Quick Start

Modular UPS MUST400T

Safety Precautions

This manual contains information concerning the installation and operation of Modular UPS. Please carefully read this manual prior to installation.
The Modular UPS cannot be put into operation until it is commissioned by engineers approved by the manufacturer (or its agent). Not doing so could result in personnel safety risk, equipment malfunction and invalidation of warranty.
The UPS has been designed for commercial or industrial use only, and is not intended for use in any life support application.
This is a CLASS C Uninterruptible Power Supply (UPS) product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take additional measures.

Conformity and standards

This product complies with 2006/95/EC ,CE73/23 & 93/68 (low voltage safety) and 2004/108/EC, 89/336 (EMC), and the following UPS product standards:
*IEC62040-1 General and safety requirements for use in operator access area
*IEC/EN62040-2 EMC requirements CLASS C
*IEC62040-3 Performance requirements and test methods
Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.

WARNING: high earth leakage current

Earth connection is critical before connecting the input supply (include both utility supply and battery).
"Earth leakage current introduced by the UPS, in any configuration from 10kW to 200kW, exceeds 3.5 mA and is less than 1000 mA and complies with the requirements of IEC/EN 62040-1 / IEC/EN 60950-1" Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous RCCB or RCD devices.
Residual Current Circuit Breakers (RCCBs) must be selected sensitive to DC (class B) and insensitive to transient current pulses Type S.
Note also that the earth leakage currents of the load will be carried by this RCCB or RCD.
This equipment must be earthed in accordance with local electrical authority codes of practice.

WARNING: backfeeding protection

This system has a control signal available for use with an automatic device, externally located, to protect against backfeeding voltage through the mains Static Bypass circuit. If this protection is not used with the switchgear that is used to isolate the bypass circuit, a label must be added to the switchgear to advise service personnel that the circuit is connected to a UPS system.
The text has the following meaning or is equivalent to: Isolate the UPS before working on the circuit of this UPS.

 **Components that can be maintained by user**

All the equipment maintenance and servicing procedures involving internal access need special tools and should be carried out only by trained personnel. The components that can only be accessed by opening the protective cover with tools cannot be maintained by user.

This UPS full complies with "IEC62040-1-1-General and safety requirements for use in operator access area UPS". Dangerous voltages are present within the battery box. However, the risk of contact with these high voltages is minimized for non-service personnel. Since the component with dangerous voltage can only be touched by opening the protective cover with a tool, the possibility of touching high voltage component is minimized. No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures in this manual.

 **Battery voltage higher than 400Vdc**

All the battery maintenance and servicing procedures involving internal access need special tools or keys and should be carried out only by trained personnel.

SPECIAL CARE SHOULD BE TAKEN WHEN WORKING WITH THE BATTERIES ASSOCIATED WITH THIS EQUIPMENT.

WHEN CONNECTED TOGETHER, THE BATTERY TERMINAL VOLTAGE WILL EXCEED 400Vdc AND IS POTENTIALLY LEATHAL.

Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times. Particular attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.

THE NON-COMPLIANCE WITH THE REQUIREMENTS PRESENT IN THIS MANUAL WILL VOID THE WARRANTY.

THE WARRANTY IS VOID IF THE INTERVENTIONS AND/OR MODIFICATIONS ARE EXECUTED BY UNAUTHORIZED PERSONNEL.

1.1 Introduction

This chapter introduces the relevant requirements for positioning and cabling of the Modular UPS and related equipment. Because each site has its requirements, it is not the aim of this chapter to provide step-by-step installation instructions, but to act as a guide for the general procedures and practices that should be observed by the installing engineer.

Warning: installation can only be done by authorized engineers

Do not apply electrical power to the UPS equipment before the commissioning engineer arrives at installation site.
The UPS should be installed by a qualified engineer in accordance with the information contained in this chapter. All the equipment not referred to in this manual is shipped with details of its own mechanical and electrical installation information.

Note: 3-Phase 4-Wire Input Power is required

The standard UPS system can be connected to TN, TT AC distribution system (IEC60364-3) of 3-phase 4-wire, and a 3-wire to 4-wire conversion transformer is provided as an optional part.

WARNING: battery hazards

SPECIAL CARE SHOULD BE TAKEN WHEN WORKING WITH THE BATTERIES ASSOCIATED WITH THIS EQUIPMENT.

After battery connection, the battery terminals voltage will exceed 400Vdc and is potentially lethal.
Follow the suggested actions here below:

- Eye protection must be worn to prevent injury from accidental electrical arcs.
- Remove rings, watches and all metal objects.
- Only use tools with insulated handles.
- Wear rubber gloves.
- If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.
- If electrolyte comes into contact with the skin, the affected area should be washed immediately with water.

1.2 Initial Checking

Before installing UPS, please check these items as below:
1. Visually examine if there is any damage inside and outside the UPS rack and battery equipment due to the transportation. Report any such damage to the shipper immediately.
2. Verify the product label and confirm the correctness of the equipment. The equipment label is attached on the back of front door. The UPS model, capacity and main parameters are marked on the label.

1.3 Location

1.3.1 UPS Location

The UPS is intended for indoor installation and should be located in a cool, dry and clean environment with adequate ventilation to keep the environmental parameters within the specified operating range (see Table.9-2).

Improper use of UPS and in condition out of the operating range invalid the warranty.

Avoid to install the UPS in room which are exposed directly under sunlight or near sources of hot air.

The Modular series UPS uses forced convection cooling by internal fans. Cooling air enters the module through ventilation grills located at the front part of the cabinet and exhausted through grills located in the rear part of the cabinet. Please do not block the ventilation holes.
If necessary, an extractor fans system should be installed to aid cooling-air flow.
An air filter should be used when the UPS is to operate in a dirty environment and should be regularly cleaned to maintain proper airflow.
The cooling capacity of air conditioner should be selected according to the power loss data of UPS specified in *Table.9-8*: Normal mode (VFI SS 111 double-conversion UPS)
Note 1 : The UPS should be installed on a concrete surface or other surface that is not combustible.
Note 2 : Ensure that the capacity of the floor is greater than the weight of the UPS and battery cabinet (if present), and verify that the floor is flat.

1.3.2 External Battery Room

The battery will generate some amount of hydrogen and oxygen at the end of charging, so the fresh air volume of the battery installation environment must meet EN50272-2001 requirements.
The environmental temperature of the battery must be stable. Ambient temperature is a major factor in determining the battery capacity and lifetime.
The rated operating temperature of battery is 20°C. Operating above this temperature will reduce the battery life, and operation below this temperature will reduce the battery capacity. If the average operating temperature of battery is increased from 20ºC to 30ºC, then the service life of the battery will be reduced by 50%. If the operating temperature of the battery is above 40ºC, then the battery service life will decrease in exponential rate.
In a normal installation, the battery temperature is maintained between 15°C and 25°C. Keep batteries away from heat sources or air outlets.
If external batteries are used, the battery circuit breakers (or fuses) must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible.

(*): The standard EN 50272-2 for air change envisages that the minimum opening must satisfy the following equation:

$$A = 28 \times Q = 28 \times 0.05 \times n \times Igas \times C10 \ (1/10^3) \ [cm^2]$$

where:
A = free opening for air intake and outlet
Q = flow of air to be removed [m^3/h]
n = number of battery elements;
C10 = battery capacity over 10 hours [Ah]
Igas = current that produces gas [mA//Ah]
in accordance with the standard: Igas = 1 VRLA type battery

When the equation is applied for 240 element (40 battery) hermetically-sealed lead batteries:

$$A = 336 \times C10 / 10^3 \ [cm^2]$$

When using 120Ah batteries, the minimum aperture should be approximately:

$$A = 41 \ [cm^2]$$

1.3.3 Storage

If the equipment is not installed immediately, it must be stored in a room protected against excessive humidity and heat sources (see *Table.9-2*).
The battery needs to be stored in dry and cool place with good ventilation.
The most suitable storage temperature is from 20 ºC to 25ºC.

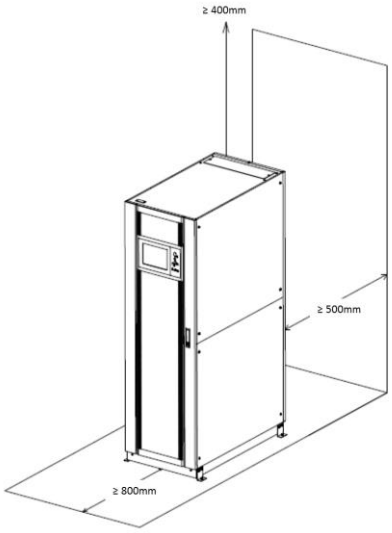
Preventing battery slow discharge

Should the UPS remains unpowered for a prolonged period of time while the battery are connected, the batteries may slowly discharge and being so permanently damaged .In such cases it is therefore recommended to leave the battery circuit breaker(s) open. During storage in any case, periodically charge the battery according to the battery user manuals.

1.4 Positioning

When the equipment has been positioned, ensure the UPS will remain stationary and stable.
To guarantee optimize working lifetime, the place chosen must guarantee:

- Space for easy operation on the UPS
- Enough air to dispel heat produced by UPS
- Protection against atmospheric agents
- Protection against excessive humidity and heat sources
- Protection against dust
- With the current fire prevention requirements
- The operating environment temperature is within +20°C to +25°C. The batteries are at maximum efficiency in this temperature range (for information about the battery storage and transportation as well as the environment, refer to *Table.9-2*)
- This equipment is of steel frame structure wrapped by removable panels. The cover and the lateral panels are fixed by screws.
- After opening the UPS rack door, the auxiliary connections for communitation ports and dry-contact and the maintenance bypass can be accessed.
- The UPS provides air inlet port in the front and the air exhaust port in the rear part. ***It is forbidden to install the UPS directly to the rear wall. Leave at least 50cm of free space in the rear. See picture below.***



1.4.1 System Cabinet

A UPS system can comprise an UPS rack system, external battery cabinet, depending on the specific system requirement.
All the UPS system cabinets used in the same installation site are of the same height and should be positioned side-by-side to achieve an aesthetically appealing effect. Refer to Chapter 7 Installation Drawing for the positioning of UPS cabinet.

1.4.2 Moving the Cabinets

Warning
Ensure that any lifting equipment used in moving the UPS cabinet have sufficient lifting capacity. The UPS is fitted with castors – take care to prevent movement when unbolting the equipment from its shipping pallet. Ensure adequate personnel and lifting aids are available when removing the shipping pallet.

Ensure that the UPS weight is within the weight loading capacity range of any hoisting equipment. *See Table.9-3 for UPS weight.*

UPS and optional cabinets can be handled by means of a fork lift or similar equipment. The UPS cabinet can also be moved by its wheels (where are present) only for short distance.

Note: *Care must be taken when handling units fitted with batteries. Keep such moves to a minimum.*

1.4.3 Distances Required for Operating

It's no necessary to leave free space in lateral part of the UPS.

To permit first commissioning, the tightening of power terminals inside the UPS and all service activity, it is recommended to leave enough free space to enable the passage of personnel with the doors fully opened. It is important to leave a distance of 500mm in the rear side of the rack to permit adequate circulation of air coming out the unit.

1.4.4 Front Access & Rear access

The UPS system is designed for front and rear access. For common service activity and replacement of power modules is required only front access, for installation is required rear access.

1.4.5 Final Positioning

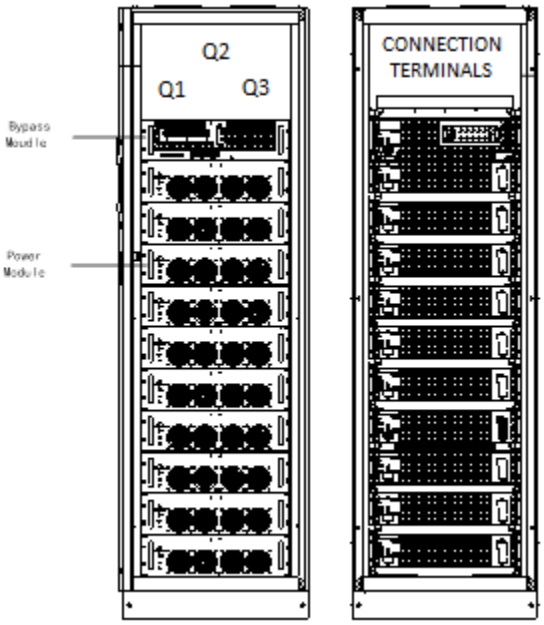
When the equipment has been finally positioned, ensure the adjustable feet are set so that the UPS will remain stationary and stable.

1.4.6 Installation of Adjustable Feet

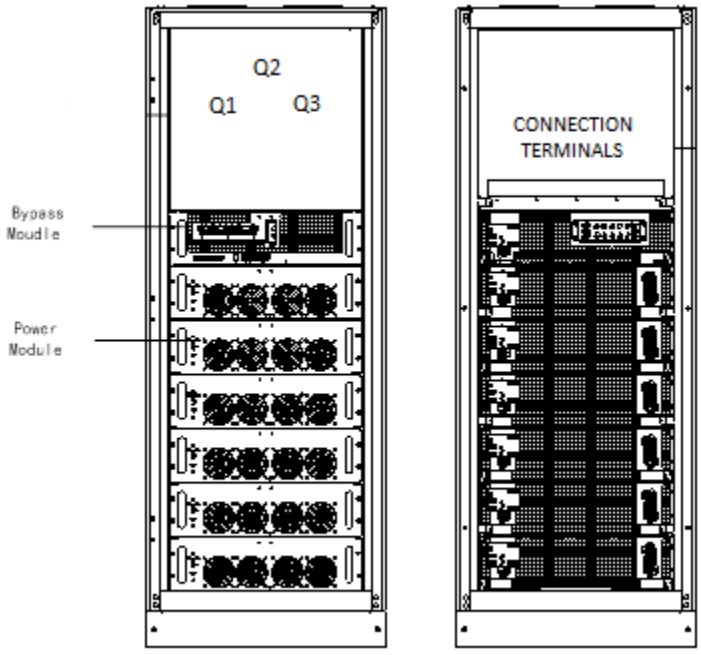
Installation diagrams in Chapter 4 of this manual identify the location of the holes in the base plate through which the equipment can be bolted to the floor. If the UPS is to be located on a raised floor, it should be mounted on a pedestal suitably designed to accept the UPS point loading (more than 800 kg).

1.4.7 UPS Composition

The UPS structure is shown in *Fig. 1-1*. The UPS configuration is available in *Table. 1-1*



(a) 10 module cabinet



(b) 6 module cabinet

Fig.1- 1: UPS Structure

Table.1- 1: UPS Configuration List

Item	Component	Quantity	Remarks
1	System Display	1	Requisite, factory installed
2	Bypass module	1	Requisite, factory installed
3	Input/output/maintenance bypass siwtches	1	Requisite, factory installed
4	Power module	1 ≤n ≤10	Requisite

1.4.8 Installing Power Modules

It's not possible to install a power module with different rated power.
The default power modules number is from the top to the bottom.
Insert the module in the right free shelf, and push it into the cabinet.
Secure the module to the cabinet through the fixing holes on both sides of the front panel of the module.
See fig.1-2

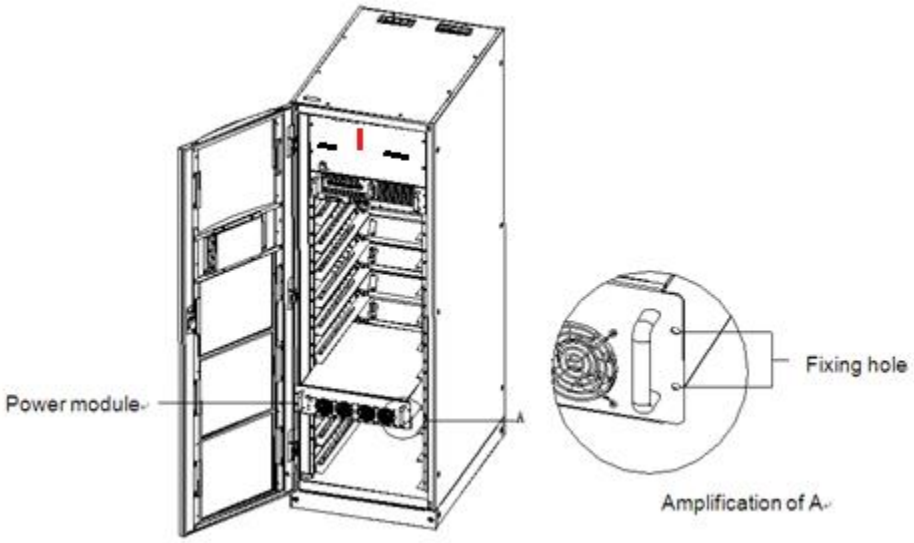


Fig.1- 2: Power Module Installation Diagram

1.4.9 Cable Entry

Cables can enter into the UPS system both from bottom and top. Cable entry is made possible through a blanking plates fitted at the bottom or top of the equipment. The recommended installation practice is to install glands to prevent foreign material entering into the cabinet.

1.5 External Protective Devices

For safety concerns, it is necessary to install external circuit breakers or other protective devices for the input AC supply of the UPS system. This section provides generic practical information for qualified installation engineers. The installation engineers should have the knowledge of the wiring standards, and the equipment to be installed.

1.5.1 Rectifier and Bypass Input Supply of the UPS

Over currents

Install suitable protective devices in the distribution unit of the incoming mains supply, considering the power cable current-carrying capacity and overload capacity of the system (*see Tab. 9-7*). Generally, the magnetic circuit breaker with IEC60947-2 tripping curve C (normal) at the 125% of the current listed in Tab. 9-7 is recommended.

Dual input: In case of double mains used, separate protective devices should be installed for the rectifier input and bypass input in the incoming mains distribution panel.

Note: <u>The rectifier input and bypass input must use the same neutral line</u>.

So don't remove the neutral common copper bridge present between input and bypass terminals

Protection against earth faults (RCD devices):

The RCD device installed upstream of the input supply should be comply with:

Sensitive to DC unidirectional pulses (class A) in the network

Insensitive to transient current pulses

Have an average sensitivity that is adjustable between 0.3A and 1A.

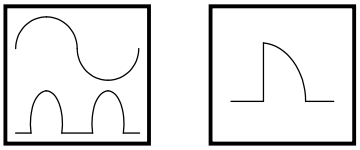


Fig.1- 3: The Symbols of RCCB

When using the RCD in the split bypass system or parallel system, the RCD should be installed upstream of the input distribution to avoid wrong alarm.

The residual current introduced by RFI filter in the UPS is between 3.5mA and 1000mA. It is recommended to confirm the sensitivity of each RCD of upstream input distribution and downstream distribution (to load).

1.5.2 External Battery

The DC compatible circuit breaker provides over current protection for UPS system and battery, which is provided by the external battery cabinet.

1.5.3 UPS Output

In case of an external distribution cabinet is used for load distribution, the selection of protective devices must provide discrimination with those that are used at the input to the UPS (*see Tab. 9-7*).

1.6 Power Cables

Design the cables according to the descriptions in this section and local regulatory wiring standards, and the environmental conditions (temperature and physical support media) should be taken into consideration.
Refer to IEC60950-1 Table 3B Cabling.

⚠⚠ WARNING

FAILURE TO FOLLOW ADEQUATE EARTHING PROCEDURES CAN RESULT IN EMI, ELECTRIC SHOCK HAZARD, OR RISK OF FIRE, IF AN EARTH FAULT OCCURS.

Table.1- 2: Maximum Steady AC and DC Current

UPS power(KVA)	Rated current (A)								
	Main input current at full load battery charging (1，2)			Output current at full load (2)			Battery discharging current at E.O.D=1.67V/cell, no overload		
	380V	400V	415V	380V	400V	415V	36 Batt./string	38 Batt./string	40 Batt./string
200	306	291	280	303	288	277	468	443	421
120	184	175	168	182	173	166	281	266	253
100	153	146	140	152	144	139	234	222	211
60	92	88	84	91	87	83	142	133	127
40	62	59	56	61	68	56	94	89	85
30	46	44	42	46	44	42	71	67	64
20	31	29	28	31	34	28	47	45	43

Note:

1. Input current related to single mains supply.

2. Take special care when determining the size of the output and bypass neutral cable, as the current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads, which is usually 1.732 times of rated currents.

3. The earth cable connecting the UPS to the main ground system must follow the most direct route possible. The earth conductor should be sized according to the fault rating, cable lengths, type of protection, etc. According to AS/IEC60950-1, the cross section area of the conductor is 90mm2 (200kVA), the cross section area of the conductor is 50mm2 (120KVA).

4. When sizing battery cables, a maximum volt drop of 4Vdc. is permissible at the current ratings given in Table.1-2. The load equipment is connected to a distribution network of individually protected busbars fed by the UPS output rather than connected directly to the UPS. In case off cabinet parallel, the output cable of each ups rack unit should be kept at equal length between the output of the ups rack output terminals and the parallel distribution busbars to avoid affecting the shared current. When laying the power cables, do not form coils, so as to avoid the formation of electromagnetic interference.

5. See Chapter 4 Installation Drawing for the positions of wiring terminals.

1.6.1 Cable Connections

⚠ Note
The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficulties, do not hesitate to contact our Customer Service & Support department.

After the equipment has been finally positioned and secured, refer to Chapter 4 Installation Drawing to connect the power cables as described in the following procedures:

1. Verify that all the external input distribution switches of the UPS are completely opened and the UPS internal maintenance bypass switch is opened. Attach necessary warning signs to these switches to prevent unauthorized operation.
2. Open rear panel of the UPS, and then the power connection terminals are accessible.
3. Connect the protective earth and any necessary grounding cables to the PE terminal. The cabinet for the UPS must be connected to the user's ground connection.

Note: *The grounding cable and neutral cable must be connected in accordance with local and national codes practice.*

Identify and make power connections for incoming cables according to one of the two procedures below, depending on the type of installation:

Common Input Connections

4. For common bypass and rectifier inputs, connect the AC input supply cables to the UPS bypass terminals (X2/L21-L22-L23 X1/N1) Refer to *Fig. 4-11* and tighten the connections to 5 Nm (M6 Bolt), 13Nm (M8 Bolt) or 25Nm (M10 Bolt). Do not remove copper bridge between X1 and X2 terminals.

ENSURE CORRECT PHASE ROTATION AND TIGHTEN CONNECTION TERMINALS

Split Bypass Connections

5. If a 'split-bypass' configuration is used, ensure that the common copper bridges between Bypass and Rectifier inputs are removed.

Note: DO NOT REMOVE THE NEUTRAL COPPER BRIDGE

Connect the AC input supply cables to the rectifier input terminals (X1/L1-L2-L3-N1) Refer to *Fig.4-11* and the AC bypass supply cables to the bypass input terminals (X2/L21-L22-L23) and tighten the connections to 5 Nm (M6 Bolt) or 13Nm (M8 Bolt) or 25Nm (M10 Bolt).

Note: ENSURE CORRECT PHASE ROTATION AND TIGHTEN CONNECTION TERMINALS

Frequency Converter Mode

If the frequency converter configuration is used, connect the AC input cables to the rectifier input terminals (X1/L1-L2-L3-N1) Refer to *Fig.4-11* and tighten the connections to 5Nm (M6 bolt), or to 13Nm (M8 bolt), or to 25Nm (M10 bolt).

Note: ENSURE CORRECT PHASE ROTATION AND TIGHTEN CONNECTION TERMINALS.

No need to connect the bypass input cables to bypass input terminals in case of dual input version and ensure to remove copper bridge in phases terminals. Leave the neutral copper bridge installed.

Output System Connections

6. Connect the system output cables between the UPS output terminals (X3/L31-L32-L33-N2) Refer to *Fig.4-11* and the critical load and tighten the terminals screws to 5Nm (M6 Bolt) or to 13Nm (M8 Bolt) or to 25Nm (M10 Bolt).

Note: ENSURE CORRECT PHASE ROTATION.

WARNING
If the load equipment will not be ready to accept power on the arrival of the commissioning engineer, then ensure that the system output cables are safely isolated at their ends.

7. Re-install all the protective covers.

General safety information for UPS 62040-2 CLASS 2-3:

	Italiano	English	Francais	Deutsch	Espanol
	Attenzione leggi per prima il manuale.	Warning: please read the manual first.	Attention, lire le manuel d'instruction.	Achtung: Zuerst die Bedienungsanleitungen durchlesen.	Cuidado! Leer el manual de el usuario antes de obrar
	Apparato per ambiente di lavoro interno con polveri e inquinanti normali.	Indoor equipment for environment with normal pollution and dust.	Equipements pour l'intérieur avec une pollution normale.	Gerät für interne Arbeitsräume mit normaler Schadstoff- und Staubentwicklung.	Equipo por el interior con polvo y poluciòn normal
 EMC	L'Apparato In ambienti residenziali può causare interferenze	In residential environments the equipment can cause interference	L'appareil peut provoquer des interférences dans une zone résidentielle.	Das Gerät kann in Wohngebäuden Interferenzen verursachen.	En el ambiente residencial el equipo puede causar interferencias
	Collegare il conduttore di terra al UPSE' consigliata la protezione differenziale	At first connect the Pe conductor.Differential protection is suggested.	En premier connecter le conducteur de terre (PE). Protection différentielle suggérée.	Das Erdungskabel an die USV abschließen. Ein Differentialschutz ist ratsam.	Conectar el cable de tierra a el SAE. Se aconseja la protecction con el interruptor diferencial
	Attenzione batterie interne non aprire pericolo	Warning: batteries inside, do not open for chemical and electrical risk	Attention, batteries internes, risques chimiques et électriques.	Achtung! Batterien im Inneren. Nicht öffnen! Gefahr!	Cuidado! Batteries en el interior, no abrir, peligro
	Attenzione la manutenzione è consentita solo al personale dell'assistenza tecnica scollegare rete e le batterie prima di operare	Warning, maintenance is allowed only to duly trained persons. Only technical assistance personnel can open and repair the UPS. Before working on the UPS disconnect mains and batteries.	Attention, seules les personnes autorisées peuvent ouvrir et intervenir dans l'onduleur. En premier, couper l'alimentation et le circuit des batteries.	Achtung: Die Wartung ist ausschließlich dem technischen Kundendienst vorbehalten! Das USV-Netz vor dem Eingriff abtrennen!	Cuidado! La asistencia tècnica debe ser hecha solamente para el personal tècnico especializado. Desconectar el SAE antes de operar
	Attenzione durante la manutenzione usare i DPI	Warning: during maintenance use protection devices	Attention, utilizer les EPI (équipements de protection individuels)	Achtung! Während der Wartungsarbeiten müssen die PSA verwendet werden.	Attencion utilizer los dispositivo de protection individual antes de obrar