

Altivar Process ATV6000 UL

Variable Speed Drives

Installation Manual

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification Of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used. All persons working on and with

the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

Intended Use

This product is a drive for three-phase synchronous, asynchronous motors and intended for industrial use according to this manual.

The product may only be used in compliance with all applicable safety standard and local regulations and directives, the specified requirements and the technical data. The product must be installed outside the hazardous ATEX zone. Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented. Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design). Any use other than the use explicitly permitted is prohibited and can result in hazards.

Product Related Information

Read and understand these instructions before performing any procedure with this drive.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Before performing work on the drive system:

- Follow the instructions given in the section "Complete drive system power Off procedure" of the installation manual.

Before applying voltage to the drive system:

- Verify that the work has been completed and that the entire installation cannot cause hazards.
- Remove the ground and the short circuits on the mains input terminals and the motor output terminals.
- Verify proper grounding of all equipment.
- Verify that all protective equipment such as covers, doors, grids is installed and/or closed.

Failure to follow these instructions will result in death or serious injury.

⚠ ⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Only appropriately trained persons who are familiar with and fully understand the contents of the present manual and all other pertinent product documentation and who have received all necessary training to recognize and avoid hazards involved are authorized to work on and with this drive system.
- Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Only use properly rated, electrically insulated tools and measuring equipment.
- Do not touch unshielded components or terminals with voltage present.
- Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- Insulate both ends of unused conductors of the motor cable
- Do not create short circuits across the DC bus terminals or the DC bus capacitors.

Failure to follow these instructions will result in death or serious injury.

Damaged products or accessories may cause electric shock or unanticipated equipment operation.

⚠ ⚠ DANGER**ELECTRIC SHOCK OR UNANTICIPATED EQUIPMENT OPERATION**

Do not use damaged products or accessories.

Failure to follow these instructions will result in death or serious injury.

Contact your local Schneider Electric sales office if you detect any damage whatsoever.

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER**POTENTIAL FOR EXPLOSION**

Install and use this equipment in non-hazardous locations only.

Failure to follow these instructions will result in death or serious injury.

Your application consists of a whole range of different interrelated mechanical, electrical, and electronic components, the drive being just one part of the application. The drive by itself is neither intended to nor capable of providing the entire functionality to meet all safety-related requirements that apply to your application. Depending on the application and the corresponding risk assessment to be conducted by you, a whole variety of additional equipment is required such as, but not limited to, external encoders, external brakes, external monitoring devices, guards, etc.

As a designer/manufacturer of machines, you must be familiar with and observe all standards that apply to your machine. You must conduct a risk assessment and determine the appropriate Performance Level (PL) and/or Safety Integrity Level (SIL) and design and build your machine in compliance with all applicable standards. In doing so, you must consider the interrelation of all components of the machine. In addition, you must provide instructions for use that enable the user of your machine to perform any type of work on and with the machine such as operation and maintenance in a safe manner.

The present document assumes that you are fully aware of all normative standards and requirements that apply to your application. Since the drive cannot provide all safety-related functionality for your entire application, you must ensure that the required Performance Level and/or Safety Integrity Level is reached by installing all necessary additional equipment.

⚠ WARNING

INSUFFICIENT PERFORMANCE LEVEL/SAFETY INTEGRITY LEVEL AND/OR UNINTENDED EQUIPMENT OPERATION

- Conduct a risk assessment according to EN ISO 12100 and all other standards that apply to your application.
- Use redundant components and/or control paths for all critical control functions identified in your risk assessment.
- Implement all monitoring functions required to avoid any type of hazard identified in your risk assessment, for example, slipping or falling loads.
- Verify that the service life of all individual components used in your application is sufficient for the intended service life of your overall application.
- Perform extensive commissioning tests for all potential error situations to verify the effectiveness of the safety-related functions and monitoring functions implemented, for example, but not limited to, speed monitoring by means of encoders, short circuit monitoring for all connected equipment, correct operation of brakes and guards.
- Perform extensive commissioning tests for all potential error situations to verify that the load can be brought to a safe stop under all conditions.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Product may perform unexpected movements because of incorrect wiring, incorrect settings, incorrect data or other errors.

⚠ WARNING

UNANTICIPATED EQUIPMENT OPERATION

- Carefully install the wiring in accordance with the EMC requirements.
- Do not operate the product with unknown or unsuitable settings or data.
- Perform a comprehensive commissioning test.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

▲ WARNING
<p>LOSS OF CONTROL</p> <ul style="list-style-type: none"> • The designer of any control scheme must consider the potential failure modes of control paths and, for critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop, overtravel stop, power outage and restart. • Separate or redundant control paths must be provided for critical control functions. • System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link. • Observe all accident prevention regulations and local safety guidelines (1). • Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

(1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.

▲ WARNING
<p>LOSS OF CONTROL</p> <p>Perform a comprehensive commissioning test to verify that communication monitoring properly detects communication interruptions</p> <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

NOTICE
<p>DESTRUCTION DUE TO INCORRECT MAINS VOLTAGE</p> <p>Before switching on and configuring the product, verify that it is approved for the mains voltage.</p> <p>Failure to follow these instructions can result in equipment damage.</p>

Complete Drive System Power Off Procedure

Perform the following actions to verify the absence of voltage

Step	Description
1	Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
2	Wear appropriate personal protective equipment (PPE). e.g. Arc flash protection, helmet & visor, Insulation gloves.
3	Before disconnecting mains voltage, verify that the red LEDs of all power cells are ON by checking the LED state via the openings in the cabinet doors. If one or more of the red LEDs of the power cells are OFF, do not perform any further work, but contact your local Schneider Electric representative.

Step	Description
4	Switch OFF all main power supply and ground the mains breaker. Switch OFF all external auxiliary power supply (230V / 400V / ...) and lock them in off position.
5	Lock the grounding switch of the mains breaker with your personal lock and place a "Do Not Turn On" label on the medium voltage circuit breaker.
6	Wait 20 minutes to allow the DC bus capacitors to discharge. The DC bus LEDs located on each power cell are not an indicator of the absence of DC bus voltage.
7	Verify that the red LEDs on all power cells are OFF. If one or more of the red LEDs of the power cells remain ON for 20 minutes after the mains voltage has been disconnected, do not perform any further work, but contact your local Schneider Electric representative
8	Remove free key K0 from the medium voltage circuit breaker of the drive system and release the keys to open the cabinet doors.
9	Open the transformer cabinet doors and verify the absence of voltage with a properly rated voltage sensing device on the mains terminals and motor terminals.
10	If there is no voltage detected on the mains terminals, short circuit the input terminals to ground using a properly rated grounding equipment.
11	If there is no voltage detected on the motor terminals, short circuit the terminal to ground using a properly rated grounding equipment.
12	Verify that no other voltage is present in the drive system.

About the Book

Document Scope

The purpose of this document is to:

- give you mechanical and electrical information related to the ATV6000 drive.
- show you how to install and wire this drive.

Validity Note

The information in this manual is merely informative and maybe subject to modification.

Original instructions and information given in this manual have been written in English (before optional translation).

All pictures shown are for 3D illustration purpose only. Depending on the product chosen, product layout may vary.

This documentation is valid for the Altivar Process ATV6000 Medium Voltage Drives.

The asterisks (*) available to this document is linked to the following information: Based on previous data. This is not a guarantee of future performance or performance in your particular circumstances.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Use your tablet or your PC to quickly access detailed and comprehensive information on all our products on www.se.com.

The Internet site provides the information you need for products and solutions:

- The Handbook for detailed characteristics and selection guides,
- The CAD files to help design your installation,
- All software and firmware to maintain your installation up to date,
- Additional documents for better understanding of drive systems and applications
- And finally all the User Guides related to your drive, listed below:

(Other option manuals and Instruction sheets are available on www.se.com)

Title of Documentation	Catalog Number
Altivar Process range brochure	998-20307132 (English)
Recommended Cybersecurity Best Practices	CS-Best-Practices-2019-340 (English)
ATV6000 UL Handbook	GDE99017 (English), NNZ67544 (Spanish)
ATV6000 UL Installation Manual	GDE99019 (English), NNZ67545 (Spanish)
ATV6000 Programming Manual for Operator and Advanced Operator	QGH83265 (English), QGH83266 (French), QGH83268 (German), QGH83267 (Spanish), GDE94088 (Italian)
ATV6000 Embedded Ethernet Manual	PHA30472 (English)
ATV6000 Modbus SL Manual	MFR24213 (English)
ATV6000 PROFIBUS Manual	PHA30474 (English)
ATV6000 DeviceNet Manual	PHA30471 (English)
ATV6000 EtherCat Manual	PHA30473 (English)
ATV6000 Profinet Manual	PHA30475 (English)
ATV6000 CANopen Manual	PHA30470 (English)
SoMove: FDT	SoMove_FDT (English, French, German, Spanish, Italian, Chinese)
Altivar Process ATV6000: DTM	ATV6000 DTM Library EN (English)
Recommended Cybersecurity Best Practices	CS-Best-Practices-2019-340 (English)

You can download these technical publications and other technical information from our website at www.se.com/en/download

Terminology

The technical terms, terminology, and the corresponding descriptions in this manual normally use the terms or definitions in the relevant standards.

In the area of drive systems this includes, but is not limited to, terms such as **error**, **error message**, **failure**, **fault**, **fault reset**, **protection**, **safe state**, **safety function**, **warning**, **warning message**, and so on.

Among others, these standards include:

- IEC 61800 series: Adjustable speed electrical power drive systems
- IEC 61508 Ed.2 series: Functional safety of electrical/electronic/programmable electronic safety-related
- EN 954-1 Safety of machinery - safety-related parts of control systems
- ISO 13849-1 & 2 Safety of machinery - safety related parts of control systems
- IEC 61158 series: Industrial communication networks - Fieldbus specifications
- IEC 61784 series: Industrial communication networks - Profiles
- IEC 60204-1: Safety of machinery - Electrical equipment of machines – Part 1: General requirements

In addition, the term **zone of operation** is used in conjunction with the description of specific hazards, and is defined as it is for a **hazard zone** or **danger zone** in the EC Machinery Directive (2006/42/EC) and in ISO 12100-1.

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Technical Data and Features

Presentation

Control and Transformer Cabinet

Clever and modular arrangement of control section in front of transformer. This section with independent access allows the integration of additional components according to your personal needs.

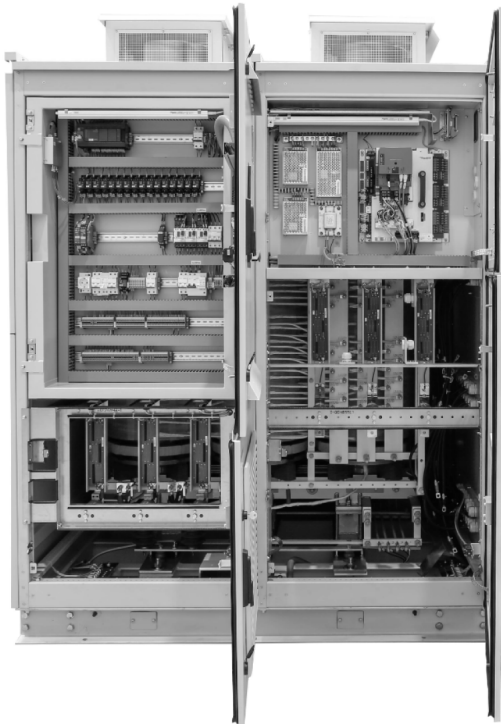


Fig. Control and transformer cabinet

Benefits

- Space optimized dimensions without squeezing components in small compartments, granting you a nominal service life avoiding hot spot inside the system.
- The integrated transformer and multilevel structure helps to avoid bearing currents in existing motors. This results in a capability to run your old motor on a new MV drive, leading to a drastic reduction of energy costs where your damper controlled fan or throttle controlled pump is concerned.

Power cells Cabinet

The power cells cabinet contains the inverter function of the ATV6000. It is a modular cabinet that can be used with the transformer cabinet according to the implementation requirements. The power cells are placed onto a fast-track system providing a convenient access to it.



Fig. Power cells cabinet and Power cell

Benefits

- Clear arrangement of components helping your team in maintenance and service
- Compact and low weight cell design saving maintenance shutdown time
- Easier installation to save time

Drive Topology

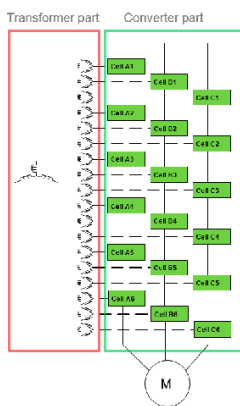


Fig. ATV6000 multilevel architecture

Its simple two level power cell design takes away the complexity of multilevel architecture and makes it into a clear and easy understandable technology. This saves your maintenance cost because the crew will easily understand Altivar 6000.

One of the core component of ATV6000 is the "Power cell". This "Power cell" is a single phase, two level output switching device, supplied by a 700/720 V low voltage winding of a transformer.

The big advantage of this is, that the switching elements are state-of-the-art LV components. By putting this AC - supplies in series, higher voltages are achieved. The number of "Power cells" determines the output voltage. Every cell provides a small step of motor supply, resulting in a smooth waveform. Phase shifting can be done on the secondary windings of transformer, allowing an elimination of harmonics of input.

The drive regulation system and control system are installed at front of the drive to provide an optimized footprint. The transformer and cell section can be separated for easy installation.

As an option the adequate cooling fans on top of the cabinet can be supplied by an additional secondary windings of the integrated transformer to avoid additional 3phase supplies for the drive

Schneider Electric offers this transformer in a standard efficiency as well as in increased high efficiency.

Benefits

Services-oriented drives

Increase availability and reduce Downtime for service continuity by 20%*



Improved operator efficiency

- Generation of robust, actionable, and relevant information
- Advanced communication and predictive maintenance capabilities
- Functionalities for remote intervention and online support
- Easy troubleshooting with QR code
- Comfortable usability with the connected 10" Magelis HMI screen
- Key performance indicators

Fast and easy on-site maintenance operation

- Quicker intervention
- Optimized management of spare parts stock with modular architecture
- Easy front access design

Digital services

More uptime & shorter recovery time with predictive maintenance and reduce TCO by 20%*



- Predictive maintenance, including continuous monitoring, risk assessment, and mitigation plan, with EcoStruxure™ Asset Advisor
- Identification of energy saving potential
- Optimized maintenance budgeting
- 360° diagnostics, with report and analysis
- Records of your crucial assets
- Access to 24/7 Schneider Electric service assistance

EcoStruxure Asset Advisor

Preventive analytics to increase operational performance of your drives systems



ATV6000 UL provides a unique solution to optimize the operation and maintenance of your installation. It allows you to manage maintenance tasks on your assets with preventive and predictive management based on real-time assessments and predictive analytics. All thanks to the combination of smart connected device technologies and powerful cloud-based risk prediction capabilities.

The ATV6000 UL with EcoStruxure Asset Advisor transforms data into insight to help run your operations more efficiently and safer, with more availability, and increased profits.

Continuous health monitoring

The operator gets a complete health monitoring view of its assets and conditions of usage (drive, transformer, motor) and the assets are seen as super-sensors providing relevant data and KPIs.

Risk evaluation

The operator knows in real-time where and what risks are on the installation. Predictive analytics constantly evaluates the level and criticality of risk by looking at an asset, the process duty cycle, and the condition of usage. This enables the ability to predict, in advance, a potential failure or dysfunction of the installation.

Risk mitigation

The operator receives notification of the necessary maintenance task required at the right time to secure the asset and production at minimal cost, mitigating the risks of downtime.

QR code interface

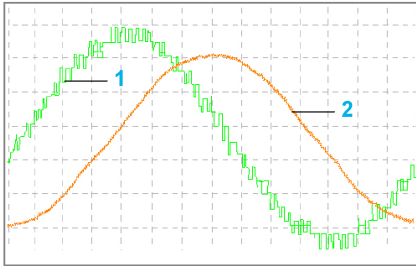
Empowered operator to improve efficiency



The ATV6000 UL provides a smart and easy to use QR-code interface to provide the operator with relevant drive information. With just one scan of the QR-code with a mobile device (as tablet or smartphone) on the name plate or the HMI screen you get easy access to technical documentation or technical online support for easy error management.

Energy management

Optimize usage of energy and reduce consumption by up to 30%*

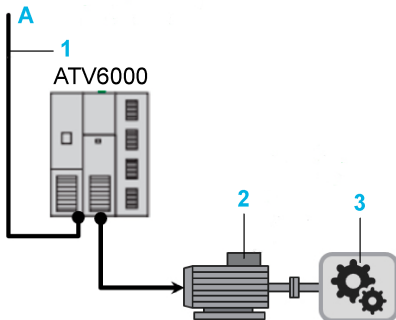


1 Voltage on motor side

2 Current on motor side

Better usage of energy

- Embedded power management with < 5% measurement error
- Key performance indicators and service life monitoring on energy usage
- Smart data collection and access to real-time information



A Mains

1 Drive input voltage, Drive input current, Drive input power

2 Motor current, Motor voltage, Motor speed, Motor winding & bearing temperature, Consumption kWh

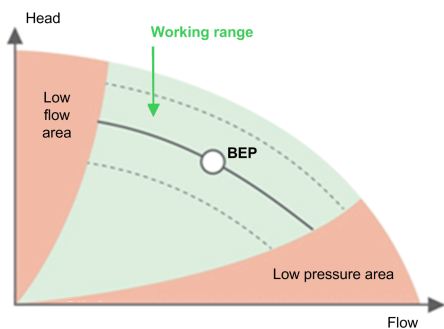
3 Over-/Underload, Stall, Cavitation, Flow, Pressure, BEP

Use of clean power

- Designed for seamless integration into installation
- No need to add harmonic mitigation on mains side
- Minimized energy waste
- Reduced motor losses, vibrations, and torque pulses with advanced harmonic-free technology

Process optimization

Improve productivity and availability by up to 20%*



BEP Best Efficiency Point Function

Error tolerant operations

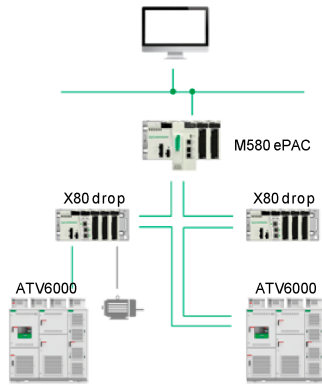
Equipped with level inverter bypass features, ATV6000 UL help to reduce process interruption.

Proactive maintenance approach

With improved warning functions in case of unusual conditions, and sophisticated measures to help protect equipment against damage. The ATV6000 UL is also highly modular, enabling fast maintenance operation.

Maximized performance and production output

Ensuring sustainable operation efficiency through making necessary adjustment in case of best efficiency point (BEP) deviation.



Our IIoT-enabled EcoStruxure solution

Provides compatibility with Process Expert System (PES) architectures, Modicon M580 controllers, and Foxboro EVO DCS systems.

The ATV6000's smart drive capabilities offer innovative features based on IIoT, mobility, detecting, analysing, and recommending solutions to boost your operation and maintenance activities.

The drive is EcoStruxure-ready, providing a complete integrated solution for overall equipment effectiveness.

It allows you to save time and exploit the full range of capabilities of your equipment on a single platform.

- EcoStruxure PES and Modicon™ M580-compatible, enabling use of dedicated libraries for quicker product implementation and commissioning
- DTM library and application function blocks provide full programming and diagnostic functions
- EcoStruxure Asset Advisor uses the drive as a super sensor for predictive maintenance

Tailored solutions

Deliver solutions to optimize your operation efficiency and investment (time & expenditure)

- Delivers a highly versatile platform to meet demanding customer requirements beyond those of standard drives
- Provides a high level of customization to fit specific purposes
- Offers flexibility with electrical or mechanical modifications and extensions easily delivered
- Utilizes a simplified design process and shortened system implementation time

General Technical Data

Input	18-48 pulse diode rectifier bridge.
Output	Multilevel PWM with 2 level low-voltage IGBT inverter cells.
Input voltage	<ul style="list-style-type: none"> • 2.4 kV, 4.16 kV, 6.6 kV • Variation: $\pm 10\%$
Allowable voltage fluctuation	The drive is subject to derating operation when the voltage drop of power supply is within -20% .
Input frequency	50/60 Hz $\pm 5\%$.
Incoming short circuit withstand	31.5 kA for 150 ms.
Inrush current	<p>The Multilevel topology implies that the input transformer is designed with the primary coil at the inner side at the opposite of usual distribution transformers. For that reason, the inrush current has a higher amplitude but is shorter in time.</p> <p>Typical values for ATV6000 are $\hat{I}_{inrush} = [8 \text{ to } 14] \times \sqrt{2} \times I_{input_RMS}$ with a time constant limited to 80 to 120ms.</p> <p>The amplitude increases when the supply short circuit power increases or the transformer power rating increases. The time constant increases when the transformer power rating increases.</p>
Overload capability	<ul style="list-style-type: none"> • Normal duty: 120 % 60 s/10 min and 150 % 3 s/10 min. • Heavy duty: 150 % 60 s/10 min, 185 % 3 s/10 min.
Total harmonics THD(i)	Comply with the requirements of power quality standard of IEEE519-2014. (When supplied by balanced network without preexisting pollution. For more details please contact Schneider Electric.)
Input power factor	≥ 0.96 from 20 % to 100 % of load.
Cable entry	Bottom (on request for others).
Frequency resolution	0.01 Hz.
Power cells command signals transmission	Fiber optic transmission.
Efficiency at rated power	Inverter efficiency is 98.5 %. Drive efficiency including input transformer is 96 % to 96.5 % depending on product.
Type of motor	Asynchronous motor, synchronous motor, permanent magnet motor (Surface / Interior magnet).
Three-phase output voltage for motor connection	0 to respective output voltage.
Output frequency	0.1 to 120 Hz.
Input transformer	Indoor type integrated in the frequency variable device, the dry phase-shifting transformer can be supplied for 18-66 pulse rectifier.
Control power supply	<p>100...240 Vac $\pm 10\%$ (47...63 Hz), 1 kVA up to 2 kVA capacity.</p> <p>Power supply must be secured (uninterrupted) or internal UPS option has to be selected.</p> <p>Other AC and DC voltage on request.</p>
Auxiliary power supply	100...240 Vac $\pm 10\%$ (47...63 Hz), 1 kVA up to 4 kVA depending on auxiliary options used.
Cooling fan power supply	<p>480 VAC $\pm 10\%$, 3-phase, 50/60Hz, actual capacity depending on drive reference.</p> <p>Other voltage on request.</p>
Communication protocols	Modbus TCP, EtherNet/IP, Modbus serial.
HMI	10 inch, color graphic, touch screen, multi-languages.
Control interface	8 DI, 3AI, 2AO, 3 relay output (more on request).
Degree of protection	UL type 1.
Paint	RAL 7035.
Panel thickness	2 mm .
Cooling	Forced air ventilation.

EMC	EN/IEC 61800-3 environment 2 category C4 for power, C3 for control.
Reference standard	IEC EN 61800-3, IEC EN 61800-4, IEC EN 61800-5-1, IEC EN 60529, IEEE 519 and other optional ones. C22.2 No.274-17 second edition, UL347A.
Product certification	CE, EAC, cULus.
Environment features	
Storage temperature	32°F to 122°F (0°C to 50°C).
Transportation temperature	-13°F to 158°F (-25°C to 70°C).
Working temperature	32°F to 104°F (0°C to 40°C), up to 122°F (50°C) possible with derating ⁽¹⁾ .
Relative humidity	Up to 90% (without condensation). Optional: maximum up to 95% (without condensation).
Altitude	≤3.280 ft (1.000m), up to 5.560 ft (2.000m) possible with derating.
Noise level	80/83/85 dB (A) .
Over Voltage Category	IEC61800 (Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy).
<ul style="list-style-type: none"> • Drive line side • Drive motor side • Secures Control power supply • Auxiliary and fan power supply 	<ul style="list-style-type: none"> • Category III • Category II • Category II • Category III
Pollution in accordance with IEC 61800-5-1	Pollution degree 2.
Environmental parameters (operation)	Refer to IEC60721-3-3.
<ul style="list-style-type: none"> • Climatic conditions • Mechanical conditions • Biological conditions • Chemical conditions • Mechanically active substances 	<ul style="list-style-type: none"> • 3K3 • 3M1 • 3B1 • 3C2 • 3S1
⁽¹⁾ : Derating must be applied on the drive system and the value of the derating is defined by Schneider Services depending on the customer application and the local environment conditions.	

⚠️⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Verify that environmental conditions such as temperature, relative humidity, air contamination, shock, and vibration comply with the specifications provided in the present manual.

Failure to follow these instructions will result in death or serious injury.

If one of the condition differs from the specifications, contact your local Schneider Electric representative.

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠️ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

Failure to follow these instructions will result in death or serious injury.

Type designation

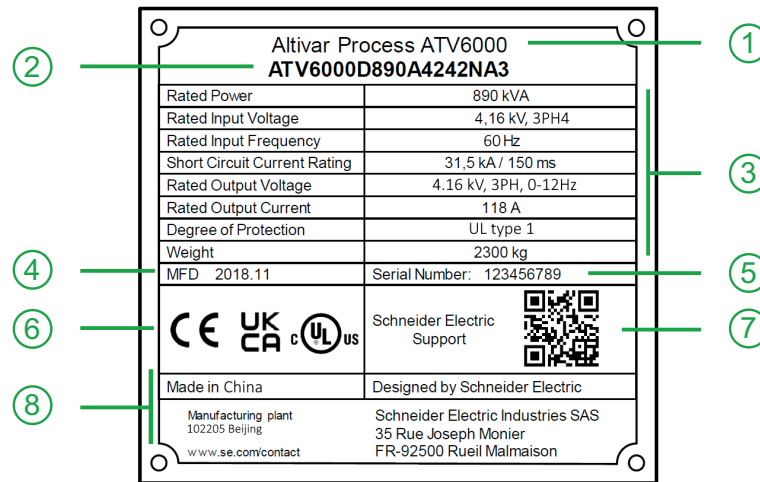
The product designation of the ATV6000UL consists of several points of reference (characters and figures). The meaning of each point is illustrated in the following example.

For ATV6000 UL

		ATV6000	C	470	A	66	66	N	D	3
Product Range										
ATV	6000									
Factor for power rating										
D	x 1 kVA									
C	x 10 kVA									
Transformer rating										
470	470									
...	...									
Cooling type										
A	Air cooled									
R	Redundant fan cooling									
Input voltage										
24	2.4 kV									
42	4.16 kV									
66	6.6 kV									
Output voltage										
24	2.4 kV									
42	4.16 kV									
66	6.6 kV									
Style										
N	No bypass									
B	Powercell bypass									
C	Powercell bypass n+1									
D	Powercell bypass n+2									
Standard										
D	cULus 60Hz Standard efficiency									
E	cULus 60Hz High efficiency									
K	cULus 50Hz Standard efficiency									
L	cULus 50Hz High efficiency									
IP rating										
3	UL Type 1 / IP31									
4	UL Type 1 / IP41									
5	UL Type 1 / IP42									

Nameplate Example

The nameplate contains the following data:



Legend

Marking	Description	Marking	Description
①	Product Type	②	Part number
③	Technical data	④	Manufacturing date
⑤	Serial number	⑥	Certifications
⑦	QR code	⑧	Legal information

NOTE: Use the nameplate to validate that the product characteristics are compatible with your local installation.

Selection and ordering data

Voltage class 2.4 kV

Power specifications for output voltage 2.4 kV, 9 power cells, 18 input pulses											
Model	Transformer rating (1)	Normal duty				Heavy duty				Power cell	
		Maximum motor shaft power (2)		Nominal continuous current	120% overload 1 min/10 mins	Maximum motor shaft power (2)		Nominal continuous current	150% overload 1 min/10 mins	Individual power cell rating	Max overload 3 sec/10 mins
		kVA	kW	HP	A	A	kW	HP	A	A	A
Voltage class: 2.4 kV (3)											
ATV6000D200A2424●●●	200	160	214	46	55.2	150	201	44	66	65	97.5
ATV6000D280A2424●●●	280	220	295	65	78	180	241	52	78	65	97.5
ATV6000D350A2424●●●	350	280	375	80.6	96.7	260	348	77	116	100	150
ATV6000D430A2424●●●	430	340	455	100	120	270	362	80	120	100	150
ATV6000D570A2424●●●	570	450	603	130	155	410	549	120	180	150	225
ATV6000D650A2424●●●	650	520	697	150	180	410	549	120	180	150	225
ATV6000D790A2424●●●	790	630	844	181	218	550	737	160	240	200	300
ATV6000D950A2424●●●	950	760	1019	220	264	610	818	176	264	220	330
ATV6000C122A2424●●●	1220	970	1300	280	336	770	1032	224	336	280	420
ATV6000C139A2424●●●	1390	1100	1475	320	384	880	1180	256	384	320	480
ATV6000C163A2424●●●	1630	1300	1743	374	449	1130	1515	328	492	410	615
ATV6000C178A2424●●●	1780	1420	1904	410	492	1130	1515	328	492	410	615
ATV6000C200A2424●●●	2000	1600	2145	460	552	1360	1823	392	588	490	735
ATV6000C213A2424●●●	2130	1700	2279	490	588	1360	1823	392	588	490	735
<p>(1) For higher drive power please contact Schneider Electric.</p> <p>(2) Values valid for synchronous motor and asynchronous motor. The specifications for the maximum motor shaft power is based on a motor efficiency of 95%, and power factor 0.88.</p> <p>(3) Please contact Schneider Electric for other combinations of input and output voltage.</p>											

Voltage class 4.16 kV

Power specifications for output voltage 4.16 kV, 12 power cells, 24 input pulses											
Model	Transformer rating (1)	Normal duty				Heavy duty				Power cell	
		Maximum motor shaft power (2)		Nominal continuous current	120% overload 1 min/10 mins	Maximum motor shaft power (2)		Nominal continuous current	150% overload 1 min/10 mins	Individual power cell rating	Max overload 3 sec/10 mins
		kVA	kW	HP	A	A	kW	HP	A	A	A
Voltage class: 4.16 kV (3)											
ATV6000D350A4242●●●	350	280	375	46.5	55.8	260	348	44	66	65	97.5
ATV6000D490A4242●●●	490	390	522	65	78	310	415	52	78	65	97.5
ATV6000D570A4242●●●	570	450	603	74.7	89.6	420	563	71	107	100	150
ATV6000D630A4242●●●	630	500	670	83	99.6	470	630	79	119	100	150
ATV6000D750A4242●●●	750	600	804	100	120	480	643	80	120	100	150
ATV6000D890A4242●●●	890	710	952	118	141	680	911	113	170	150	225
ATV6000C100A4242●●●	1000	800	1072	133	159	720	965	120	180	150	225
ATV6000C113A4242●●●	1130	900	1206	150	180	720	965	120	180	150	225
ATV6000C125A4242●●●	1250	1000	1341	166	199	950	1273	159	239	200	300
ATV6000C150A4242●●●	1500	1200	1609	199	239	960	1287	160	240	200	300
ATV6000C165A4242●●●	1650	1320	1770	220	264	1060	1421	176	264	220	330
ATV6000C188A4242●●●	1880	1500	2011	249	299	1340	1796	224	336	280	420
ATV6000C210A4242●●●	2100	1680	2252	280	336	1340	1796	224	336	280	420
ATV6000C240A4242●●●	2400	1920	2574	320	384	1540	2065	256	384	320	480
ATV6000C275A4242●●●	2750	2200	2950	365	438	1970	2641	328	492	410	615
ATV6000C308A4242●●●	3080	2460	3298	410	492	1970	2641	328	492	410	615
ATV6000C338A4242●●●	3380	2700	3620	448	538	2360	3164	392	588	490	735
ATV6000C369A4242●●●	3690	2950	3956	490	588	2360	3164	392	588	490	735

(1) For higher drive power please contact Schneider Electric.

(2) Values valid for synchronous motor and asynchronous motor. The specifications for the maximum motor shaft power is based on a motor efficiency of 95%, and power factor 0.88.

(3) Please contact Schneider Electric for other combinations of input and output voltage.

Voltage class 6.6 kV

Power specifications for output voltage 6.6 kV, 15 (18) power cells, 30 (36) input pulses											
Model	Transformer rating (1)	Normal duty				Heavy duty				Power cell	
		Maximum motor shaft power (2)		Nominal continuous current	120% overload 1 min/10 mins	Maximum motor shaft power (2)		Nominal continuous current	150% overload 1 min/10 mins	Individual power cell rating	Max overload 3 sec/10 mins
		kVA	kW	HP	A	A	kW	HP	A	A	A
Voltage class: 6.6 kV (3)											
ATV6000D450A6666●●●	450	355	476	37.1	44.5	330	442	35	52.5	65	97.5
ATV6000D570A6666●●●	570	450	603	47.1	56.5	430	576	45	67.5	65	97.5
ATV6000D630A6666●●●	630	500	670	52.3	62.7	470	630	50	75	65	97.5
ATV6000D780A6666●●●	780	620	831	65	78	590	791	62	93	100	150
ATV6000D890A6666●●●	890	710	952	74.3	89.1	670	898	71	107	100	150
ATV6000C100A6666●●●	1000	800	1072	83.7	100	760	1019	80	120	100	150
ATV6000C119A6666●●●	1190	950	1273	100	120	760	1019	80	120	100	150
ATV6000C138A6666●●●	1380	1100	1475	115	138	1050	1408	110	165	150	225
ATV6000C163A6666●●●	1630	1300	1743	136	163	1140	1528	120	180	150	225
ATV6000C179A6666●●●	1790	1430	1917	150	180	1140	1528	120	180	150	225
ATV6000C200A6666●●●	2000	1600	2145	167	201	1520	2038	160	240	200	300
ATV6000C225A6666●●●	2250	1800	2413	188	226	1520	2038	160	240	200	300
ATV6000C263A6666●●●	2630	2100	2816	220	264	2010	2695	211	317	280	420
ATV6000C288A6666●●●	2880	2300	3084	241	289	2140	2869	224	336	280	420
ATV6000C334A6666●●●	3340	2670	3580	280	336	2140	2869	224	336	280	420
ATV6000C382A6666●●●	3820	3050	4090	320	384	2930	3929	307	461	410	615
ATV6000C425A6666●●●	4250	3400	4559	356	427	3130	4197	328	492	410	615
ATV6000C489A6666●●●	4890	3910	5243	410	492	3740	5015	392	588	490	735
ATV6000C538A6666●●●	5380	4300	5766	450	540	3740	5015	392	588	490	735
ATV6000C585A6666●●●	5850	4680	6275	490	588	3740	5015	392	588	490	735
<p>(1) For higher drive power please contact Schneider Electric.</p> <p>(2) Values valid for synchronous motor and asynchronous motor. The specifications for the maximum motor shaft power is based on a motor efficiency of 95%, and power factor 0.88.</p> <p>(3) Please contact Schneider Electric for other combinations of input and output voltage.</p>											

Key Interlock System

Main Features

Key interlock system is used to help to prevent opening a door when the mains supply is present and also helps to prevent powering on the drive system when a door is still unlocked. (Only the control cabinet is unlocked when the mains supply is applied).

Key box is used to mechanically lock electrical installations. The basic functionalities are:

- The lock only can work with special key.
- The lock must self- lock (i.e. cannot rotate) without special key.
- The key can not be pulled out when it is rotated to locked position.
- The lock can not popup the key automatically. Hereafter, a 4 key product example.



Figure 1-8

NOTE: the keys for interlock system are located in a file box inside the control cabinet.

Description

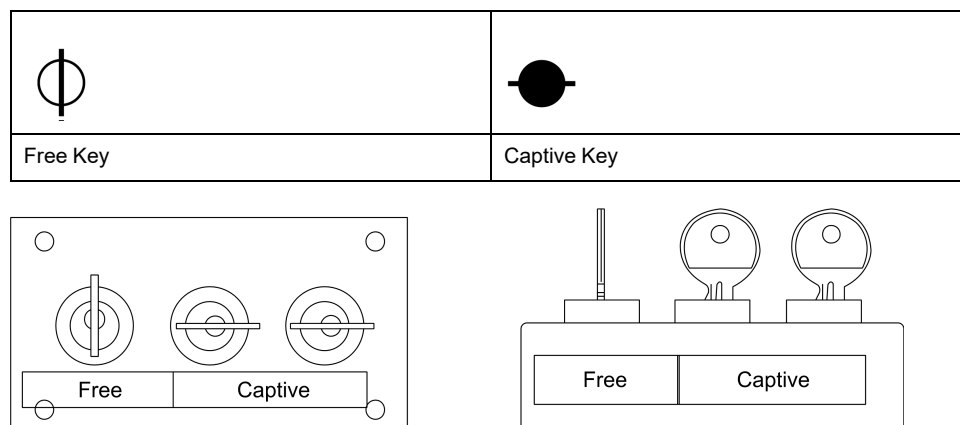
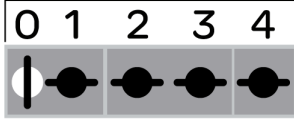
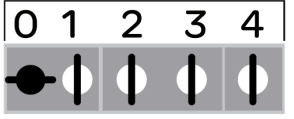


Figure 1-9

Power on Procedure

Step	Action
1	<p>Once installation is completed, close all the doors and take the captive key out of each door.</p> <p>Closed door:</p>  <p>Figure 1-10</p> <p>The free key 0 only can be released when the captive keys 1,2,3,4 have been turned to captive position.</p>
2	Put the keys from all the doors into the key box then turn to captive position (control compartment is not part of the interlock system).
3	Take the free key out after all the captive keys are in the captive position.
4	Switch off the grounded switch of the QF1 Medium Voltage Circuit Breaker (QF1 MVCB), interlock the free key with QF1 MVCB.
5	Get authorization from the person(s) in charge to work on and with this equipment to Power On.

Power off Procedure (for Maintenance)

Step	Action
1	Switch the QF1 MVCB off then switch on its grounding switch.
2	Take the free key out the QF1 MVCB.
3	Put the free key into the key box and turn to captive position.
4	<p>Turn the captive keys to free position and then take them out to open the corresponding door for maintenance.</p> <p>Opened door:</p>  <p>Figure 1-11</p> <p>The 1,2,3,4 keys may be released when the free key 0 has been turned to the captive position.</p>

NOTE: If the free key K0 we provide cannot be used as the Key for the QF1 MVCB cabinet, it's mandatory to attach the both keys together on a permanent manner (Free Key k0 and MVCB Key) to forbid to use them separately.

An interlock compatible box can be provided as an option.

The standard brand of mechanical locks provided for the ATV6000 is STI. In case the key of the QF1 Medium Voltage Circuit Breaker (QF1 MVCB) and the key K0 of the VSD cannot be attached together, it is possible to supply a QF1 MVCB compatible box if brands such as Fortress or others are used on site. The interlock compatible box has a dual cylinder lock system: one cylinder for the QF1 MVCB's brand and the other is a "Free key" lock, from the brand STI.

- Once the QF1 MVCB's brand and key identification code of lock cylinder is provided, a QF1 MVCB interlock compatible box such as the picture can be provided.
- The QF1 MVCB's key can only be released when the "Free key" (K0) is inserted into the compatible box and turned to the captive position.
- Switch off the grounded switch of the QF1 MVCB; lock the QF1 MVCB with the QF1 MVCB's key.

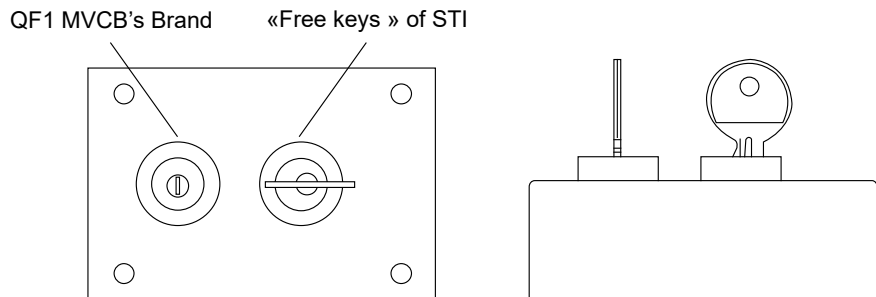


Figure 1-12

Dash Blocks (out of supply scope)

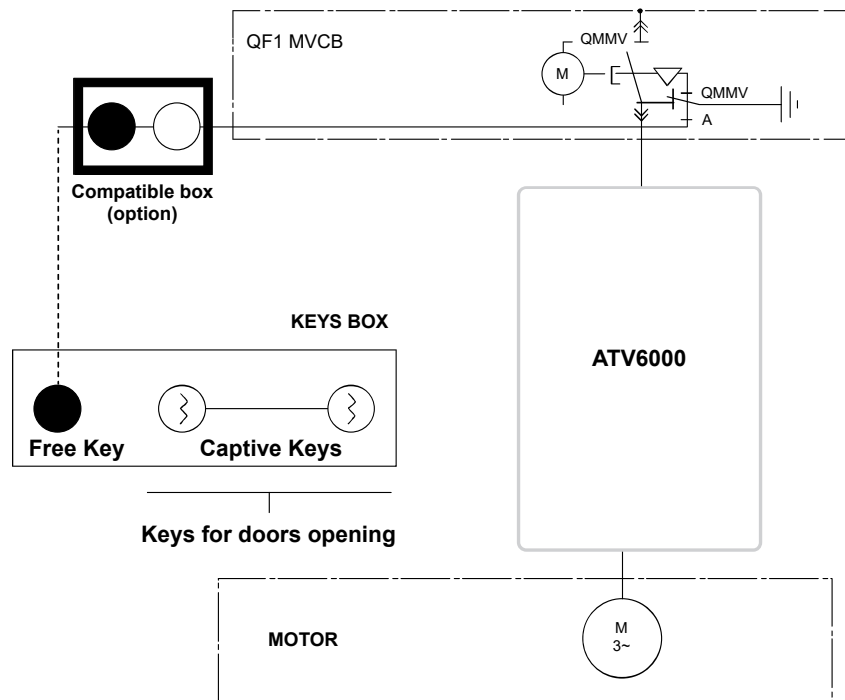


Figure 1-13

Mechanical Interlock with QF1 Medium Voltage Circuit Breaker (QF1 MVCB)

The QF1 MVCB can be switched on only if the free key "K0" is taken out from the key box and interlocked with the QF1 MVCB. Once the QF1 MVCB is powered on,

the free key is trapped and cannot be taken out, so that the doors cannot be opened.

To open the doors for maintenance purposes, the free key can be removed from the QF1 MVCB only if the QF1 MVCB is grounded. If any door is opened, the QF1 MVCB cannot be powered on.

Steps for Setting Up

Procedure

1. Receive and inspect the drive

- Check that the part number printed on the label is the same as that on the purchase order.
- Remove the drive from its packaging and check that it has not been damaged.

2. Verify the supply voltage

- Verify that the supply voltage is compatible with the voltage range of the drive.

3. Mount the drive

- Mount the drive in accordance with the instructions in this document.
- Install any internal and external option.

Steps 1 to 4 must be performed with the power off.



4. Wire the drive

- Connect the line supply, ensuring that the drive is grounded whilst the power supply is off.
- Connect the motor, ensuring that its connections correspond to the voltage.
- Connect the control wires according to the drawing.

5. Commissioning and programming

- Contact your local Schneider Electric representative.

Transportation, Storage and Disposal

Transport and Storage Conditions

The product should be protected from rain and excessive sun exposure. The room where the drive is stored should be well dry and ventilated, ensure that there is no corrosive gas in the storage room.

The following temperature range is permissible during transportation and storage:

- Transportation temperature: -25°C to 70°C (-13°F to 158°F)
- Storage temperature: 0°C to 50°C(32°F to 122°F)

The following relative humidity is permissible during transportation and storage:

- Relative humidity: up to 90%(without condensate)

If the product is stored for more than six months, the oxidation and aging of cabinets and components of ATV6000 UL must be inspected completely.

Long Time Storage for the Drive or Power Cell (as spare parts)

If the drive or the power cell (as spare parts) were not connected to mains for an extended period of time, the capacitors must be restored to their full performance before the motor is started.

NOTICE

REDUCED CAPACITOR PERFORMANCE

- Apply mains voltage to the drive for one hour before starting the motor if the drive has not been connected to mains for 12 months.
- Verify that no Run command can be applied before the period of one hour has elapsed.

Failure to follow these instructions can result in equipment damage.

If the specified procedure cannot be performed without a Run command because of internal mains contactor control, perform this procedure with the power stage enabled, but the motor being at standstill so that there is no appreciable mains current in the capacitors.

Long Time Storage for the Optional Internal UPS

If UPS does not work for a long time, it must be charged and discharged completely once every 6 months to help ensure the service life of the battery.

Storage and Handling Instructions for Spare Parts

NOTICE

RISK OF COMPONENT DAMAGE DUE TO INCORRECT HANDLING AND STORAGE

- Apply static-free precautions when handling these components.
- Do not touch components without wearing a wrist grounding strap.
- Put the component on a grounded working surface to help protect against electrostatic discharges.
- Take components only at their edges.
- The storage conditions and the packaging must be checked regularly.
- Any damage that occurs during the storage period must be repaired immediately.
- Follow the “storage place requirements” described below.

Failure to follow these instructions can result in equipment damage.

Storage place requirements:

- Protected against vibration and shocks.
- Free from dust, sand, vermin, and insects.
- Free from corrosive gases, salt mist, and others that could damage electronic equipment.
- Keep dry; relative air humidity up to 90% without condensation.
- Keep spare parts in their original packaging.
- Store printed circuit board assembly in anti-static bags or boxes.
- Storage temperature range: 0°C to 50°C(32°F to 122°F).

Damaged products or accessories may cause electric shock or unanticipated equipment operation.

⚠️⚠️ DANGER

ELECTRIC SHOCK OR UNANTICIPATED EQUIPMENT OPERATION

Do not use damaged products or accessories.

Failure to follow these instructions will result in death or serious injury.

Contact your local Schneider Electric sales office if you detect any damage whatsoever.

Unpacking and Inspection

Proceed as follows:

Step	Action
1	Remove all packaging material carefully. Do not use sharp tools.
2	Check if drive and spare parts are not damaged.
3	Check if deliveries are consistent with the purchase order and the packing list.
4	Contact your local Schneider Electric sales office if you detect any damage whatsoever. The user must record any damage in detail, obtain a confirmation signature from the carrier, take photos.
5	Reserve the package of spare parts that can be recycled for transportation in case of repair is required.

▲ CAUTION

INCORRECT UNPACKING

Do not use sharp tools to open the packaging.

Failure to follow these instructions can result in injury or equipment damage.

End of Life / Disposal

The components of the product consist of different materials which can be recycled and which must be disposed of separately.

- Dispose of the packaging in compliance with all applicable regulations.
- Dispose of the components of the product in compliance with all applicable regulations.

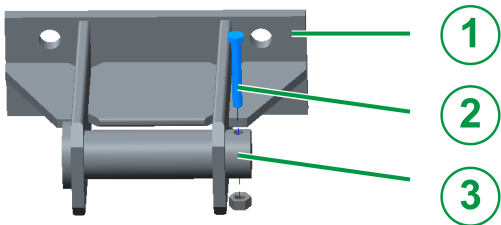
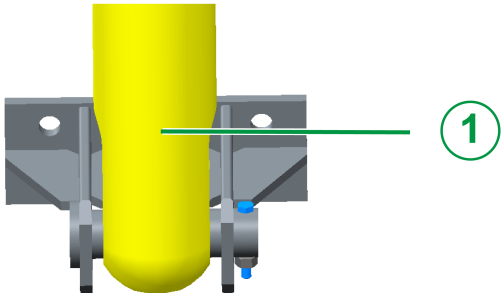
Lifting and Transport

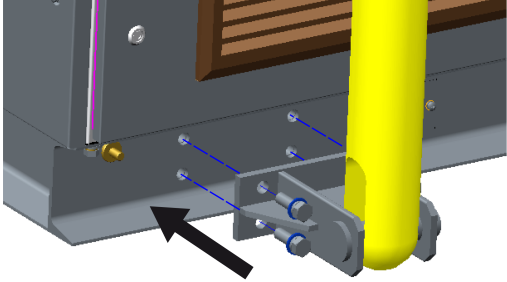
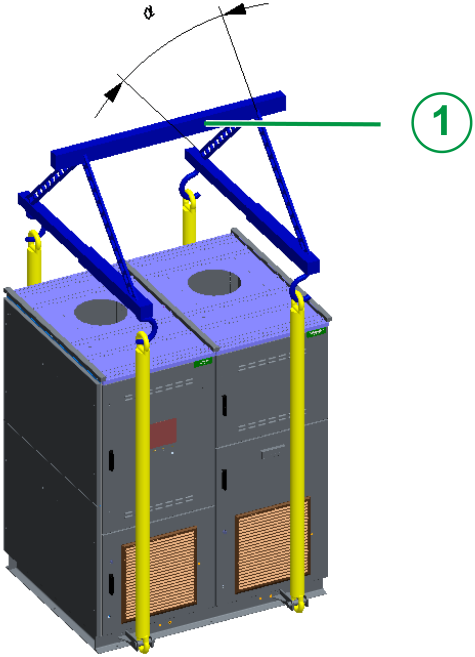
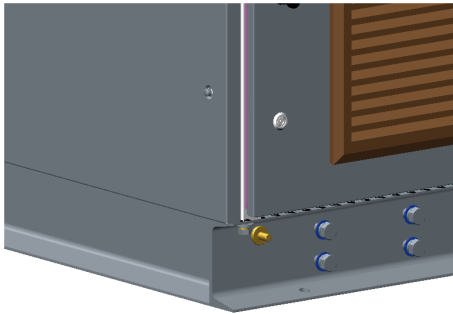
Verify the size and weight of ATV6000 UL to choose proper lifting equipment. It is required to have the general layout drawing which contains relevant dimensions and weight information of the product before it is transported.

⚠ WARNING
<p>INCORRECT LIFTING AND HANDLING</p> <ul style="list-style-type: none"> • Lifting and handling must be performed by qualified personnel in accordance with the requirements of the site and in compliance with all pertinent regulations. • Use lifting and handling equipment appropriate for the load and take all necessary measures to avoid swinging, inclination, toppling and any other potentially hazardous conditions. • Verify that there are no persons or obstructions in the area of operation of the lifting and handling equipment. • Use a cross spreader to lift and handle the product. • To prevent possible damage to the frame of equipment from excessive compressive forces by lifting belts, ensure the angle is not less than 30°, additional spreader beams need be equipped if necessary. • During lifting and handling, do not exceed an acceleration of 0.1 m/s² and a speed of 6m/min. • Load swinging must be less than 6°. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

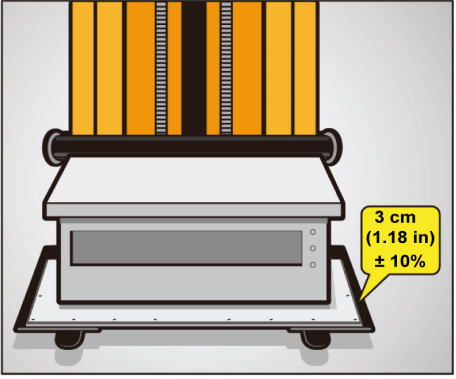
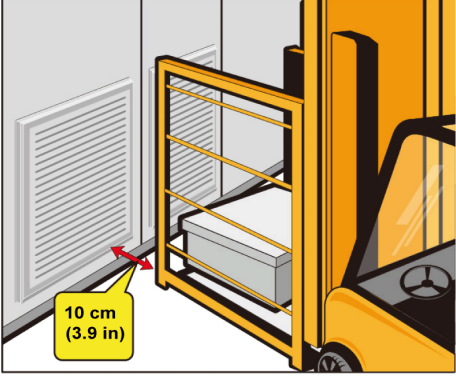
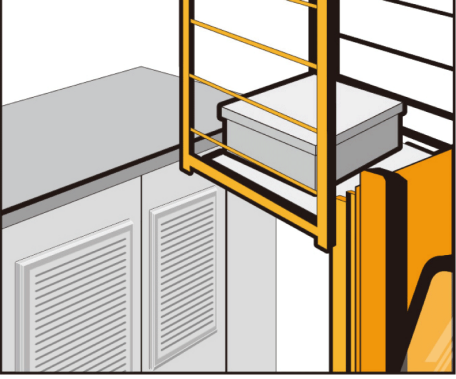
Cabinet Lifting

Lifting equipment and lifting belts are not part of the delivery and must be provided by the customer.

Mounting steps	Key points	Illustration
Unscrew the M8 screw, pull out the clevis pin.	4 lifting lugs is packed in drive package. NOTE: There are two sizes of lifting lugs : ≤10t and ≥10t.	 <p>1 Lifting lugs 2 M8 screw 3 Clevis pin</p>
Insert the clevis pin within the lifting belt, secure the clevis pin with the M8 screw and nuts. Refer to the torque setting table		 <p>1 Lifting belt</p>

Mounting steps	Key points	Illustration
<p>Remove the screws from base frame, assemble the lifting lugs on the base frame then tighten the screws. Refer to the torque setting table</p>	<p>M16 bolt for the drive which weight less than 10 tons, M20 for the drive which weight more than 10 tons.</p>	
<p>Use 4 lifting belts to lift the cabinet to the final position.</p>	<p>The load bearing of each lifting must not be less than 20 tons of load capacity.</p>	 <p>α: angle $\geq 30^\circ$</p> <p>1: lifting equipment</p>
<p>Remove the lifting lugs and take out the lifting belts, then reassemble the screws on the base frame.</p>		

Cooling Fan Lifting

Mounting steps	Key points	Illustration
<p>Move the assembled cooling fan on the forklift.</p>	<p>The distance must be 3 cm±10% between each outer side of forklift arm and the side edge of the fan.</p>	 <p>3 cm (1.18 in) ± 10%</p>
<p>Transport the cooling fan to the cabinet using the forklift, forklift arms facing the front of the cabinet.</p>	<p>Keep the forklift front ends at least 10 cm from the cabinet.</p>	 <p>10 cm (3.9 in)</p>
<p>Lift the forklift arms to the same height as the cabinet top; stop the forklift, and then the worker on the cabinet top may move the cooling fan to the top of the cabinet.</p> <p>NOTE: Take appropriate measure to secure the position of the worker in compliance with your national and local safety regulations.</p>	<ol style="list-style-type: none"> 1. The lifting height of the forklift arms shall be at the same level of the cabinet top. 2. The worker can move the cooling fan only after the forklift has stopped. 	
<p>See Cooling Fan Installation, page 47.</p>		


Mechanical Installation

General Notes on Mechanical Installation

Overview of Installation

Note: All pictures shown are for 3D illustration purpose only. Depending on the product chosen, product layout may vary.

Conductive foreign objects may cause parasitic voltage.

 DANGER	
ELECTRIC SHOCK AND/OR UNANTICIPATED EQUIPMENT OPERATION	
<ul style="list-style-type: none">• Keep foreign objects such as chips, screws or wire clippings from getting into the product.• Verify correct seat of seals and cable entries in order to avoid deposits and humidity.	
Failure to follow these instructions will result in death or serious injury.	

Dimensions

Refer to the general layout drawing shipped with the drive for information on:

- Cabinet dimensions
- Maintenance space
- Foundation plan

Cabinet Top

It is not allowed to install any foreign device on the top of the cabinet.

Cabinets Fixed

Verify the drive cabinets are reliably fixed, one of the two methods below must be followed.

- The base of ATV6000 UL must be connected to the embedded channel steel by spot - welding.
- Match the cabinet base with specially designed fixing holes by which VSD cabinet is fixed on the ground.

Floor fixings are not supplied. Anchor bolts or screws and nuts of size M14 are recommended.

NOTE: For fixing holes, refer to the Foundation Plan, also available in the Handbook Manual GDE99017 (English).

Foundation Requirements

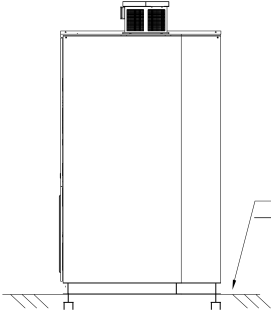
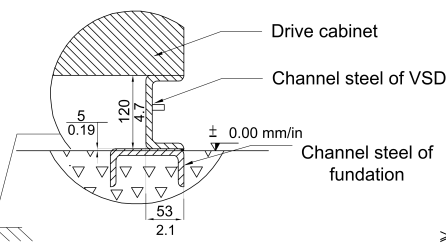
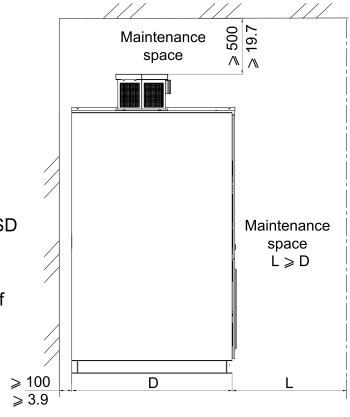
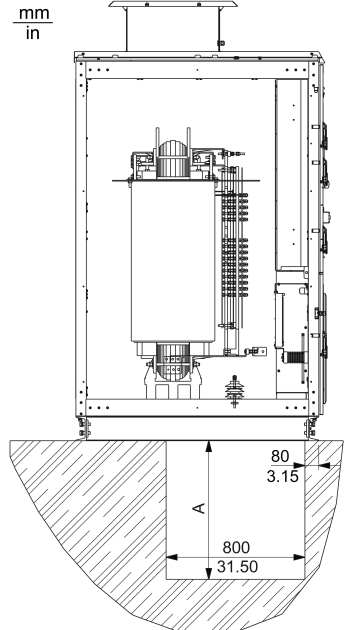
Foundation Requirements

Before installation, the foundation for ATV6000 UL positioning must be prepared by the user. The floor must be made of non-flammable material, with smooth and non-abrasive surface, protected against humidity diffusion, level, and able to support the cabinet.

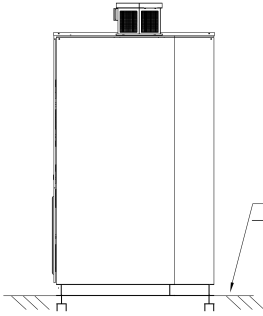
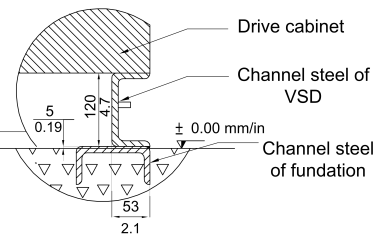
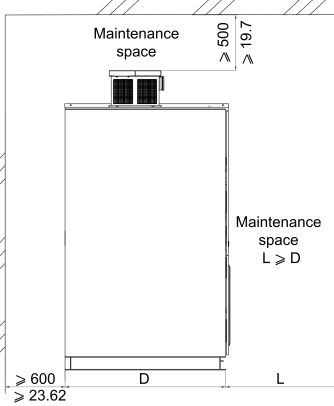
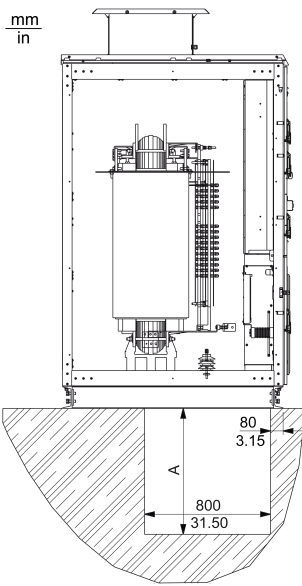
The suggestions for the foundation depend on your ATV6000 UL configuration.

NOTE: Cable trench has to be prepared for bottom-in cable connection.

Front access:

<p>1</p>	<p>The embedded channel steel must be 5 mm higher than the ground. In order to increase the stress area, the length of the embedded channel steel must be 400 mm longer than the base of the ATV6000 UL (200 mm longer for left and right sides respectively), the quality of the embedded channel steel installation must be guaranteed.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>$\frac{\text{mm}}{\text{in}}$</p> <p>Right side</p>  </div> <div style="text-align: center;"> <p>Detail of foundation</p>  </div> <div style="text-align: center;"> <p>Left Side</p>  </div> </div> <p>Figures 4-1 Foundation plan</p>
<p>2</p>	<p>Cable ducts should be of non-flammable material and of a non-abrasive surface. All cable entries and exits should be protected against dust, humidity, and animals entering into the drive. Suitable fire protection measures should be applied to prevent fire from the drive.</p>
<p>3</p>	<p>Cable trench considerations</p> <p>Standard design of ATV6000 UL is for cable entry from bottom (cable entry from top is available as option).</p> <p>Therefore a corresponding cable trench has to be prepared for appropriate cable connection.</p> <div style="text-align: center;"> <p>$\frac{\text{mm}}{\text{in}}$</p>  </div> <p>A) The depth of cable trench is depending on the required bending radius of the used cable type and cross section.</p>

Front & Rear access:

<p>1</p>	<p>Depending on the model, the drive may require a 600 mm rear access for maintenance.</p> <p>The embedded channel steel must be 5 mm higher than the ground. In order to increase the stress area, the length of the embedded channel steel must be 400 mm longer than the base of the ATV6000 UL (200 mm longer for left and right sides respectively), the quality of the embedded channel steel installation must be guaranteed.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>$\frac{\text{mm}}{\text{in}}$</p> <p>Right side</p>  </div> <div style="text-align: center;"> <p>Detail of foundation</p>  </div> <div style="text-align: center;"> <p>Left Side</p>  </div> </div> <p>Figures 4-2 Foundation plan</p>
<p>2</p>	<p>Cable ducts should be of non-flammable material and of a non-abrasive surface. All cable entries and exits should be protected against dust, humidity, and animals entering into the drive. Suitable fire protection measures should be applied to prevent fire from the drive.</p>
<p>3</p>	<p>Cable trench considerations</p> <p>Standard design of ATV6000 UL is for cable entry from bottom (cable entry from top is available as option).</p> <p>Therefore a corresponding cable trench has to be prepared for appropriate cable connection.</p> <div style="text-align: center;"> <p>$\frac{\text{mm}}{\text{in}}$</p>  </div> <p>A) The depth of cable trench is depending on the required bending radius of the used cable type and cross section.</p>

Cabinet Installation

Typical ATV6000 UL consists of two cases:

- Front access drive with transformer and control cabinet + power cell cabinet
- Front & Rear access drive with transformer cabinet + control cabinet + power cell cabinet

The ATV6000 UL is disassembled into different parts according to cabinets:



Figure 4-3 Front view of ATV6000

1. Transformer and control cabinet
2. Power cell cabinet

Note of Integrated Transportation

ATV6000 UL is designed as integrated transportation for the 145, 245, 335 types of power cells. Power cell is fastened on its rail by front and back screws for easy and quick installation.

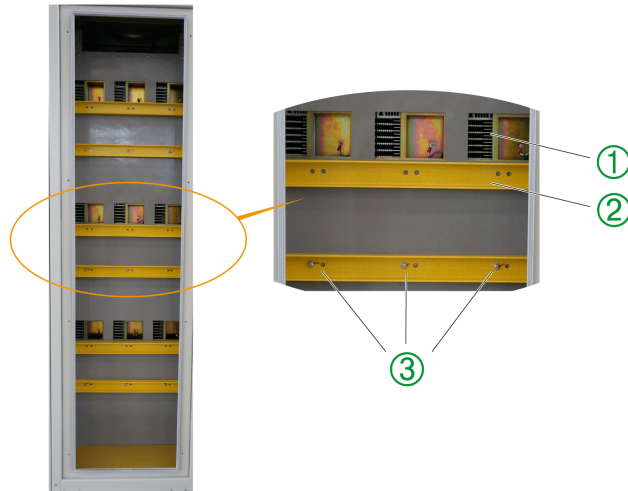


Figure 4-4 Back view of power cell cabinet

- 1. Power cell
- 2. Bearing beam
- 3. Fastening screws

For front access before mounting against a wall, the fastening screws at the rear of the power cell cabinet must be removed (the fastening screws must be kept for future transportation of the cabinet.).

Procedure:

Step	Action
1	Open the doors on the back side of the power cell cabinet;
2	Remove the fastening screws, refer to the following illustration (Rear view A or B);
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Rear view A (1 fixation screw for each power cell)</p> </div> <div style="text-align: center;"> <p>Rear view B (2 fastening screws for each power cell)</p> </div> </div> <ul style="list-style-type: none"> 1. Power cell 2. Bearing beam 3. fastening screws
3	Close the back side doors after confirming that the product is well-grounded.

Cabinet Combination

Before fixing the cabinets on the base by anchor bolts, the cabinets need to be combined.

⚡ ⚠ DANGER

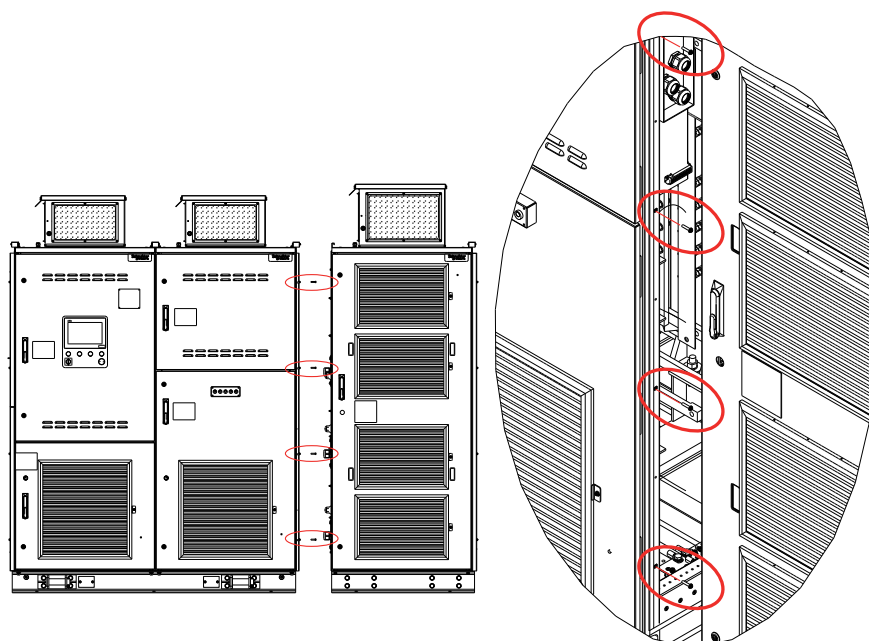
ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING

- Join all cabinets by means of the bolts provided with the drive system as shown in the figures below.
- Fasten the bolts with the tightening torques specified in this document.

Failure to follow these instructions will result in death or serious injury.

The connection between transformer cabinet and power cell cabinet must be precisely adjacent to help ensuring that the doors can easily be opened and closed:

Between transformer cabinet and power cell cabinet:



8 M6 bolts are fixed to the cabinet (4 M6 bolts at the front of cabinet, 4 M6 bolts at the back of cabinet), according to the tightening torque given in the table 5-1, page 53.

- Units must be bolted or welded to the channel steel embedded in the concrete.
- Verify that the electrical resistance of the channel steel embedded in the concrete is equal to or less than 1 Ohm.

Instructions for Cabinet Combination

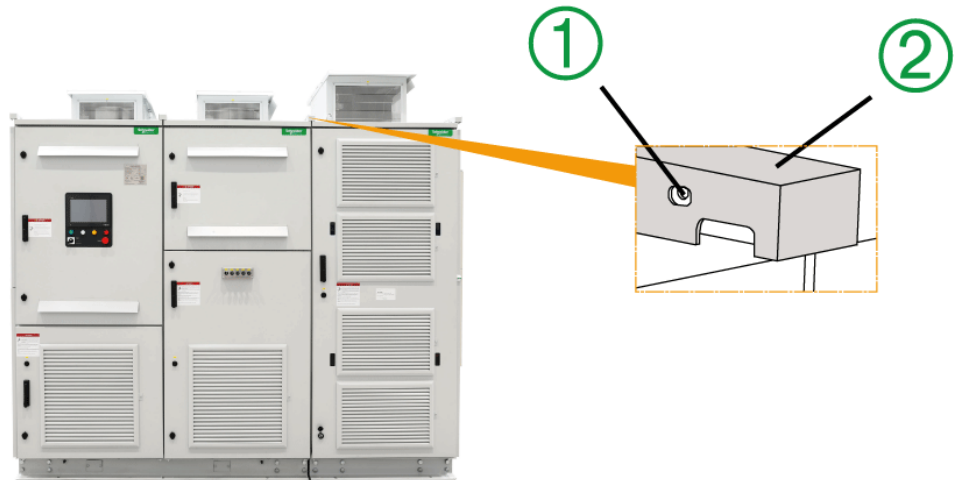


Figure 4-6

1 Screw

2 Cabinet cover plate

Step	Action
1	Place the cabinet cover plate on top of the cabinet to cover the gap.
2	Use the M6*16 screws (contained in spare parts box) to fasten the cabinet cover plate, according to the tightening torque given in the table 5-1, page 53.

Power Cell Installation

Power Cell Inspection (Before Installing):

Conduct a careful inspection before installing power cells:

Step	Action
1	Confirm that the technical label of power cell is consistent with the nameplate of the drive.
2	Confirm that each power cell is referring to the same drawing number.

Markings Specification

NOTICE
<p>IMPROPER CONNECTION AND LAYOUT</p> <ul style="list-style-type: none"> The head of the optical fiber and its socket must be clean and fixed. Never pull or bend it. Bending radius no less than 50 mm. The Color of the optical fiber heads and sockets must be the same. <p>Failure to follow these instructions can result in equipment damage.</p>

Step	Action
1	Each power cell is marked with a part reference, for example: APVa1, APVa2..., APVb1, APVb2..., APVc1, APVc2..., which indicates the location of the cell in the system: e.g. APVa1 is the marking of the first cell of L1/A phase.
2	Each power cell has 2 fuses, 2 optical fiber sockets (J1, J2) and 3 input terminals. Each terminal is marked with L1-LV, L2-LV, L3-LV, which indicates the input terminals of each phase.

Power Cell Installation

⚠️ DANGER
<p>HAZARD OF FIRE OR ELECTRIC SHOCK</p> <p>Tightening torques must comply with the specifications provided in this document</p> <p>Failure to follow these instructions will result in death or serious injury.</p>

For drives using power cells type 510 and 710, the power cells are delivered separately and must be installed on site.

Step	Action
1	Install power cells (510 or 710 type, if the current is above 320 A) by sliding them into the cabinet channels, verify that the power cells are correctly positioned.
2	Input power wiring connection: Connect the input terminals (L1-LV, L2-LV...) and input fuses, according to the tightening torque given in the table 5-1, page 53. See the drawing in step 4 below.
3	Connection between the power cells: Connect the terminal V with terminal U between two adjacent power cells using a copper bar, according to the tightening torque given in the table 5-1, page 53. The cells of the same phase are connected in series. See the drawing in step 4 below.
4	Communication wirings connection used to connect the power cell and master controller: Insert the optical fiber cables.

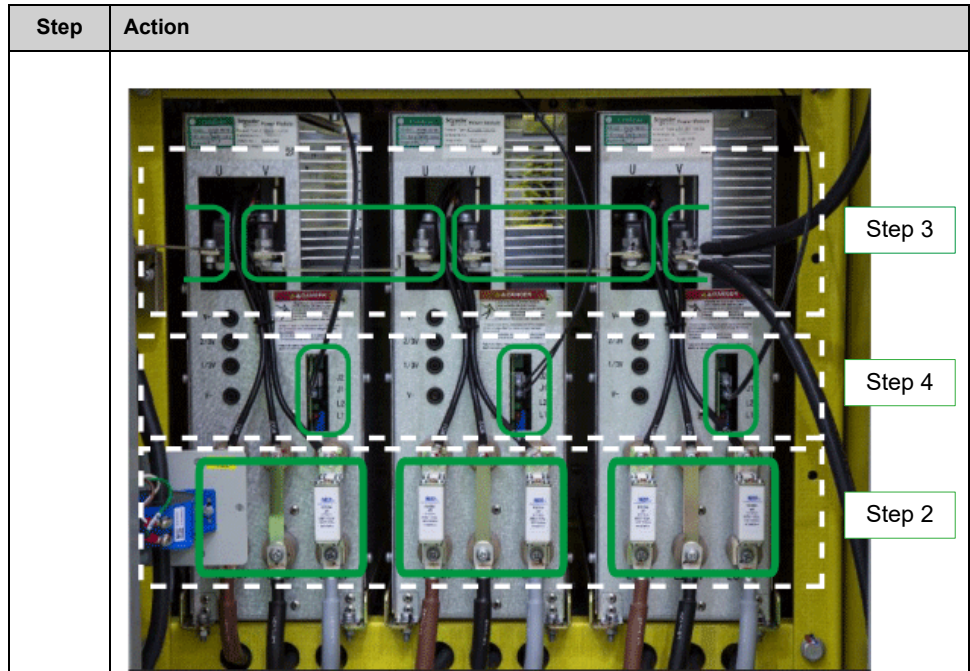
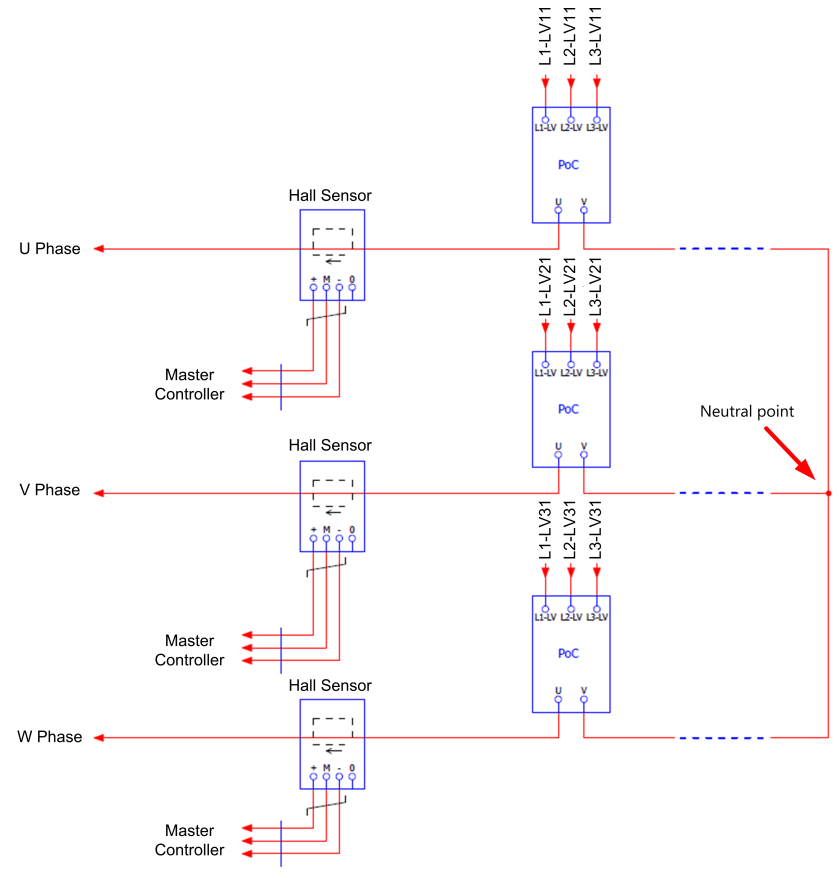


Figure 4-7 configuration drawing of installed power cells.

5 Connection between the neutral points: The output terminal V of each cell at the end of every phase is connected at neutral point using cables or a copper bar, according to the tightening torque given in the table 5-1, page 53. See the drawing as below step 6.

6 Connection of output cables: Connect the terminal U of the cells which is the first one in each phase with output cables, the hall sensor should be mounted with a cable/copper bar passing through it.

NOTE: Plug the connectors of hall sensor to the Master controller terminal.

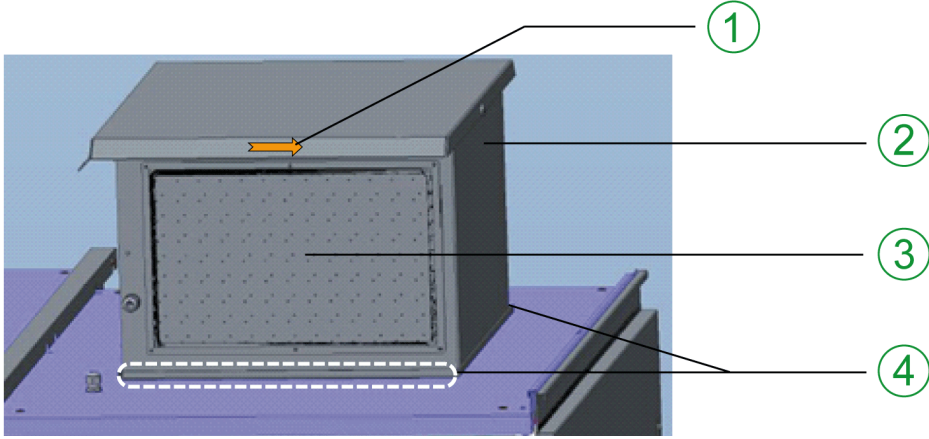
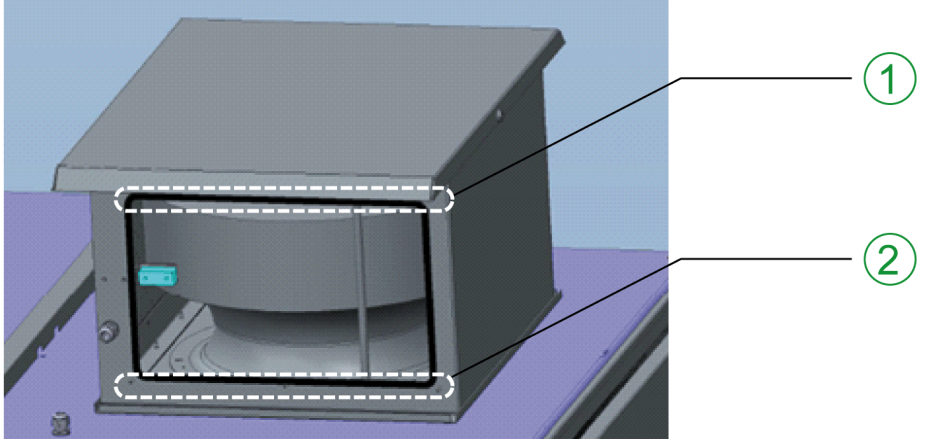


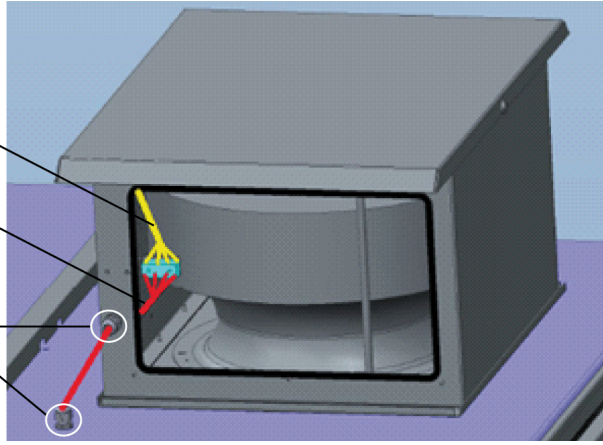
NOTE: For details refer to the drawing delivered in the drive package.

Cooling Fan Installation

Procedure

For convenience during transportation, cooling fans are packed individually. Carefully distinguish power cell cabinet cooling fans and transformer cabinet cooling fans according to drawings and labels before installing cooling fans.

Step	Action
<p>1</p>	<p>Mount the fan and fan housing on the top of cabinet. The face with yellow arrow should be faced towards front side of cabinet.</p> <p>Use 5 M8 bolts (contained in the spare parts box) to fasten the fan housing, according to the tightening torque given in the table 5-1, page 53.</p>  <ol style="list-style-type: none"> 1. The yellow arrow represents direction of fan rotation 2. Fan and fan housing. 3. Front dust filter. 4. 3 M8 bolts (2 M8 for rear side)
<p>2</p>	<p>Remove the front dust filter (6 M4 nuts) from fan housing and keep it.</p>  <ol style="list-style-type: none"> 1. 3 M4 bolts. 2. 3 M4 bolts.

Step	Action
3	<p>Connect fan wire with terminal and power wire with terminal through PG gland (the wirings according to the drawings in the drive package).</p>  <p>1. Fan wire. 2. Power wire. 3. PG gland.</p> <p>NOTE: The red power fan cable is inside the cabinet (on the top).</p>
4	Install the front dust filter with 6 M4 nuts.
5	Mount the fan cover for each fan if provided. (Option for air duct)

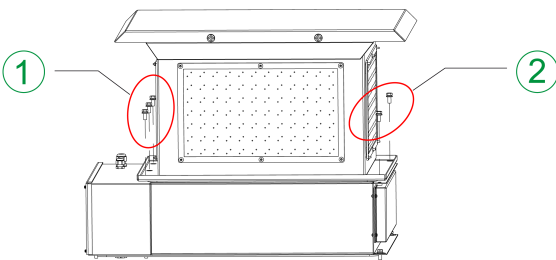
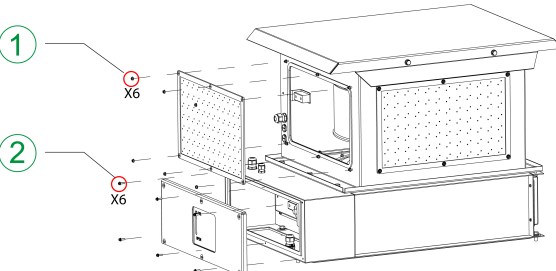
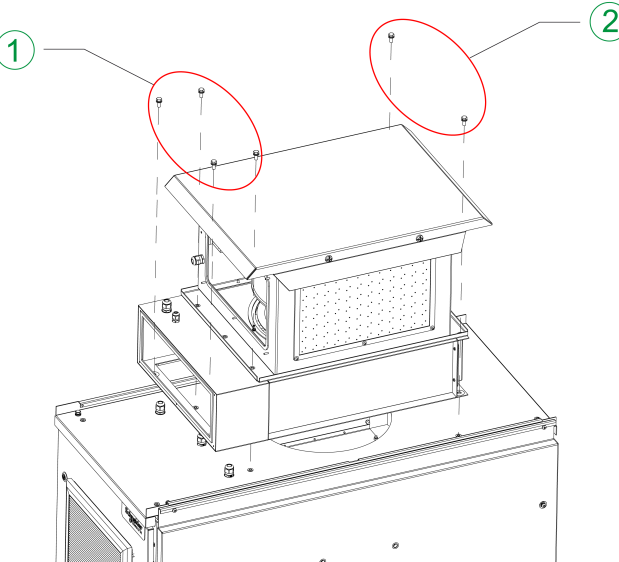
Fan Type	Size (mm)	Weight in kg (lb)
400	580*745*330	15 (33.1)
450	580*745*394	11 (24.2)
500	620*803*408	22 (48.5)
560	750*933*435	31 (68.3)

NOTE: the service life of cooling fan will be reduced if the working temperature is more than 40°C (104°F). This information can be provided by Schneider Services depending on the local environment conditions.

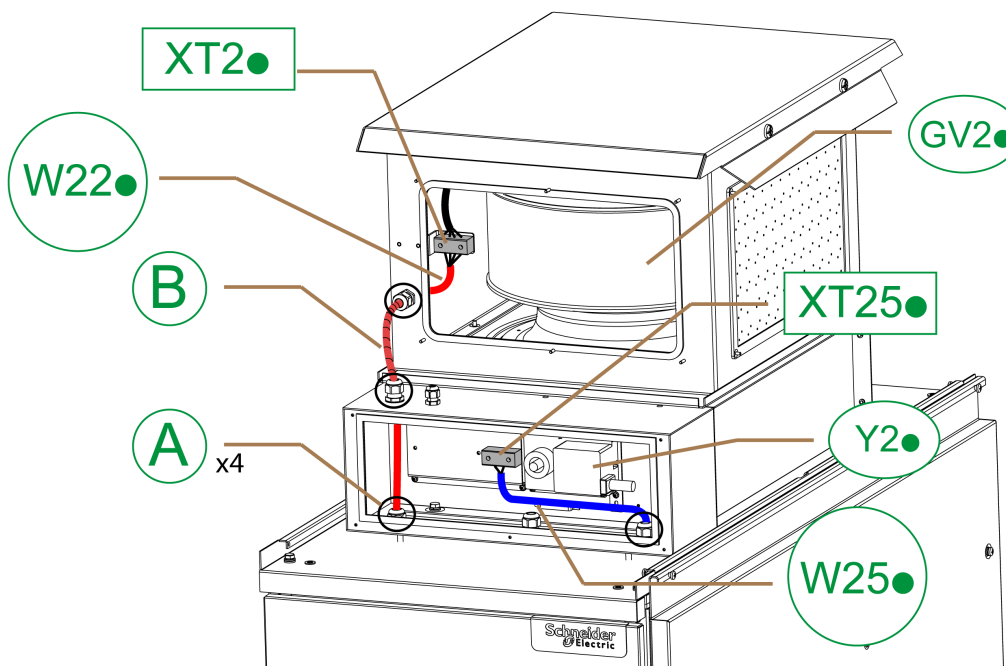
Fan Shutter Installation

Procedure

For convenience during transportation, fan shutter are packed individually.

Step	Action
1	<p>Assemble the fan and fan shutter, (5 M8 bolts) according to the tightening torque given in the table 5-1, page 53.</p>  <p>1. 3 M8 bolts for front side 2. 2 M8 bolts for rear side</p>
2	<p>Remove the front cover of fan, and front cover of fan shutter.</p>  <p>1: 6 M4 nuts for fan cover 2: 6 M5 bolts for fan shutter cover</p>
3	<p>Put the fan group into the correct position and fix it according to the tightening torque given in the table 5-1, page 53.</p>  <p>1. 4 M8 bolts for front side 2. 2 M8 bolts for rear side</p>

For more details and full overview refer to the schematics delivered with your product.



NOTE: before wiring, check the fan shutter position. , page 52

A: PG gland



B: Protection tube for the cable.

Must be added in external (bonding with power cable on roof)

GV2•: Fan motor

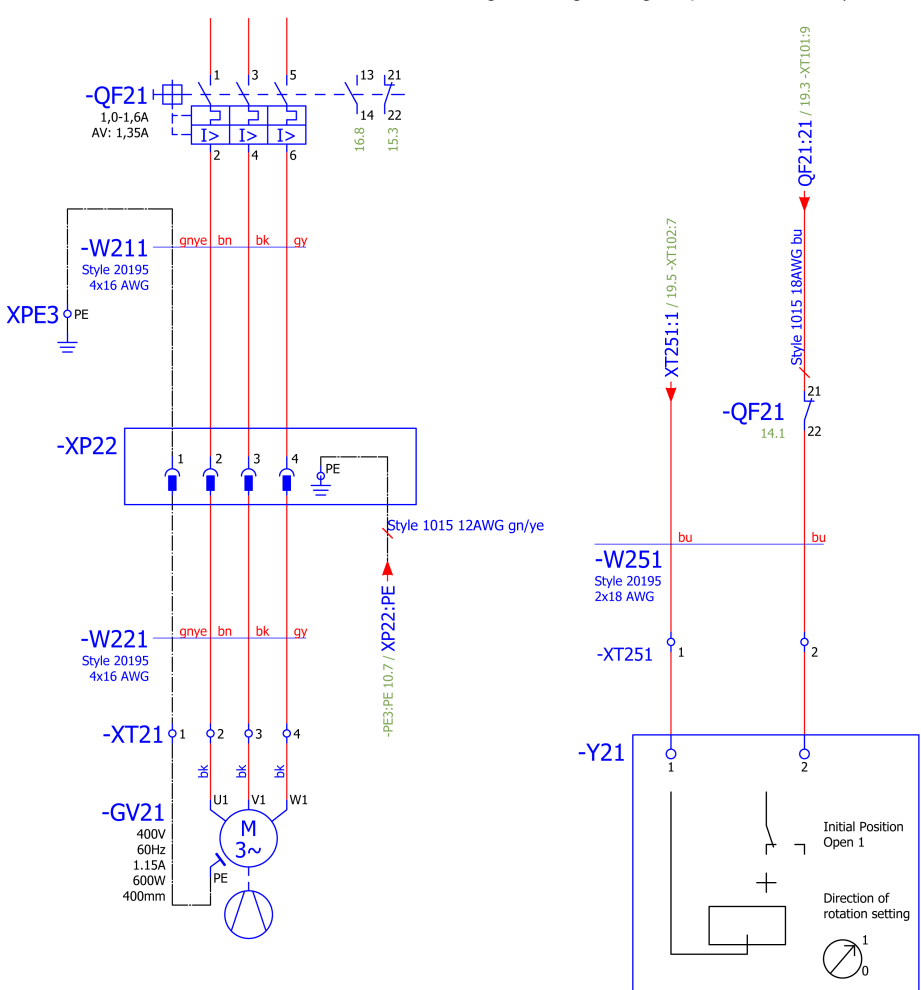
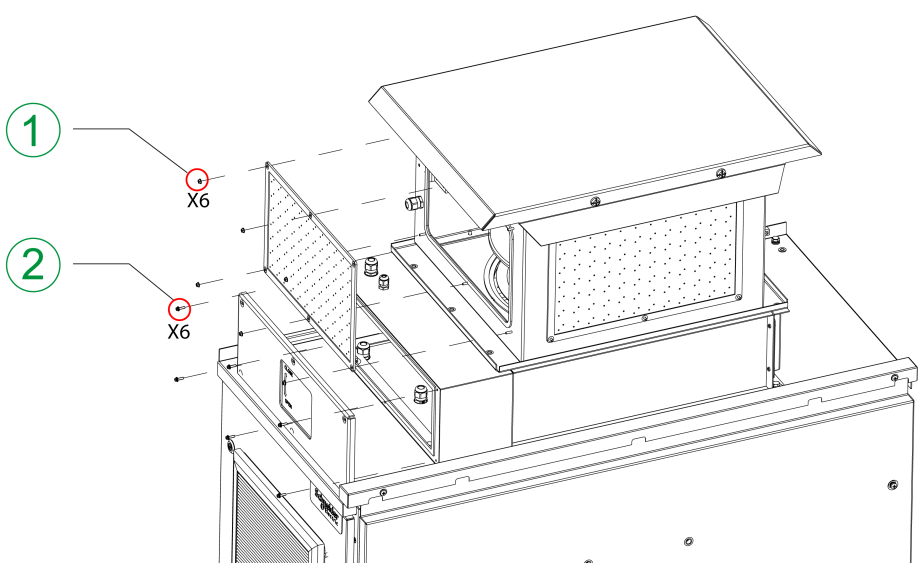
XT2•: Fan terminal block

W22•: Fan power cable

XT25•: Fan shutter terminal block

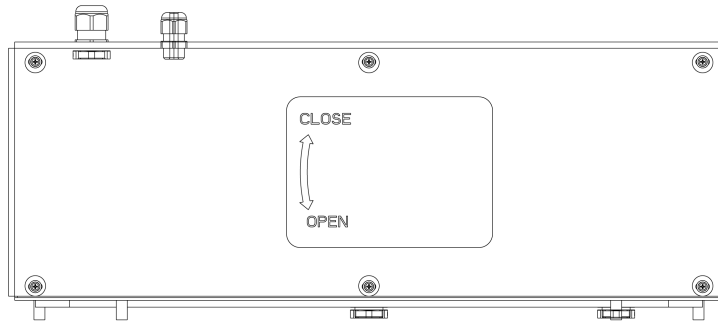
Y2•: Fan shutter controller

W25•: Fan shutter power cable

Step	Action
4	<p>Connect cables and fasten the cables with PG gland:</p> <ul style="list-style-type: none"> Connect cable W25• to terminal XT25• according to the tightening torque 0.6...0.8Nm (5.3 lbf in ...7.1 lbf in). Connect cable W22• to terminal XT2• according to the tightening torque 0.6...0.8Nm (5.3 lbf in ...7.1 lbf in). 
5	<p>Assemble the front cover of fan and fan shutter according to the tightening torque given in the table 5-1, page 53</p>  <p>1: 6 M4 nuts for fan cover 2: 6 M5 bolts for fan shutter cover</p>

Fan Shutter Open/Close Position

Position of fan shutter can be checked through the window.



Electrical Installation

General Notes on Electrical Installation

Overview of Installation

Note: All pictures shown are for 3D illustration purpose only. Depending on the product chosen, product layout may vary.

⚡ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Read and understand the instructions in "Safety Information" chapter before performing any procedure in this chapter.
- When the electrical installation is completed, the mains and auxiliary power supply to the drive must not be switched on without the approval of the commissioning personnel.

Failure to follow these instructions will result in death or serious injury.

Tightening torque

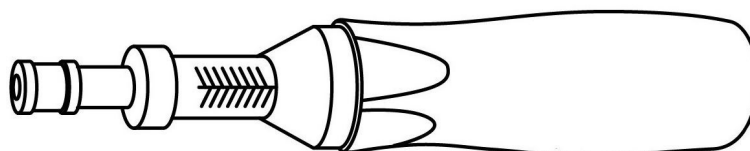
- Tightening torque settings (table 5-1)

Torque Setting Table		
Bolt dimension	Mechanical assembly	
	N·m	lbf·in
M3	0.8	7.1
M4	1.2	10.6
M5	3.3	29.2
M6	5.5	48.7
M8	13.5	119.5
M10	27	238.9
M12	45	398.2
M16	130	1150.4
M20	250	2212.4

NOTE:

- 1lbf.in = 0.113 N.m
- 1 N.m = 8.85 lbf.in
- The maximum deviation of the torque applied should be no more than ± 10%.

NOTE: Use torque screwdriver for tightening of terminal connections



Grounding Connection

Overview

⚡⚠ DANGER

ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING

- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of the entire device.
- Ground the device before applying voltage.
- The cross section of the protective ground conductor must comply with the applicable standards.
- Do not use conduits as protective ground conductors; use a protective ground conductor inside the conduit.
- Do not consider cable shields to be protective ground conductors.

Failure to follow these instructions will result in death or serious injury.

In the transformer cabinet, two PE bars for grounding are available as shown below. For each PE bar, there are 8 M10 terminals and 12 M6 terminals for customer connection, follow the tightening torque given in the table 5-1, page 53.



1 Left PE Bar

2 Right PE Bar

Protective Grounding (ground cable provided by customer)

Left PE bar: Connect to ground electrode (customer side) by ground cable.

Use a M10 bolt to fasten the ground cable, according to the tightening torque given in the table 5-1, page 53.

Cross-Section:

The cross-section of the ground cable and the ground connection must be in compliance with national and local electrical codes. In addition, it needs to be meet minimum short circuit current 31.5kA/150ms:

- Cross-section of ground cable: at least half of mains cable with a minimum cross-section of ground cable of **50 mm²**.

Power Cable Shields Grounding

Cable shields must be connected to the PE bars.

Left PE bar:

- Connect the screen ends of the shield of mains cable

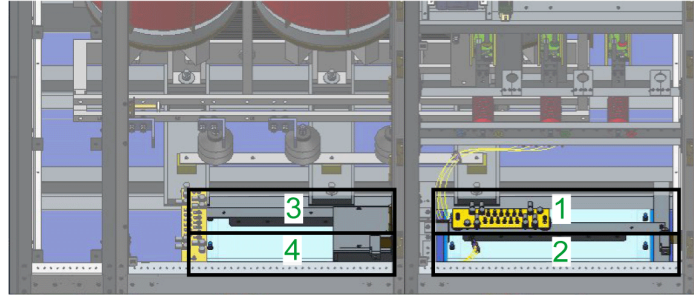
Right PE bar:

- Connect the screen ends of the shield of motor cable

External Power cabling

Overview

On the baseplate of transformer and control cabinet, there are four dismantable aluminum plates for easy onsite installation.



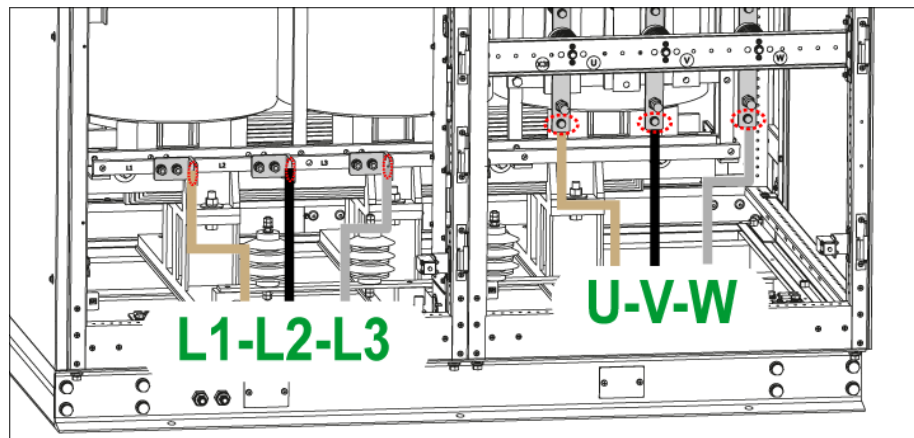
4 dismantable aluminum plates

Step	Action
1	Remove the dismantable aluminum plate (4 M10 nuts) from the cabinet and keep them.
2	Drill proper size hole to fit diameter of cable gland corresponding to the cable.
3	Install suitable cable glands to achieve the corresponding degree of protection and to help avoid to damage the insulation of the cables.
4	Pass the cables through the aluminum plate.
5	Install the aluminum plate (4 M10 nuts).

NOTE: Fireproofing mud or epoxy resin is needed to seal the holes. The fireproofing mud and epoxy resin are not provided..

Mains Cables and Motor Cables Wiring

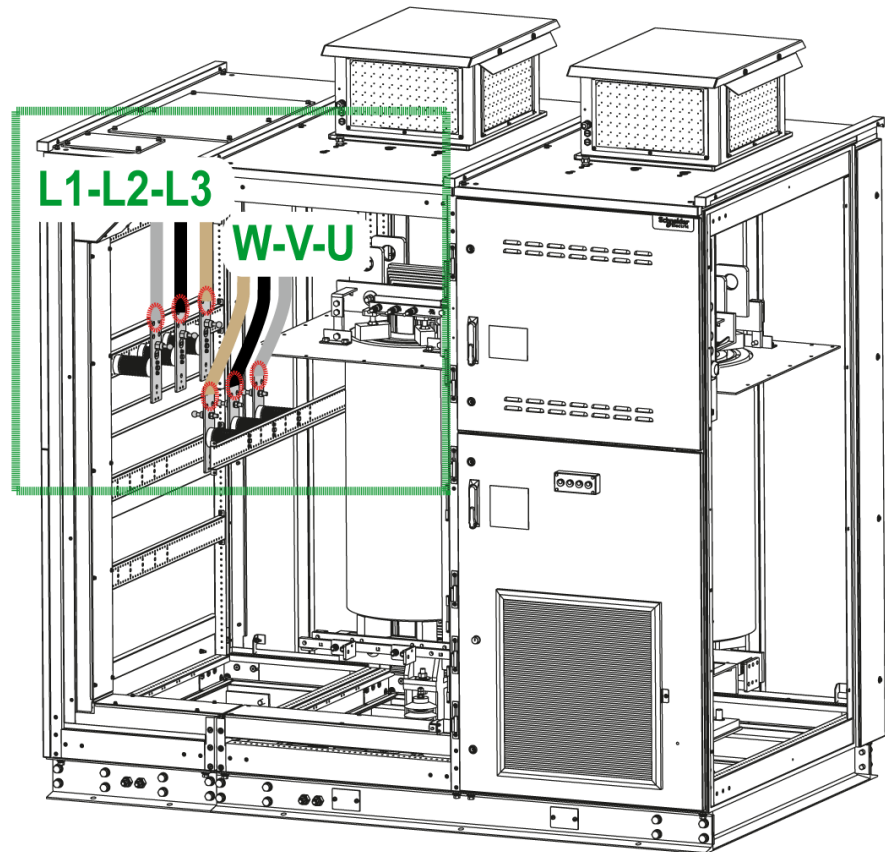
Standard: Bottom in/ Bottom out



L1-L2-L3 Mains cables wiring

U-V-W Motor cables wiring

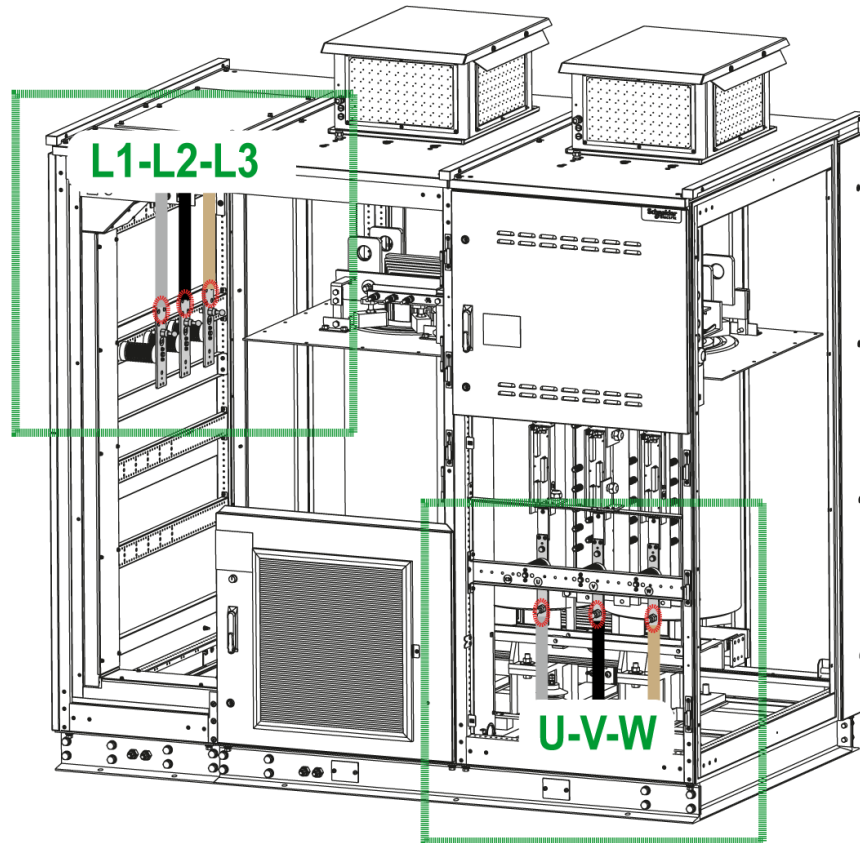
Use a M10 bolt to fasten the mains and motor cables, according to the tightening torque given in the table 5-1, page 53.

Option: Top in/Top out

L1-L2-L3 Mains cables wiring

U-V-W Motor cables wiring

Use a M10 bolt to fasten the mains and motor cables, according to the tightening torque given in the table 5-1, page 53.

Option: Top in/Bottom out

L1-L2-L3 Mains cables wiring

U-V-W Motor cables wiring

Use a M10 bolt to fasten the mains and motor cables, according to the tightening torque given in the table 5-1, page 53.

Cable preparation

Conductive foreign objects in the product may cause parasitic voltage.

DANGER

ELECTRIC SHOCK AND/OR UNANTICIPATED EQUIPMENT OPERATION

- Keep foreign objects such as screws or wire clippings or any other type of residue from getting into the cabinet.
- Verify correct seat of seals and cable entries in order to avoid deposits and humidity.

Failure to follow these instructions will result in death or serious injury.

Cable lugs:

Mount cable lugs suitable for M10 bolts. Cables must be terminated with lugs according to the specification of the cable manufacturer. Connect the cables to their corresponding busbars:

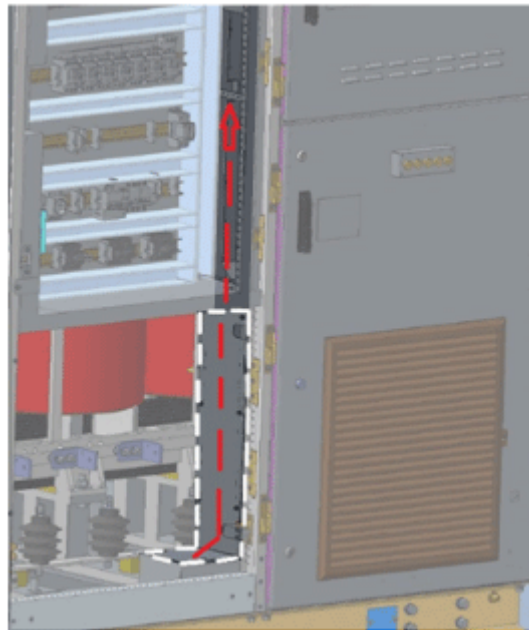
- The mains cable wires to **L1/L2/L3** copper bar
- The motor cables to **U/V/W** copper bar

The cable cross section depends on several factors like cable type, laying and ambient temperature.

Therefore the cable selection has to be calculated according to local conditions and local rules and standards.

Auxiliary Power cabling

Cable Routing



Determining the cable length

Determine the required length of a cable between the point of entry and the connection point inside the cabinet. Cut the cable to the required length before connection to avoid excess cable to be stored in the cable ducts. In order to open the cabinet doors more easily, an additional 15 to 20cm should be added to the swivel frame cable length.

How to Mount Auxiliary Power Cable

Bottom entry

Step	Action
1	Remove the cover (M6 bolts) above the cable duct to facilitate cable routing.
2	Drill a proper hole from dismountable aluminum plate (refer to " External Power cabling " part).
3	Pass the cables through the aluminum plate.
4	Connect and tie the wires.
5	Install the cover with M6 bolts according to the tightening torque given in the table 5-1, page 53.

Types of Power supplies

⚠️⚠️ DANGER

RISK OF ELECTRIC SHOCK

- Use appropriate Residual Current Device (RCD) for auxiliary and control power supplies.
- Use only Control Power Supply Overvoltage Category II.

Failure to follow these instructions will result in death or serious injury.

Type 1: 230 V Control and Auxiliary Power Supply

1	Control Power Supply - Terminal XT10 (provided by customer, available in option)	Offer provides the uninterruptible power for all the LV control circuits.
2	Auxiliary Power Supply - Terminal XT16 (provided by customer)	Powers all cubicle lamps of cabinets and auxiliary electric device.

Type 2: 400 V Fan Power Supply

1	Fan Power Supply - Terminal XT13 (provided by customer, available in option)	Powers all fans of cabinets.
---	---	------------------------------

NOTE: If internal fan power supply option is delivered, no need for external fan power supply.

Power Supply Requirement for Customer

Type	Control Power Supply	Auxiliary Power Supply	Fan Power Supply
Voltage	100...240 Vac ± 10 % (47...63 Hz)	230 Vac ± 10 %	400 Vac ± 10 %,
Capability	1kVA	2kVA (depends on options)	See schematic (delivered with drive)
Wire Range	Single flexible conductor with ferrule with plastic sleeve: 0.25mm ² -2.5mm ² (23AWG - 13AWG). Single flexible conductor with ferrule without plastic sleeve: 0.25mm ² -4mm ² (23AWG - 11AWG).		Single flexible conductor with ferrule: 1.5mm ² -16mm ² .

Wiring

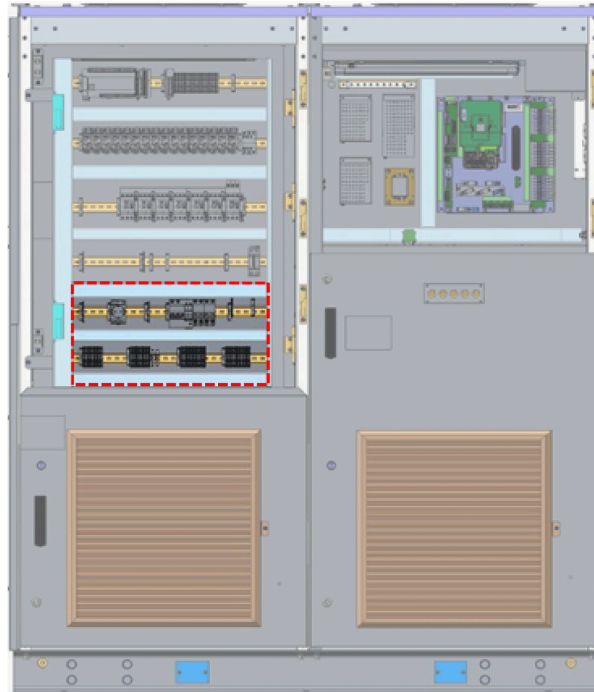
NOTE: Refer to the drawing that will be shipped with the drive.

Control cabling

Control cables should not be laid in parallel to the power cables. If this cannot be avoided, a minimum distance of 30 cm must be maintained between control and power cables. Control and power cables should be crossed at an angle of 90°.

Input / Output Connection

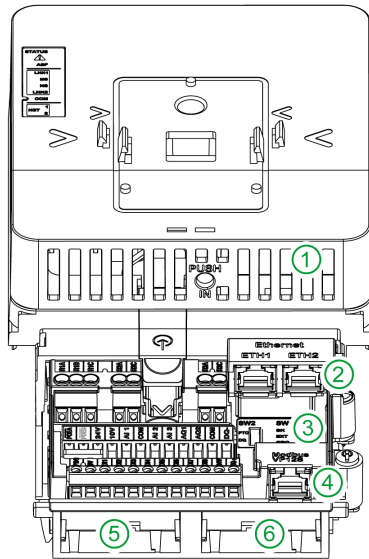
It is located in the low voltage cabinet of drive.



NOTE: Refer to the drawing that will be shipped with the drive.

Arrangement and Characteristics of Control Block Terminals and Communication and I/O Ports

Communication (Control Block Ports)



Legend

Marking	Description
①	Slot C, for internal communication
②	RJ45 port for Ethernet embedded
③	Sink-Ext-Source switch PTO-DQ switch
④	RJ45 port for Modbus embedded
⑤	Slot B, for encoder interface, and I/O module
⑥	Slot A, for fieldbus and I/O relay modules

RJ45 Communication ports

The control block includes 3 RJ45 ports for customer side.

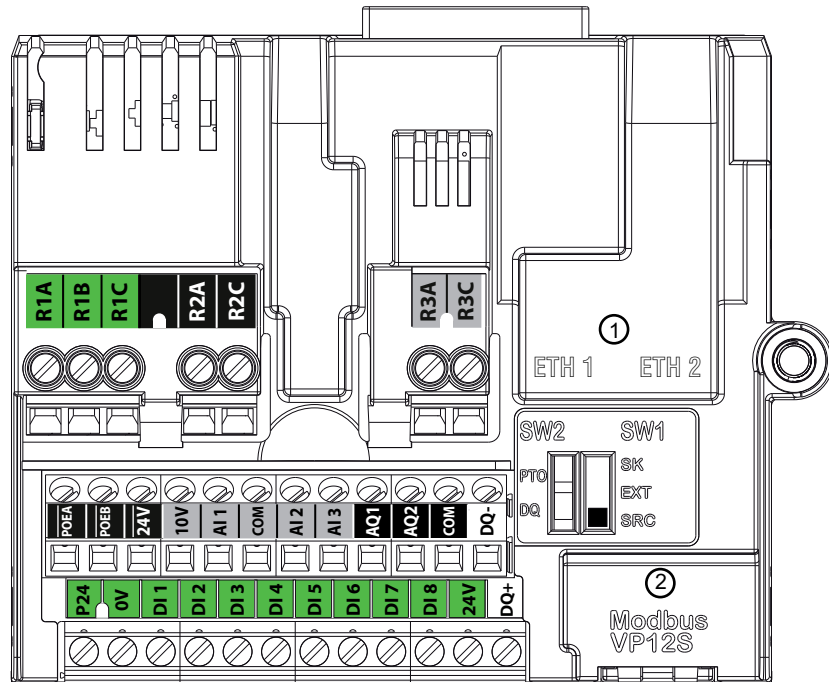
They allow to connect:

- A PC
 - Using a commissioning software (SoMove, SoMachine...), to configure and monitor the drive
 - To access the drive webserver
- A SCADA system
- A PLC system
- A Graphic Display terminal, using Modbus protocol
- A Modbus fieldbus

NOTE: Verify that RJ45 cable is not damaged prior to connecting it to the product otherwise the power supply of the control could be lost.

NOTE: Do not plug Ethernet cable in Modbus plug or vice versa.

Control Block — Terminals Arrangement



① Ethernet Modbus TCP, ② Serial Modbus

Wiring Characteristics

⚡ ⚠ DANGER

HAZARD OF FIRE OR ELECTRIC SHOCK

- Wire cross sections and tightening torques must comply with the specifications provided in this document.
- If you use flexible multi-wire cables for a connection with a voltage higher than 25 Vac, you must use ring type cable lugs or wire ferrules, depending on the wire gauge and the specified stripping length of the cable.

Failure to follow these instructions will result in death or serious injury.

Note: Control terminals can accept 1 or 2 wires.

Wire cross sections and tightening torques per wire:

Control Terminals	Relay Output Wire Cross Section		Other Wire Cross Section		Tightening Torque
	Minimum (1)	Maximum	Minimum (1)	Maximum	
	mm ² (AWG)	mm ² (AWG)	mm ² (AWG)	mm ² (AWG)	
All terminals	0.75 (18)	1.5 (16)	0.5 (20)	1.5 (16)	0.5 (4.4)

(1) The value corresponds to the minimum permissible cross section of the terminal.

Maximum cable length:

- AI•, AQ•, DI•, DQ•: 50 m (164 ft) shielded
- POEA, POEB: 30 m (98 ft) unshielded or 50 m (164 ft) shielded

Control Terminals Electrical Data

Characteristics of Terminals

NOTE:

- For a description of the terminal arrangement, refer to the Interface Diagram
- For factory setting I/O assignment, refer to the Programming manual.
- For tightening torque refer to *Wiring Characteristics*, page 64.

Customer terminal strips	Terminal	Description	I/O Type	Electrical characteristics
XT11:30	R1A	NO contact of relay R1	O	Output Relay 1 <ul style="list-style-type: none"> • Minimum switching capacity: 5 mA for 24 Vdc • Maximum switching current on resistive load: ($\cos \varphi = 1$): 3 A for 250 Vac (OVC II) and 30 Vdc • Maximum switching current on inductive load: ($\cos \varphi = 0.4$ and $L/R = 7$ ms): 2 A for 250 Vac (OVC II) and 30 Vdc • Refresh time: 5 ms +/- 0.5 ms • Service life: 100,000 operations at maximum switching current
XT11:31	R1B	NC contact of relay R1	O	
XT11:32	R1C	Common point contact of relay R1	O	
XT11:33	R2A	NO contact of relay R2	O	Output Relay 2 <ul style="list-style-type: none"> • Minimum switching capacity: 5 mA for 24 Vdc • Maximum switching current on resistive load: ($\cos \varphi = 1$): 5 A for 250 Vac and 30 Vdc • Maximum switching current on inductive load: ($\cos \varphi = 0.4$ and $L/R = 7$ ms): 2 A for 250 Vac and 30 Vdc • Refresh time: 5 ms +/- 0.5 ms • Service life: <ul style="list-style-type: none"> ◦ 100,000 operations at maximum switching power ◦ 500,000 operations at 0.5 A for 30 Vdc ◦ 1,000,000 operations at 0.5 A for 48 Vac
XT11:34	R2C	Common point contact of relay R2	O	
XT11:35	R3A	NO contact of relay R3	O	Output Relay 3 <ul style="list-style-type: none"> • Minimum switching capacity: 5 mA for 24 Vdc • Maximum switching current on resistive load: ($\cos \varphi = 1$): 5 A for 250 Vac and 30 Vdc • Maximum switching current on inductive load: ($\cos \varphi = 0.4$ and $L/R = 7$ ms): 2 A for 250 Vac and 30 Vdc • Refresh time: 5 ms +/- 0.5 ms • Service life: <ul style="list-style-type: none"> ◦ 100,000 operations at maximum switching power ◦ 500,000 operations at 0.5 A for 30 Vdc ◦ 1,000,000 operations at 0.5 A for 48 Vac
XT11:36	R3C	Common point contact of relay R3	O	
XT11:4	POE A	POE inputs	I	Power Output Enable POE inputs
XT11:5	POE B			
XT11:4	STO \bar{A}	STO inputs	I	Safety Function STO Inputs Refer to the ATV6000 Embedded Safety Function manual xxxxx available on www.se.com
XT11:5	STO \bar{B}			
XT11:1	24V	Output supply for digital inputs and POE inputs	O	<ul style="list-style-type: none"> • 24 Vdc • Tolerance: minimum 20.4 Vdc, maximum 27 Vdc • Current: maximum 200 mA for both 24 Vdc terminals • Terminal protected against overload and short-circuit • In Sink Ext position, this supply is powered by external PLC supply
XT11:1	24V	Output supply for digital inputs and STO inputs	O	<ul style="list-style-type: none"> • 24 Vdc • Tolerance: minimum 20.4 Vdc, maximum 27 Vdc • Current: maximum 200 mA for both 24 Vdc terminals

Customer terminal strips	Terminal	Description	I/O Type	Electrical characteristics
				<ul style="list-style-type: none"> Terminal protected against overload and short-circuit In Sink Ext position, this supply is powered by external PLC supply
XT11:28	10V	Output supply for Analog input	O	Internal supply for the analog inputs <ul style="list-style-type: none"> 10.5 Vdc Tolerance $\pm 5\%$ Current: maximum 10 mA Short circuit protected
XT11:27	AI1	Analog inputs and sensor inputs	I	Software-configurable V/A : voltage or current analog input <ul style="list-style-type: none"> Voltage analog input 0...10 Vdc, impedance 31.5 kΩ, Current analog input X-Y mA by programming X and Y from 0...20 mA, with impedance 250 Ω Maximum sampling time: 1 ms \pm 1 ms Resolution 12 bits Accuracy: $\pm 0.6\%$ for a temperature variation of 60°C (140°F) Linearity $\pm 0.15\%$ of maximum value Software-configurable thermal sensors or Water level sensor <ul style="list-style-type: none"> PT100 <ul style="list-style-type: none"> 1 or 3 thermal sensors mounted in series (configurable by software) Sensor current: 5 mA maximum Range -20...200°C (-4...392°F) Accuracy $\pm 4^\circ\text{C}$ (39°F) for a temperature variation of 60°C (140°F) PT1000 <ul style="list-style-type: none"> 1 or 3 thermal sensors mounted in series (configurable by software) Sensor current: 1 mA Range -20...200°C (-4...392°F) Accuracy $\pm 4^\circ\text{C}$ (39°F) for a temperature variation of 60°C (140°F) KTY84 <ul style="list-style-type: none"> 1 thermal sensor Sensor current: 1 mA Range -20...200°C (-4...392°F) Accuracy $\pm 4^\circ\text{C}$ (39°F) for a temperature variation of 60°C (140°F) PTC <ul style="list-style-type: none"> 6 sensors maximum mounted in series Sensor current: 1 mA Nominal value: < 1.5 kΩ Overheat trigger threshold: 2.9 kΩ \pm 0.2 kΩ Overheat reset threshold: 1.575 kΩ \pm 0.75 kΩ Threshold for low impedance detection: 50 kΩ -10 Ω/+20 Ω Protected for low impedance < 1000 Ω
XT11:25	AI2			
XT11:24	AI3			
XT11:26	COM	Analog I/O common	I/O	0 V for Analog outputs
XT11:25	AI2	Analog input	I	Voltage bipolar analog input -10...10 Vdc, impedance 31.5 k Ω <ul style="list-style-type: none"> Maximum sampling time: 1 ms \pm 1 ms Resolution 12 bits Accuracy: $\pm 0.6\%$ for a temperature variation of 60°C (140°F) Linearity $\pm 0.15\%$ of maximum value
XT11:22	AQ1	Analog output	O	AQ: Analog output software-configurable for voltage or current <ul style="list-style-type: none"> Voltage analog output 0...10 Vdc, minimum. Minimum load impedance 470 Ω, Current analog output X-Y mA by programming X and Y from 0...20 mA, maximum load impedance 500 Ω Maximum sampling time: 5 ms \pm 1 ms
XT11:23	AQ2	Analog output	O	

Customer terminal strips	Terminal	Description	I/O Type	Electrical characteristics
				<ul style="list-style-type: none"> Resolution 10 bits Accuracy: $\pm 1\%$ for a temperature variation of 60°C (140°F) Linearity $\pm 0.2\%$
XT11:21	COM	Digital and analog output Common	I/O	0 V for analog outputs and logic output
XT11:20	DQ-	Digital output	O	Digital output configurable by switch
XT11:19	DQ+	Digital output	O	<ul style="list-style-type: none"> Insulated Maximum voltage: 30 Vdc Maximum current: 100 mA Frequency range: 0...1 kHz Positive/Negative logic is managed by user external wiring.
XT11:19	DQ+	Pulse output	O	Pulse train output configurable by switch <ul style="list-style-type: none"> Open collector not insulated Maximum voltage: 30 Vdc Maximum current: 20 mA Frequency range: 0...30 kHz
XT11:7	P24	External input supply	I	External input supply +24 Vdc <ul style="list-style-type: none"> Tolerance: minimum 19 Vdc, maximum 30 Vdc Maximum current: 0.8 A
XT11:8	0V	0 V	I/O	0 V of P24
XT11:9	DI1	Digital inputs	I	8 programmable logic inputs 24 Vdc, comply with IEC/EN 61131-2 logic type 1 <ul style="list-style-type: none"> Positive logic (Source): State 0 if ≤ 5 Vdc or logic input not wired, state 1 if ≥ 11 Vdc Negative logic (Sink): State 0 if ≥ 16 Vdc or logic input not wired, state 1 if ≤ 10 Vdc Impedance 3.5 kΩ Maximum voltage: 30 Vdc Maximum sampling time: 2 ms \pm 0.5 ms Multiple assignment makes it possible to configure several functions on one input (example: DI1 assigned to forward and preset speed 2, DI3 assigned to reverse and preset speed 3).
XT11:10	DI2			
XT11:11	DI3			
XT11:12	DI4			
XT11:13	DI5			
XT11:14	DI6			
XT11:15	DI7			
XT11:16	DI8			
XT11:15	DI7	Pulse inputs	I	Programmable Pulse input <ul style="list-style-type: none"> Comply with level 1 PLC, IEC 65A-68 standard State 0 if < 0.6 Vdc, state 1 if > 2.5 Vdc Pulse counter 0...30 kHz Frequency range: 0...30 kHz Cyclic ratio: 50 % \pm 10 % Maximum input voltage 30 Vdc, < 10 mA Maximum sampling time: 5 ms \pm 1 ms
XT11:16	DI8			

Inspection

This section generally describes the necessary inspection before ATV6000 UL is powered on. Besides, review the following steps:

Step	Description	✓
1	Verify that the site power supply meets the requirement of the medium voltage drive system. The rated input voltage of the medium voltage drive system must be compatible with grid voltage.	
2	The rated output voltage of the medium voltage drive system must be compatible with rated voltage of the motor which is marked on the motor nameplate.	
3	The control power supply (low voltage) must be compatible with rated voltage of control system.	
4	The rated power of the ATV6000 UL must be compatible with the power of motor.	
5	Verify that the ATV6000 UL is connected to ground securely, and its grounding resistance must be lower than 4 Ω . The control system with a separate ground bus-bar and its resistance must be lower than 1 Ω .	
6	Verify the insulation of all cables and terminals is not damaged.	
7	Verify all terminals, components mounting, and other parts are marked or labeled, or contact your local manufacturer representative.	
8	Verify that control power supply and main power supply are correctly connected and follow all local and national electrical code requirements as well as all other applicable regulations.	
9	Verify that all wiring is tightly and correctly connected.	
10	Verify whether the isolating switches in bypass cabinet (optional) are installed tightly and that the mechanical interlock of the isolation switches operate normally. Verify that isolation switches is well contacted.	
11	Verify that the input and output medium voltage cables are connected correctly.	
12	Verify that all electrical connections of the transformer are tight including input, output, and auxiliary windings (option).	
13	Verify that the temperature sensors are installed appropriately.	
14	Verify that cooling fans on the top of cabinet are connected correctly and tightly, and can rotate freely in the correct direction.	
15	Verify that all bolts used for connecting transformer input, output and auxiliary cables (option) are tightly connected.	
16	Verify that the optical fiber connections are correct (Colour and wire number), optical fiber and the fiber terminal connections are correct, fiber terminal and fiber connection must be clean with good connections. The fiber length must be correct so that there is no pulling or bending	
17	All cables must be fastened. PCBAs in the control box must be plugged into the right place. The boards and control boxes must be fastened tightly by screws.	
18	Verify that frequency setting signal is a 0(4) - 20 mA or 0-10 V source signal.	
19	Verify that the control wiring is separated from power wiring.	

NOTE: If any inspection result is abnormal, please contact your local manufacturer representative.

Routine Maintenance

Service and Maintenance

Overview

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Read and understand the instructions in **Safety Information** chapter before performing any procedure in this chapter.

Failure to follow these instructions will result in death or serious injury.

Spares and repairs

Serviceable product. Refer to your Customer Care Center on: www.se.com/CCC.

Visual Inspection and Cleaning

Inspection

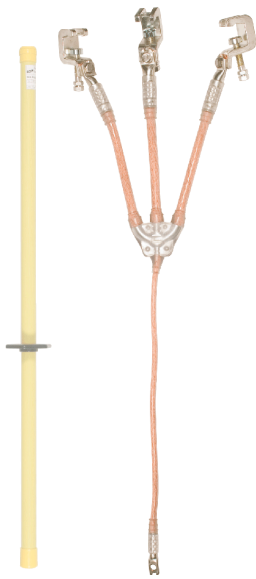
The Variable Speed Drive (VSD) must be regularly inspected and cleaned in accordance to regulations and maintenance schedule. (note that antistatic cleaning equipment must be used, and chemical cleaners, alcohol, and other solvents should not be used.)

Step	Action	✓
1	Verify that VSD exterior and interior as well as the surrounding area are free of dust, sand, vermin, and insects. Electrical components such as wiring and circuit boards are prone to overheating and being inoperative due to accumulation of dust or moisture.	
2	Verify that VSD exterior and interior has not been affected by corrosive elements such as corrosive gases, salt, or other impurities that can damage electrical equipment, structural integrity of VSD or the insulation of cabling.	
3	Verify that there are no signs of over-heating of elements and components (circuit boards, wiring connections etc...), and that cooling fans are correctly mounted and functioning. Verify that filters are not damaged and free of dust and grime. If necessary, replace filters.	
4	Verify that cables are correctly and tightly fastened as well as all other screws, bolts, and wiring.	
5	Verify that the area is dry and free of condensation and at suitable relative air humidity level.	

Wiring Inspection

- The Variable Speed Drive (VSD) is prone to vibration during running, which may lead to loss connection. It is essential to regularly check that plugs, sockets, screws, bolts, and cabling of the entire VSD and to ensure that connection or fastening are reliable.
- After being put into operation, thorough cleaning and insulation inspection of the transformer must be done at least once a year. Inspection and tightening of bolts, screws, and wiring must be conducted every 2 years.
- Staff responsible for operation and maintenance must regularly measure and record temperature and humidity. Pay particular attention to temperature of the transformer windings. End user to ensure electrical room's temperature remains below the maximum value according to drive's quotation (40 to 50° C).

Grounding Cable for Maintenance (Option)



The Variable Speed Drive (VSD) can be equipped with grounding cable for maintenance. The grounding cable and stick is a 3 poles grounding and short circuiting device in accordance with IEC61230.

The grounding cable:

- Provides personal and equipment protection during maintenance
- Discharges the residual voltage of power supply operation system.

Short-circuit rating of fixed ball points:

	Maximum permissible I _k for...				
	0.5 s	1 s	2 s	5 s	10 s
VSD Output	33.5 kA	23.7 kA	16.7 kA	10.6 kA	7.5 kA
VSD Input	19.5 kA	13.8 kA	9.8 kA	6.2 kA	4.4 kA

Cleaning and Replacement of Filters

Pollution or clogging of the filters of the cabinet doors can result in overtemperature.

NOTICE

OVERHEATING

- Inspect and clean the filters at regular intervals.
- Adapt the intervals between maintenance to the environmental conditions.
- Replace the filters at the intervals specified in this manual.

Failure to follow these instructions can result in equipment damage.

Location

The filters are located at the cabinet door of the following sections:



Figure 6-2

1. Control and transformer cabinet

2. Power cell cabinet

A, B, C. Dust filters

Uninstall Filters (A, B)

Step	Action
1	Remove a M6 screw from the louvered panel.
2	Lift the louvered panel and draw it out.
3	Pull down the filter mat.
4	Replace the filter mat and reinstall the louvered plate with M6 screw. (Tightening torque: 5.5 N•m / 48.7 lbf-in)
The process for filter mat replacement should be continuous, in case of foreign objects entering the drive.	

Uninstall Filters (C)

Step	Action
1	Open the LV door where the filter mat is installed.
2	Remove the 4 M4 nuts and extract filter mat from the plate.
3	Replace the filter mat and reinstall the plate with M4 nuts. (Tightening torque: 1.2 N•m / 10.6 lbf-in)
The process for filter mat replacement should be continuous, in case of foreign objects entering the drive.	

Dimensions

The filter dimension depend on the capacity of the drive and places.

2 types of filters can be used on the power cell cabinet:

Model A	
References	Description
VZ3V60001	ATV6000 UL Dust filter 345 x 395mm
VZ3V60002	ATV6000 UL Dust filter 545 x 395mm

2 types of filters can be used on the transformer cabinet:

Model B	
References	Description
VZ3V60003	ATV6000 UL Dust filter 545 x 615mm
VZ3V60004	ATV6000 UL Dust filter 345 x 615mm

1 type of filter can be used on the control and transformer cabinet:

Model C	
References	Description
VZ3V60009	ATV6000 UL Dust filter 580 x 100mm

Scheduled Servicing

⚠ WARNING
INSUFFICIENT MAINTENANCE
Verify that the maintenance activities described below are performed at the specified intervals.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Adherence to the environmental conditions must be ensured during operation of the device. In addition, during maintenance, verify and, if appropriate, correct all factors that may have an impact on the environmental conditions.

Maintenance has to be performed only by qualified and certified Schneider-Electric service personnel.
Always consider all local and national electrical code requirements as well as all other applicable regulations for maintenance intervals and verification.

Task / Description	Interval* [years]																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Inspection **																				
Input/output terminals tightness		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Remote/Local/Panel - Switch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Transformer visual check	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fiber optic cables visual check	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Relay contacts						✓						✓						✓		
Power cell connections		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Transformer secondary windings connection		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Plug-in connections		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Master controller cooling fan		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Cubicle roof cooling fans		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Oxidation, corrosion, rust	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Environmental conditions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
UPS function (available as option)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Door gaskets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spare parts (storage/damage)				✓				✓				✓				✓				✓
Heat sink pollution (check and clean) ***	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recorded faults analysis	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Space heater (cubicle & motor)		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Overload switch setting		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓

Task / Description	Interval* [years]																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Function of emergency stop button	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Function of door switches		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓
Completeness of walls and covers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace																				
Door filter mats ***	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Master controller cooling fans ***				✓				✓				✓				✓				✓
Cubicle roof cooling fans ***				✓				✓				✓				✓				✓
PLC Backup battery				✓				✓				✓				✓				✓
UPS battery				✓				✓				✓				✓				✓
Power Cell												✓								
Local service																				
General cleaning ***	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Parameter/PLC-software backup				✓				✓				✓				✓				✓
Current symmetry measurement				✓				✓				✓				✓				✓
Capacitor reforming (if power cells on stock)				✓				✓				✓				✓				✓
Capacitor condition check				✓				✓				✓				✓				✓
Fiber optic cable measurement				✓				✓				✓				✓				✓
<p>*) Maximum maintenance intervals from the date of commissioning. Reduce the intervals between maintenance to adapt maintenance to the environmental conditions, the operating conditions of the drive, and to any other factor that may influence the operation and/ or maintenance requirements of the drive.</p> <p>**) Recommended after each repair.</p> <p>***) Depends on the environmental conditions</p>																				

Shorter intervals must be considered while VSD under non-operational operating conditions. For drives which serve over 12 years, additional spare parts on site are highly recommended.

Spares and Repairs

Serviceable product. Please contact your Customer Care Center on:

www.se.com/CCC.

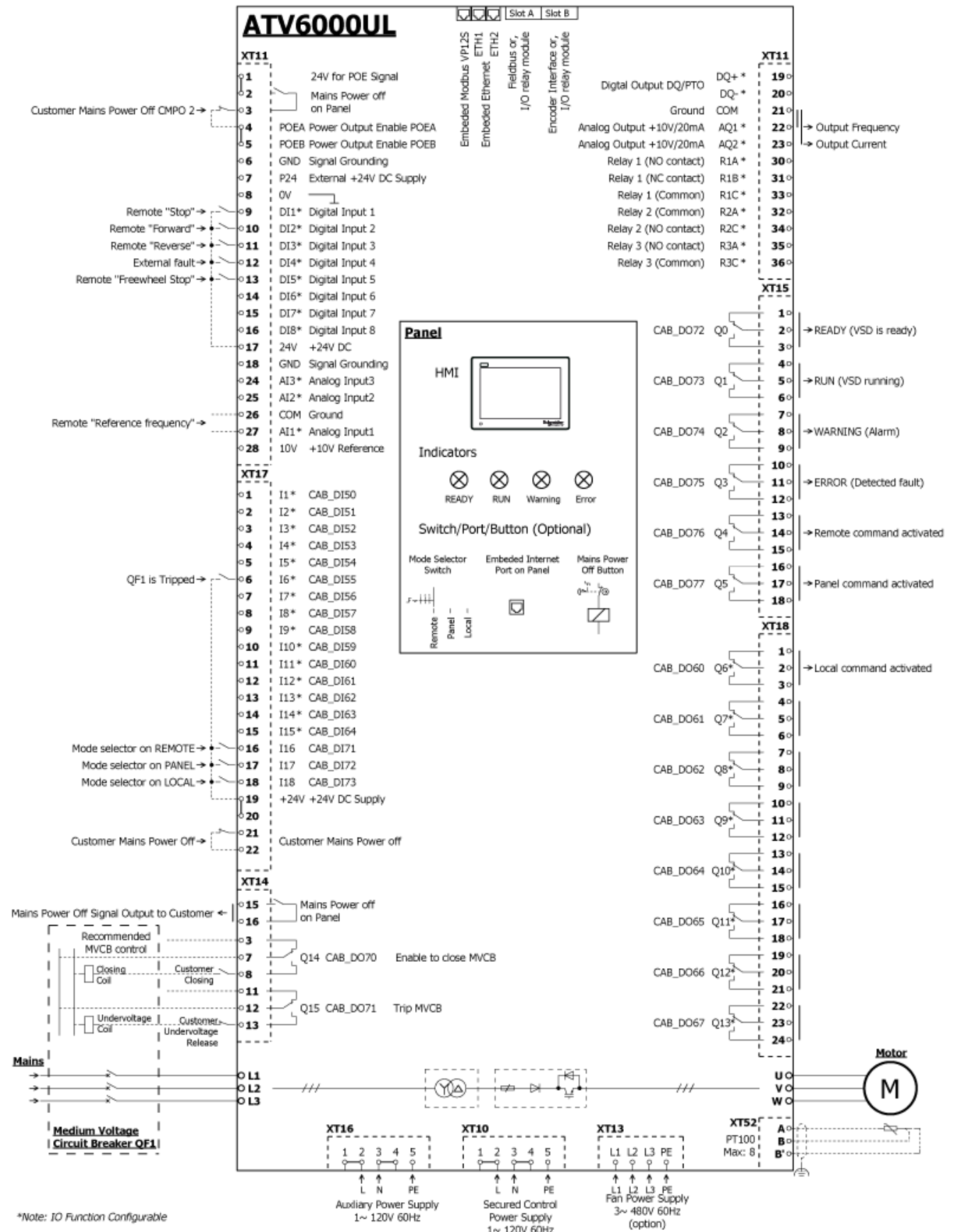
Customer Care Center

For additional support, you can contact our Customer Care Center on:

www.se.com/CCC.

ATV6000 UL Drive System I/O Interface Diagram (standard configuration)

I/O Interface Diagram (Standard Configuration)



Operating Environment Maintenance of VSD

Operating Environment Maintenance of Variable Speed Drive (VSD)

	Type of Cooling		
	Air-conditioning Cooling System	Air-water Cooling System	Air-duct Cooling System
Requirements for supporting facilities	The room must be well sealed, windows and doors must be closed. The emergency vents must have shutters that are kept closed.	A dehumidifier must be used (dehumidifier model shall be determined by the dehumidifier manufacturer). The room must be well sealed, windows and doors must be closed. The emergency vents must have shutters that are kept closed.	The air inlet must be larger than or equal to the dust filter area of VSD cabinet door. Dust filter must be used. Dehumidifier must be installed in the room.
Maintenance	The air conditioners shall be checked and maintained regularly. The VSD must keep running in dehumidifying mode during downtime.	The cooler shall be cleaned regularly, check the valve of waterway and duct filter, and air duct shall be checked and maintained to verify there's no damage. The dehumidifier should keep running after VSD has stopped running.	Air duct should be checked regularly. Seal the air inlet and outlet of the room when VSD stop running, and the dehumidifier should be working.
Preparation for power-on	The indoor humidity of VSD cabinet shall be less than 50% and the insulation resistance of the transformer shall be higher than 100MΩ. Under these conditions, it can be powered on directly. If the indoor humidity is higher than 50% or the transformer insulation resistance is lower than 100MΩ, additional dehumidification and drying are required.		If the indoor humidity of VSD cabinet has been less than 50% for 48 hours without condensation and transformer insulation resistance is higher than 100MΩ, the VSD can be powered on directly. If the indoor humidity is higher than 50% or the transformer insulation resistance is lower than 100MΩ, additional dehumidification and drying are required.
Running	Hygrometer must be installed in the room next to the drive to monitor indoor humidity. End user to ensure room's humidity stays below the maximum value according to drive's quotation (90 or 95%). If there is no leakage problem, a dehumidifier must be added in the room (If the temperature in VSD room is higher than 35 °C, air conditioning must be installed). The outlet of air conditioner should not be directed towards the drive to avoid condensation inside the cabinet.	Hygrometer must be installed in the room next to the drive to monitor indoor humidity. End user to ensure room's humidity stays below the maximum value according to drive's quotation (90 or 95%). If there is no leakage problem, a dehumidifier must be added in the room (If the temperature in VSD room is higher than 35 °C, then air conditioning must be installed), the dehumidifier should work during VSD running.	Hygrometer must be installed in the room next to the drive to monitor indoor humidity. End user to ensure room's humidity stays below the maximum value according to drive's quotation (90 or 95%). If condensation is present, it is necessary to shut down the system and start the dryer until the room humidity falls below 70%. If the humidity level reaches 70% but there is no condensation, the running frequency of VSD should be maintained at higher than 35Hz, until the indoor humidity falls below 70%.

NOTE: For users using **air-duct cooling system**: it is possible that there is conductive dust near the drive load, especially in the summer when the temperature and humidity are much higher in most countries. In order to help to protect VSD and help to ensure operation, It is advisable to modify the VSD room by using air conditioning cooling system or air-water cooling system.

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