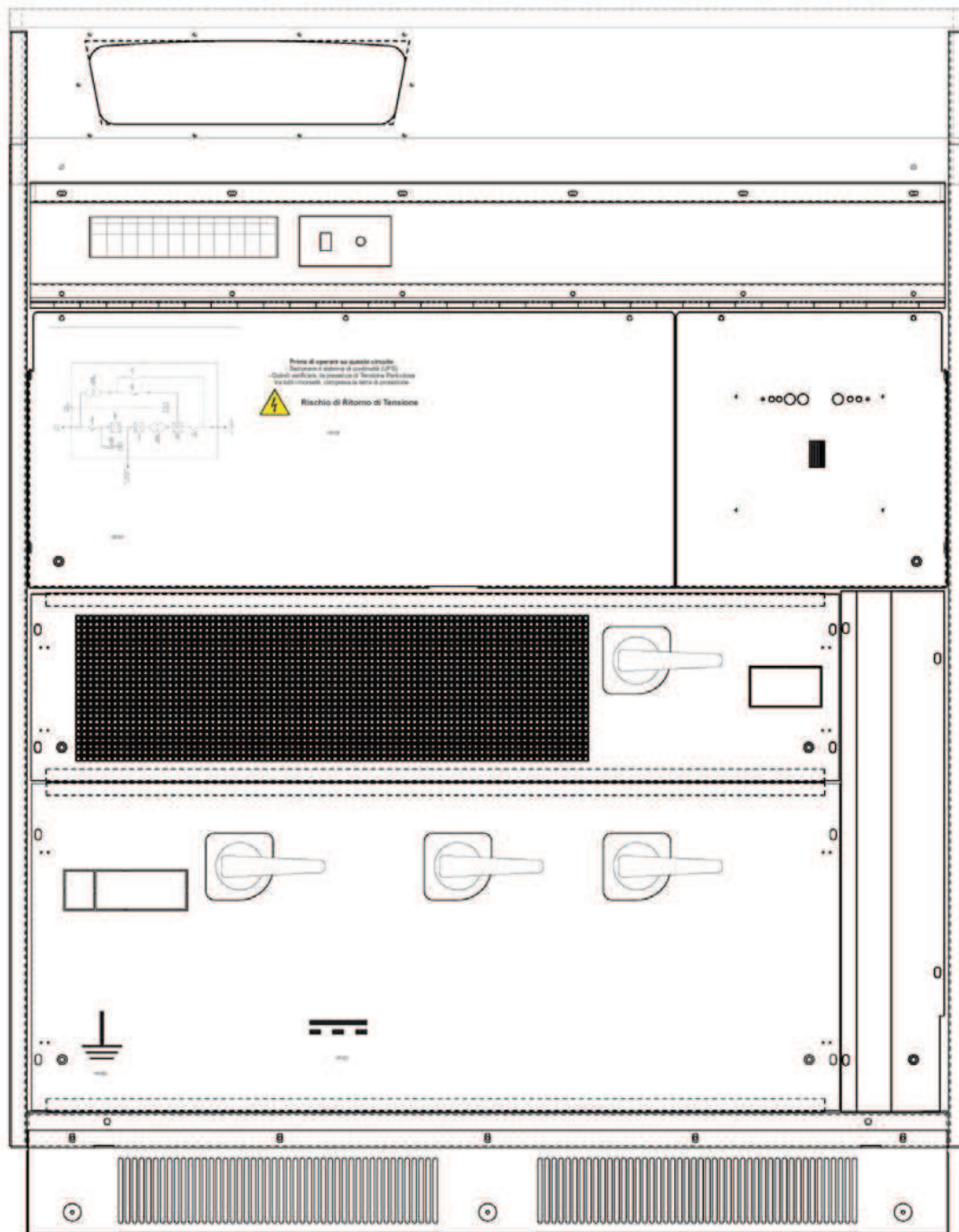








VR158 Label Switch UPS;  
 VR159 Label Back-Feed;  
 VR160 Label Ground Symbol;  
 VR162 Label DC Current;



VR157 Label Switch Central Power Supplies;  
 VR159 Label Back-Feed;  
 VR160 Label Ground Symbol;  
 VR162 Label DC Current;