Industrie Elektronik Brilon
Energy Systems

FILON FUTURE

CHARGING SYSTEMS - RESONANCE FREQUENCY TECHNOLOGY

We get electricity into shape.

Operating instructions

Rev.-No.: EN-1.4.2

FILON FUTURE

Imprint

Notes on the instructions

The safe operation of the charger requires knowledge that this Operating instructions provides. The information thus provided has been presented in a concise and well-structured form, with the sections, sub-sections and pages being consecutively numbered.

These Operating instructions documents chargers of the type FILON FUTURE. You can take the relevant data from the Technical Information in the Annex. Make sure when operating the charger and carrying out maintenance work that the product description for the relevant charger is observed.

Our chargers are continually developed further. Please understand that we reserve the right to make changes as to the shape, the design and the technology. It is therefore not possible to derive any claims regarding certain properties of the charger from the content of these operating instructions.

Information in this Operating instructions manual is subject to change without notice and does not represent a commitment on the part of the manufacturer. The manufacturer is not obliged to supplement the information in this Operating instructions or to keep it up to date. The manufacturer reserves the right to make improvements to this manual or the control centers described in it at any time without prior notice.

Manufacturer/Legal holder

Industrie Elektronik Brilon GmbH

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General equality

The manufacturer is aware of the importance of language with regard to gender equality and always endeavors to take this into account. Nevertheless, for reasons of better readability, it has been necessary to refrain from using differentiating formulations throughout.

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1 General matters concerning these instructions

This Operating instructions is meant to facilitate the intended use and the safe operation of the chargers of the type FILON FUTURE which is referred to hereinafter merely as charger.

The Operating instructions must always be available and is to be kept close at hand in the vicinity of the charger. The Operating instructions needs to be read and applied by all persons commissioned to operate the charger. Apart from actually operating the charger, this includes shipping, putting up, installing, maintaining and disassembling it.

When being used for commercial purposes, not only is this Operating instructions to be observed, but also the directives, standards and laws for the safe and professional work that are applicable at the site of deployment or in the country where the charger is used.

Further information in addition to this Operating instructions can be obtained from the experts of the manufacturer or from the supplier.

2 Safety

2.1 General matters

The Operating instructions are a major element of the charger.

The operator shall take care that the Operating instructions are always be available at the charger and that the operating personnel take note of the directives referred to in these instructions.

The owner/operator shall complement these Operating instructions by further orders and directives, so as to comply with existing national regulations on accident prevention and environmental protection. This includes also information about supervisory and reporting duties that take internal particularities into account, e.g. with regard to the work organization, the work flow and the personnel assigned to the work.

Apart from the Operating instructions and regulations on accident prevention applicable at the site of deployment or in the country where the charger is used, the generally recognized rules of sound engineering practice shall also be observed.

Do connect the charger only with a properly installed socket outlet with earthing contact.

In the event of a defect, the charger must not be connected with the mains or must immediately be isolated by unplugging it.

Pull out the plug, when you do not use the appliance.

2.2 Explanation of signs and symbols

The charger has been manufactured in accordance with the generally recognized rules of sound engineering practice. Additional safety instructions are given, in order to sufficiently ensure the personnel's safety. Sufficient safety can only be achieved and ensured, if these additional instructions are duly observed when operating the charger.

Safety instructions and markings

Safety instructions and important explanations are marked (pursuant to EN 82079) as follows:

! Danger

Identifies an imminent dangerous situation! If not being avoided, it will result in death or severe injuries.

! Warning

Identifies a potentially dangerous situation! If not being avoided, it might result in death or severe injuries.

! Caution

Identifies a potentially dangerous situation! If not being avoided, it might result in slight or minor injuries.

Note

Identifies a potentially harmful situation (risk of property damage)! If not being avoided, the plant or an object in its surroundings may get damaged.

The following symbols are used in the document:

- ⇨ stands in front of notes and explanations
- ○ identifies the optional additional equipment

2.3 Qualification of the personnel

Only duly qualified personnel must operate the charger. The personnel's responsibilities for operating, installing and repairing the charger must be clearly and strictly separated.

! Warning

Warning against dangerous voltage!
The charger is an electrical appliance that conducts electricity, the current and voltage of which is dangerous.

- ⇨ The charger must only be operated by duly qualified personnel.
- ⇨ Disconnect the power supply and, where applicable, the connection with the battery, before working on the charger.
- ⇨ The charger must only be opened and repaired by duly qualified electricians.

Duly qualified personnel in accordance with these fundamental notes are persons who are familiar with:

- putting up and installing,
- commissioning,
- operating,
- shutting down and disassembling the charger

and have the required qualification for these jobs.

The charger must only be maintained by duly qualified and authorized electricians.

The manufacturer hereby points out that he cannot be held liable for any damage, breakdowns or malfunctions caused by the non-observance of these Operating instructions.

Commercial use

If the charger is used for commercial purposes, the following shall apply additionally:

- The operator must have been familiarized with the charging process of the batteries concerned and their handling by having been given special instructions or by having attended training sessions.
- Only specialist personnel assigned to their job must work on the charger.

2.4 Intended use

The charger has exclusively been designed to charge a battery (rechargeable).

Depending on the charging parameters set, only batteries matching these pre-set parameters must be charged. The charger is not suitable for charging non-rechargeable batteries.

At the operator's request, the charger can be equipped with various types of charging plugs. The operator shall:

- only use those charging plugs that are designed and specified for the appliance's charging current and for the battery voltage.
- exclude the connection of unsuitable battery types by mistake.
- The latter can be avoided by the color-coding or the mechanical coding of the charging plug.

Note

The regulations of the battery manufacturer shall be observed and complied with.

! Caution

It is the duty of the operator in the case of a charger with a subsequently modified charging program to permanently indicate the matching battery type visibly on the outside of the housing!

! Danger

Danger of explosion when charging unsuitable or incorrectly set battery types!
Charging a battery that is not approved for this charger is prohibited. Moreover, the charging program set in the charger and the battery type to be charged must be in conformity with each other. Failing to observe the above instructions may damage both the charger and the battery. The battery can excessively emit gas, boil off and even explode!

⇨ It must always be checked, whether the charger has been set for the battery type concerned. In cases of doubt do get in touch with the competent specialists.

The intended use of the equipment requires that :

- the specification concerning the site of deployment (see section Safety instructions about putting up and installing and section Requirements concerning the site of deployment),
- the details on the name plate (see section name plate),
- the Technical Information (see annex Technical Information)

are observed and complied with.

! Danger

There is a danger of severe personal injury and property damage caused by:

⇨ the improper use or the incorrect operation,

⇨ the unauthorized opening,

⇨ or the incorrect installation or the improper maintenance and repair of the charger.

All information about the intended use, the residual risk, the installation, the operation and the maintenance as contained in this Operating instructions must be observed and complied with.

The charger must only be used for applications described in this Operating instructions and in the technical specification and only with accessories or components recommended or approved by the manufacturer.

Any other use or any use beyond these limits is not deemed to be within the scope of the unit's intended use. The operator or user of the charger shall therefore be solely responsible for any resultant damage.

The charger must only be put into operation with the Directive (2014/30/EU) on Electromagnetic Compatibility being observed.

2.5 Safety instructions on trouble-shooting and maintenance

Please observe the following notes:

- ⇨ The charger must be disconnected from the mains and from the battery before commencing any maintenance or repair work.
- ⇨ Open the housing of the charger only 5 minutes after it has been disconnected from the mains and from the battery, so that the capacitors installed in the unit can discharge.
- ⇨ Modifications, additions or conversions that may affect the safety must not be made without the manufacturer's approval! This shall also apply to the installation and setting of safety devices. Special care shall be taken that spacings, clearances and air paths are not reduced.
- ⇨ Spare parts used in the charger must conform to the technical requirements as specified by the manufacturer, which will always be ensured, when original spares are used.

3 Product details

3.1 Description of the product and its function

The charger contains:

- at least one controllable power unit with resonance frequency technology,
- microprocessor-controlled charging electronics as well as,
- an operating and display unit with pause key and five LED elements, of which one is a two-colored dual LED (red or white, depending on the status).

The individual assemblies of the charger are installed and contained in a stable sheet metal casing. The charger is equipped with a power cable and plug for the connection with the mains.

The charging program for the respective battery type is preset according to the customer's requirements.

Charging plug

The compatibility of the charging plugs of battery and charger must be ensured. The charging cables can already be equipped with a battery-specific charging plug for the connection of the battery. Further technical details are contained in the enclosed freight documents.

3.2 Type designation

The chargers of the type FILON FUTURE are available in various versions. Please find below an example of a type designation (e.g. for a 24V/50A charger).

Type: E 230 G 24 / 50 B-30 FP D

Typ:	E	230	G	24 /	50	B-30	FP	D
							Internal key	Options (e.g. display)
						Unit designation – FILON FUTURE		
					Output current			
				Output voltage				
			Type of output current "G" – direct current					
		Rated input voltage						
	Input power supply "E" – one-phase alternating current							

⇨ The precise technical data can be found on the type plate of the charger as well as in the Annex, see sections "name plate" and "Technical information".

3.3 Residual risk

! Danger

Explosion danger caused by gas generated during the charging process!

- ⇨ The battery emits a mixture of oxygen and hydrogen (detonating gas) during the charging process, which is (the result of) a chemical process. This gas mixture is highly explosive and must not be ignited.
- ⇨ The charging cable must only be connected with, and disconnected from, the battery plug when the charger is switched off.
- ⇨ As regards voltage and charging capacity, the charger must conform to the battery parameters.
- ⇨ Check the cable and plug connections before the charging process, in order to identify visible damage.
- ⇨ Ventilate the room sufficiently, where the battery is charged.
- ⇨ The surfaces of the battery cells must be exposed during the charging process, so as to ensure sufficient ventilation.
- ⇨ No smoking or open fire when handling batteries.
- ⇨ No flammable or sparking materials must be kept within 2 m of the area, where batteries are stored for charging.
- ⇨ Fire retardants shall be provided.
- ⇨ Do not place any metallic objects onto the battery.
- ⇨ Do observe the safety regulations as laid down in the section "Safety".

! Warning

Warning against dangerous voltage!
The charger is an electrical appliance that conducts electricity, the current and voltage of which is dangerous.

- ⇨ The charger must only be operated by duly qualified personnel.
- ⇨ Disconnect the power supply and, where applicable, the connection with the battery, before working on the charger.
- ⇨ The charger must only be opened and repaired by duly qualified electricians.

! Danger

Danger from being caught in charging cables!
There is a risk of tripping over charging cables lying around. People may get caught by, or trip over, loose cables pulled out.

- ⇨ Lay the charging cable in such a way that nobody can stumble or get caught by it.
- ⇨ Roll up the charging cable or put it on the cable holder (if available) after the charging process.

There is also the danger of severe personal injury and property damage, if the ongoing charging process is interrupted by pulling out the charging plug. The sparks thus generated may ignite the charging gas which is formed during the charging process and, as a consequence of it, trigger a fire or an explosion.

! Danger

Danger of explosion when charging unsuitable or incorrectly set battery types!
Charging a battery that is not approved for this charger is prohibited. Moreover, the charging program set in the charger and the battery type to be charged must be in conformity with each other. Failing to observe the above instructions may damage both the charger and the battery. The battery can excessively emit gas, boil off and even explode!

- ⇨ It must always be checked, whether the charger has been set for the battery type concerned. In cases of doubt do get in touch with the competent specialists.

! Warning

When charging wet-cell batteries, caustic acid gas may be generated!
Acid gas may cause a short circuit in chargers (risk of fire) and components may corrode!

- ⇨ Place the batteries in front of, or next to, the charger, so that the rising acid gas can freely spread at the site of deployment (dilute) and disappear.

3.4 Description of the protective devices

The charger has been designed and built in accordance with the generally recognized rules of sound engineering practice. Hence, there is no risk for the safety and health of the operating personnel or of third parties, if the charger is employed for its intended use.

All live assemblies are properly covered or housed and can only be accessed by using the relevant tools. All cables and plugs are properly screened or grounded. The charger's degree of protection is IP21 (standard, IP44/54 as option).

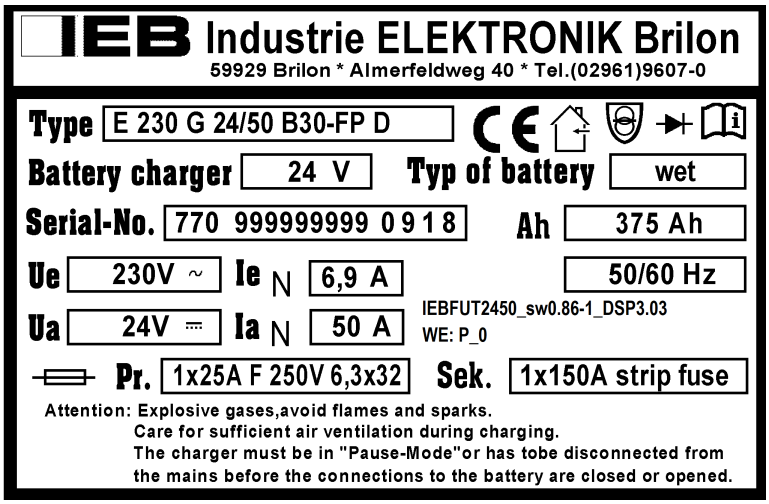
The required insulating clearances have been observed. All circuits are secured with primary-side and secondary-side fuses with a defined current and trigger characteristic.

All metallic components are grounded via a protective conductor system.

The charger is equipped with a function that prevents over-charging and the excessive emission of explosive types of vapor, after the battery's pre-set maximum charging level has been reached.

3.5 Markings and signs at the charger

3.5.1 Name plate (example)



The name plate will be produced for each charger and attached to it.

3.5.2 QR-Code (example)

The QR code will be produced for each charger and attached to it in a well visible place. It can be read out with suitable QR scanners. Modern smartphones with the relevant App (QR reading program) can also be used for this purpose.

The QR code contains the following information:

- type of appliance
- appliance number
- type of battery
- battery capacity
- software status and charging program (factory setting)
- primary/secondary fuse

4 Installation and commissioning

4.1 Safety instructions about putting up and installing the charger

- ⇨ Liquids must not get inside the charger.
- ⇨ The charger must be protected against inadmissible stress, especially against the damage of components, when shipping and handling the charger
- ⇨ There must be a horizontal distance of at least 2.5 m between the charger and flammable materials. Neither the storage of flammable materials, e.g. on shelves, nor the use of flammable building materials above the charger is permitted. There must be a minimum distance of 5.0 m to fire-risk and explosive areas (DIN VDE 0165, DIN VDE 0166).
- ⇨ It should be avoided to touch electronic components. The charger contains components that may be electro-statically charged and that can easily get damaged by improper handling. Electrical components must not be mechanically damaged or destroyed.
- ⇨ The electrical installation (wire cross-sections, fuses, protective conductor connections) shall be carried out in accordance with the valid regulations.
- ⇨ Compare the performance parameters stated on the type plate with the performance data of the power connections before the electrical installation. The power supply values stated on the name plate (voltage and frequency) shall be observed.

4.2 Scope of delivery

Note

The completeness of the scope of supply shall be checked on the basis of the enclosed freight documents before the installation commences. In the case of defects possibly identified, the manufacturer shall be immediately contacted.

The delivery consists at least of the following parts:

- charger with pre-set charging program,
- the connected mains and battery cables,
- the Operating instructions,
- the delivery note.

Depending on the customer's request, the scope of supply as well as the design of the charger may deviate from the above description. The enclosed freight documents (as well as the order confirmation) will contain further technical details.

Procedure:

- Check the completeness and integrity of the delivery immediately after its receipt.
- Check on the basis of the delivery note and of the type plate, whether the data are in conformity with each other.
- In the case of defects possibly identified, get in touch with the manufacturer and with the carrier, if applicable.
- Check the charger to identify loose external screwed connections and something like that. Re-tighten the connection, where applicable.

4.3 Requirements concerning the site of deployment

- ⇨ The charger must only be used in closed, frost-free and dry rooms.
- ⇨ The ambient temperatures at the site of deployment must not drop below 0° C and must not exceed 40° C.
- ⇨ The site of deployment must not be exposed to excessive dust. The existence of conductive materials (salt, soot, metals) must be excluded.
- ⇨ The site of deployment must be sufficiently ventilated, so that any charging gas generated during the charging process, such as acid mist or detonating gas, can spread/dilute and that the forming of explosive gas mixtures can be prevented.
- ⇨ Arrange the site of deployment in such a way that the ventilation openings are not covered and that the cooling airflow is not obstructed. The charger must not be put up in the vicinity of radiators or other heat sources. Any accumulation of heat at the charger, e.g. as a result of the ventilation slits being blocked, must be excluded.
- ⇨ There must be a minimum distance of 5.0 m to fire-risk and explosive areas (DIN VDE 0165, DIN VDE 0166).

4.4 Assembly / installation of the charger and placing the battery

! Danger

Explosion danger caused by gas generated during the charging process!

- ⇨ The battery emits a mixture of oxygen and hydrogen (detonating gas) during the charging process, which is (the result of) a chemical process. This gas mixture is highly explosive and must not be ignited.
- ⇨ The charging cable must only be connected with, and disconnected from, the battery plug when the charger is switched off.
- ⇨ As regards voltage and charging capacity, the charger must conform to the battery parameters.
- ⇨ Check the cable and plug connections before the charging process, in order to identify visible damage.
- ⇨ Ventilate the room sufficiently, where the battery is charged.
- ⇨ The surfaces of the battery cells must be exposed during the charging process, so as to ensure sufficient ventilation.
- ⇨ No smoking or open fire when handling batteries.
- ⇨ No flammable or sparking materials must be kept within 2 m of the area, where batteries are stored for charging.
- ⇨ Fire retardants shall be provided.
- ⇨ Do not place any metallic objects onto the battery.
- ⇨ Do observe the safety regulations as laid down in the section "Safety".

When assembling or installing the charger observe the following items:

- If the charger is to be mounted on the wall, use the enclosed wall attachment material (if included in the scope of delivery).
- Ensure the optimal ventilation for the charger.
- The lateral distance to the next charger must be at least twice the width of the charger. If this clearance cannot be ensured, the chargers must be positioned in a staggered arrangement.
- Keep a minimum distance of 0.5 m to any adjacent walls.

It must also be ensured that no

- aggressive gas, such as acid gas,
- conductive materials, such as salt, soot or metal dust,
- excessive quantities of non-conductive dust and
- liquids can get inside the charger.
- Put up and install the charger in such a place that the connection with the mains is within reach of the appliance's power cable (i.e. within 2 m).

! Caution

The mains cable of the charger may only be extended by qualified personnel!

! Warning

When charging wet-cell batteries, caustic acid gas may be generated!
Acid gas may cause a short circuit in chargers (risk of fire) and components may corrode!

⇨ Place the batteries in front of, or next to, the charger, so that the rising acid gas can freely spread at the site of deployment (dilute) and disappear.

Placing the battery to be charged

Procedure:

- Position the battery in front of, or next to, the charger, so that the plug of the battery is within reach of the charger's cable (standard 2.5 m).

! Caution

The charging cable of the charger must not be extended!

4.5 Connection with the mains/fuses

! Warning

Warning against dangerous voltage!
The charger is an electrical appliance that conducts electricity, the current and voltage of which is dangerous.

- ⇨ The charger must only be operated by duly qualified personnel.
- ⇨ Disconnect the power supply and, where applicable, the connection with the battery, before working on the charger.
- ⇨ The charger must only be opened and repaired by duly qualified electricians.

A connection with the mains at the intended site of deployment is required to operate the charger. Circuit breakers with D or K characteristics or gL fuses can be used. The mains connection must be properly earthed.

The supply voltage and frequency must conform to the data stated on the name plate (see section "name plate").

4.6 Cable holder

The chargers of the type FILON FUTURE (exception: housing types RF450, RF1250) have a cable holder which is located on the right-hand side of the housing and is mounted to the inside of the housing by a knurled nut.

! Warning

The cable holder of the charger of type FILON FUTURE (exception: housing types RF450, RF1250) must only be adjusted by duly qualified and authorized electricians!

Procedure:

- loose the knurled nut.
- shift the cable holder downwards.
- re-tighten the knurled nut.

4.7 Connecting the charger with the mains

Note

Observe the following sub-sections of the section "Installation and commissioning"before connecting the charger with the mains:

- ⇨ Safety instructions about putting up and installing the charger
- ⇨ Assembly/installation of the charger and placing the battery
- ⇨ Requirements concerning the site of deployment
- ⇨ Connection with the mains/fuses

The following requirements must be satisfied before connecting the charger with the mains:

- Put up and install the charger in such a place that the connection with the mains is within reach of the appliance's power cable (i.e. within 2 m).
- Position the battery in front of, or next to, the charger, so that the plug of the battery is within reach of the charger's cable (standard 2,5 m).

! Caution

The mains cable of the charger may only be extended by qualified personnel!

! Warning

When charging wet-cell batteries, caustic acid gas may be generated!
Acid gas may cause a short circuit in chargers (risk of fire) and components may corrode!

⇨ Place the batteries in front of, or next to, the charger, so that the rising acid gas can freely spread at the site of deployment (dilute) and disappear.

⇨ Detailed information about the weight, the input and output current as well as the power input is given in the Annex (see section "Technical information").

4.8 Commissioning and function test

After the charger has been properly put up and installed, it can be put into operation for the first time to carry out a function test (see section "Visual inspection before the commissioning").

5 Operation

5.1 Safety instructions for operating the charger

! Warning

Non-rechargeable batteries must not be used!

! Warning

Damage to or other defects on the charger can result in accidents!
If safety-relevant modifications, damage or other defects are found at the charger or while it is operated, it must no longer be used until the charger has been properly repaired.

- ⇨ Report any identified defects immediately to the superior.
- ⇨ Mark the defective charger as such and take it out of service.
- ⇨ Re-use the charger only after the defect has been localized and eliminated.

No liquids must get inside the charger.

The admissible battery voltage stated on the name plate must be checked and complied with, before the charging cable is connected (see section "name plate").

It must be ensured that the battery poles are correctly connected with the charging cable.

! Danger

Danger of explosion when charging unsuitable or incorrectly set battery types!
Charging a battery that is not approved for this charger is prohibited. Moreover, the charging program set in the charger and the battery type to be charged must be in conformity with each other. Failing to observe the above instructions may damage both the charger and the battery. The battery can excessively emit gas, boil off and even explode!

- ⇨ It must always be checked, whether the charger has been set for the battery type concerned. In cases of doubt do get in touch with the competent specialists.

! Danger

Danger from being caught in charging cables!
There is a risk of tripping over charging cables lying around. People may get caught by, or trip over, loose cables pulled out.

- ⇨ Lay the charging cable in such a way that nobody can stumble or get caught by it.
- ⇨ Roll up the charging cable or put it on the cable holder (if available) after the charging process.

There is also the danger of severe personal injury and property damage, if the ongoing charging process is interrupted by pulling out the charging plug. The sparks thus generated may ignite the charging gas which is formed during the charging process and, as a consequence of it, trigger a fire or an explosion.

5.2 Visual inspection before the commissioning

Check before starting the charging process, whether:

- the connection with the mains is not damaged,
- the housing does not show any signs of damage,
- the insulation of the charging cable and that of the connection cable with the mains are free from damage,
- the charging plug is not damaged and
- all external screwed connections are tight.

5.3 Actions to be taken before the charging

! Warning

Warning against dangerous voltage!
The charger is an electrical appliance that conducts electricity, the current and voltage of which is dangerous.

⇨ The charger must only be operated by duly qualified personnel.

⇨ Disconnect the power supply and, where applicable, the connection with the battery, before working on the charger.

⇨ The charger must only be opened and repaired by duly qualified electricians.

When a battery is charged, the duly instructed operator usually carries out the following steps.

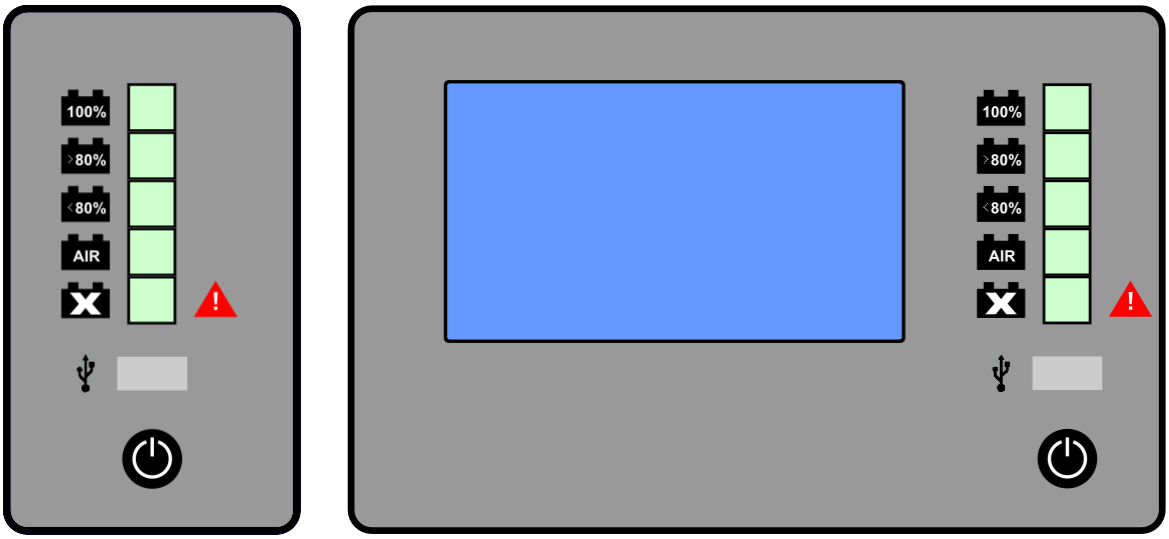
Procedure:

- Check, whether the charger and the battery type are compatible with each other.
- Check the charger to identify any damage, see section "Visual inspection before the commissioning".
- Connect the battery with the charger (i.e. connect the charger's cable with the battery plug) and connect the charger with the mains.
- The charging process will start automatically, see section "Starting the charging process".
- The charging process will stop automatically, see section "Charging process stops automatically".

⇨ The following sub-sections explain the individual operating steps in more detail. Read these sub-sections carefully before operating the charger for the first time.

5.4 Description of the operating and display unit

An operating and display unit with five LED elements (of which one is a red/white dual LED), a USB interface, a pause key and, depending on the design, the resistive 4.3-inch graphic display (optional) are located on the front side of the charger.



5.4.1 Function of the pause key

Depending on the charger's operating status, the pause key has different functions.
For further information please refer to the sub-section "Interrupting and re-starting the charging process manually".

5.4.2 Signaling the operating status on the LED display

LED display	Operating status	LED display	Operating status
	no battery connected		cooling down phase Cool Down Indication "CDI" (O)
	battery connected charge is being prepared		fast charge (O)
	start of deep discharge		desulphation
	main charge		main charge with EC (O)
	re-charge		re-charge with EC (O)
	end of charge and charge retention for the set battery type		desulphation with EC (O)
	pause mode (alternate LED flashing)	X	signals a flashing LED

5.4.3 Signaling the operating status on the graphic display (O)

The touch-sensitive graphic display is a means of visual support for the user.

The graphic display indicates the following operating statuses:

- start display
- charging display

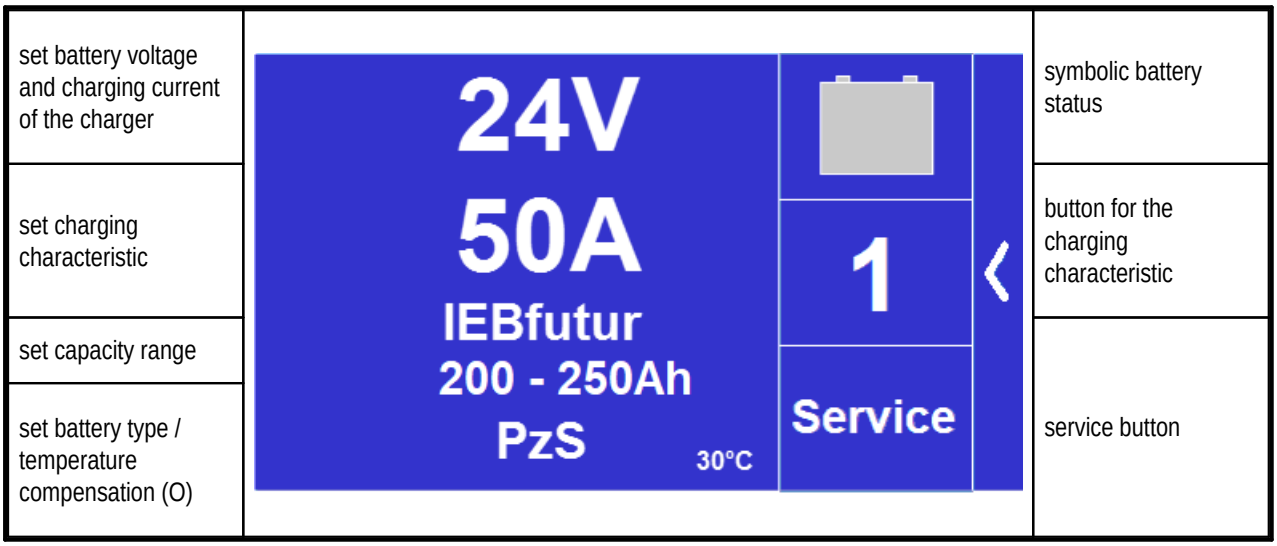
Start display
The start display indicates the set charging parameters.

This display will indicate the following conditions:

- "no battery"
- when starting the charger (with battery connected before starting charging)

Requirements:

- The charger must be connected with the mains.

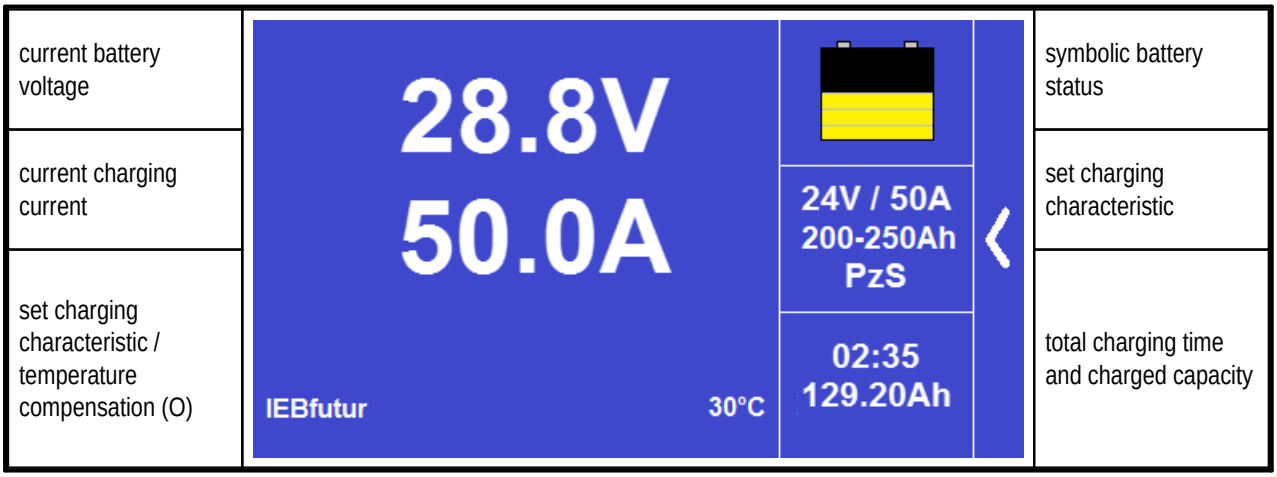


Charging display

The charging display indicates the current charging parameters during the entire charging process.

Requirements:

- The charger is connected with the mains.
- The charger is in the charging mode.



! Danger

Danger of explosion when charging unsuitable or incorrectly set battery types!

Charging a battery that is not approved for this charger is prohibited. Moreover, the charging program set in the charger and the battery type to be charged must be in conformity with each other. Failing to observe the above instructions may damage both the charger and the battery. The battery can excessively emit gas, boil off and even explode!

⇨ It must always be checked, whether the charger has been set for the battery type concerned. In cases of doubt do get in touch with the competent specialists.

5.5 Connection of the charger with the mains

The charger is equipped with a power cable and plug or, optionally, with an inlet connector for non-heating appliances.

! Caution

The mains cable of the charger may only be extended by qualified personnel!

Procedure:

- Connect the charger by plugging the connecting cable into the socket.

5.6 Battery connection

! Danger

Explosion danger caused by gas generated during the charging process!

- ⇨ The battery emits a mixture of oxygen and hydrogen (detonating gas) during the charging process, which is (the result of) a chemical process. This gas mixture is highly explosive and must not be ignited.
- ⇨ The charging cable must only be connected with, and disconnected from, the battery plug when the charger is switched off.
- ⇨ As regards voltage and charging capacity, the charger must conform to the battery parameters.
- ⇨ Check the cable and plug connections before the charging process, in order to identify visible damage.
- ⇨ Ventilate the room sufficiently, where the battery is charged.
- ⇨ The surfaces of the battery cells must be exposed during the charging process, so as to ensure sufficient ventilation.
- ⇨ No smoking or open fire when handling batteries.
- ⇨ No flammable or sparking materials must be kept within 2 m of the area, where batteries are stored for charging.
- ⇨ Fire retardants shall be provided.
- ⇨ Do not place any metallic objects onto the battery.
- ⇨ Do observe the safety regulations as laid down in the section "Safety".

! Danger

Danger of chemical burns and Warning against dangerous voltage!
The wet-cell battery contains sulfuric acid which is highly caustic. The exposed metal parts of a battery always carry voltage.

- ⇨ Do not open the battery casing and do not touch any blank metal parts!
- ⇨ Only duly qualified specialists must carry out work on or with batteries or battery systems; the battery manufacturer's Operating instructions shall be observed.

! Warning

When charging wet-cell batteries, caustic acid gas may be generated!
Acid gas may cause a short circuit in chargers (risk of fire) and components may corrode!

⇨ Place the batteries in front of, or next to, the charger, so that the rising acid gas can freely spread at the site of deployment (dilute) and disappear.

! Danger

Danger of explosion when charging unsuitable or incorrectly set battery types!
Charging a battery that is not approved for this charger is prohibited. Moreover, the charging program set in the charger and the battery type to be charged must be in conformity with each other. Failing to observe the above instructions may damage both the charger and the battery. The battery can excessively emit gas, boil off and even explode!

- ⇨ It must always be checked, whether the charger has been set for the battery type concerned. In cases of doubt do get in touch with the competent specialists.

! Danger

Danger from being caught in charging cables!
There is a risk of tripping over charging cables lying around. People may get caught by, or trip over, loose cables pulled out.

⇨ Lay the charging cable in such a way that nobody can stumble or get caught by it.

⇨ Roll up the charging cable or put it on the cable holder (if available) after the charging process.

There is also the danger of severe personal injury and property damage, if the ongoing charging process is interrupted by pulling out the charging plug. The sparks thus generated may ignite the charging gas which is formed during the charging process and, as a consequence of it, trigger a fire or an explosion.

Connecting the battery with the charger

Procedure:

- Lay the charging cable in such a way that nobody can stumble over it thus possibly interrupting the charging process.
- Put the plug of the charger into the battery plug.

5.7 Starting the charging process

Requirements:

- the charging characteristic with the charging function has been set in the charger
- the battery voltage amounts to at least 0.5 V/cell
- the battery voltage does not exceed 2.4 V/cell

Procedure:

- connect the battery with the charger
- do not press the pause key

Depending on the battery's charging level, the green LED will indicate "100 %" or one of the yellow LEDs.

⇨ If the battery voltage is below 1.9 V/cell, the middle yellow LED flashes (i.e. the battery is deeply discharged). If the battery voltage drops below 1.5 V/cell, the middle yellow LED flashes (i.e. the battery is deeply discharged) and the charging current is limited to 2A/100Ah. If this phase takes longer than 30 minutes, the charger will be automatically switched off and an error message will be indicated (the red and yellow LEDs light up).

5.8 Interrupting and re-starting the charging process manually

! Danger

Explosion danger
There is a danger of severe personal injury and property damage, if the battery is disconnected during the ongoing charging process. The sparks thus generated may ignite the gas formed during the charging process.

⇨ Press the pause button to interrupt the charging process. Then the charger can be disconnected from the battery respectively from the mains supply.

Note

During normal operation, do not stop charging before automatic shutdown. If the battery is switched off early, it will be undercharged. This reduces the available capacity of the battery.

Requirements:

- the charger must be switched on
- the battery is connected with the charger.

Procedure:

- When pressing the pause key for less than 1 sec, the charging process will be interrupted and the charger will change into the pause mode. The green LED "100 %" and the middle yellow LED will flash alternately.
- When pressing the pause key once again for less than 1 sec or automatically after 1 min, the charging process will continue again. Depending on the battery's charging level, either the green LED "100 %" or one of the yellow LEDs will light.
- When pressing the pause key for longer than 3 sec, the charger will be switched off and re-started after 15 sec.

5.9 Charging process stops automatically

The charging process will be automatically terminated, when the battery is fully charged. The green LED "100 %" signals the end of the charging process as well as the charge retention. The battery can now be used again.

5.9.1 Compensation charge

FILON FUTURE chargers use the patented FILON FUTURE characteristic for charging wet-cell batteries. The charging characteristic consists of a main charging phase which is followed by a dynamic pulse phase with dynamic switch-off. This characteristic does not require additional compensation charging.

5.9.2 Charge retention

As long as the battery is not disconnected from the charger, the charge retention specified for the set battery will take place.

Requirements:

- the charging program has been completed
- the battery is fully charged
- the green LED "100 %" comes on and signals the end of the charging process or the start of the charge retention procedure.

Procedure:

- The charger carries out the charge retention procedure specified for the set battery.

5.10 Charger options

Please find below the charger options with a brief explanation.

5.10.1 Charging process with electrolyte circulation "EC" (O)

Note

When the EC pump is switched on, the blue LED "AIR" on the operating and display unit will light. The proper operation of the electrolyte circulation (EC) will be monitored with a potential-free pressure switch in the pump housing.

If the charger notes a drop in pressure while charging, the charging process will be continued with a charging factor of 1.20, with the blue LED "AIR" on the operating and display unit flashing. The relevant operating status will continue to be indicated by the LEDs.

The battery will continue to be charged with the original charging factor, if the drop in pressure has been eliminated within the first hour of charging.

When charging with electrolyte circulation, the following needs to be observed:

⇨ The EC pump must not be operated without counter pressure.

⇨ Put the charger in such a position that the in-built EC pump is located at least 0.5 m above the battery to be charged. If this cannot be guaranteed, a non-return valve is recommended to prevent the electrolyte from flowing back into the hose system.

⇨ If an error message is indicated (i.e. the blue LED "AIR" is flashing), charge the battery without electrolyte circulation to its full capacity. When the charging process is prematurely interrupted, the battery will not be sufficiently charged, so its available capacity will be reduced.

The pump can only be re-started after the battery has been disconnected.

5.10.2 Remote display (external display) (O)

As an option, the charger can be equipped with an externally installed remote display instead of the one that is usually installed in the housing door. The LED display will always be installed by default.

The remote display is connected with the charger by way of an external cable (D-Sub) and provides a graphic image of the LED display on the right-hand side of the screen, in addition to the usual display of the charging process. Also a button for activating the pause mode is integrated in the remote display.

5.10.3 External charging indication (traffic light display) (O)

An external traffic light display with a 360° signaling capability can be connected with the charger, so that the charging level can be recognized better and faster from a larger distance. This display corresponds to the actual LED display at the charger.

5.10.4 Protection against undesired starting (O)

The protection against undesired starting can be installed in on-board appliances, where the charger will be connected with the vehicle electronics. As long as the charger is connected with the supply voltage, the electric vehicle is unable to move. The protection against undesired starting is a potential-free changeover contact (max. 42V 5A) that is attached to a three-pole terminal strip.

! Warning

Warning against dangerous voltage!
There is a danger of severe injuries and property damage, if the protection against undesired starting is not properly wired.

5.10.5 Charging process with temperature compensation (O)

Note

⇨ Apart from the temperature sensor itself, the charging software must be suitable for being used together with a temperature sensor.

When temperature compensation is used during the charging process, the charging voltage will be adjusted to the measured battery temperature with the help of an external temperature sensor. If the battery's maximum temperature is exceeded, the charger will indicate a fault (see section "Malfunctions and error messages") and interrupt the charging process.

Depending on the battery type used, the set maximum temperatures differ as follows:

- wet-cell battery: 60°C
- gel battery: 50°C

If the charger is unable to establish a connection with the temperature sensor, a warning will be issued (see section "Warnings"), although the charging will continue.

5.10.6 Aquamatic function (O)

The optional aquamatic function of the FILON FUTURE charger is intended to control an automatic water refilling system, which is used to set the battery's nominal electrolyte level automatically. The charging gas will disappear through the degassing opening of the stoppers. The valve in the stoppers, together with the floater and the floater rods, will control the refilling process with regard to the water quantity. The water pressure at the valve will make sure that the inflow of the water is stopped and that the valve is safely closed.

The automatic water refilling system can be controlled in various ways:

- by a potential-free closing contact
- by a voltage of 230 V AC
- by a voltage of 12 V DC

Note

Connection pressure/falling water
The water refilling system must be operated in such a way that the water pipe is under a pressure of between 0.3 and 1.8 bar. The installation height of the storage tank depends on the type of the water refilling system employed.

The following shall be observed in this respect:

- Control via an immersion pump: The immersion pump will generate the required filling pressure. There must be no difference in height between the storage tank and the battery's standing area.
- Control via valves without immersion pump: The lower edge of the storage tank must be located least 3 m above the upper edge of the battery, so that the necessary filling pressure can be achieved.

Functionality of the automatic water refilling system

Requirements:

- The battery is connected with the automatic water refilling system "Aquamatic".
- The charger must be equipped with the aquamatic function.
- The charger must be connected with the battery.
- The charging process can be started.

Procedure:

- A relay contact for controlling the automatic water refilling system will be activated cyclically 10 min before the end of the re-charging process at the following intervals:
  - switched on for 25 sec -> water inflow to the battery open
  - switched off for 5 sec -> water inflow to the battery blocked

5.10.7 IP44 and IP54 housings (O)

Dust filters have been installed on the chargers with IP44 and IP54 housings.

Note

The charger must be regularly cleaned to ensure its proper functioning.

- The dust filters must be inspected on a monthly basis to establish, whether they are dirty. In such case, they must be cleaned and, if necessary, replaced.
- Dirty dust filters can be cleaned with compressed air. If that proves to be impossible in view of the high degree of contamination or wear and tear, they must be replaced.
- The inspection intervals shall, where applicable, be adapted to the local conditions, e.g. when the dust formation has drastically increased.
- As a matter of principle, work must only be carried out by duly qualified specialists who wear personal protective clothing (PSA).
- The environmental regulations valid at the site of deployment must be complied with.

5.10.8 Dust filters and droplet separators (O)

FILON FUTURE chargers can be equipped with dust filters or droplet separators.
Please refer to the note in the sub-section on IP44 and IP54 housings.

5.10.9 Cool Down Indication "CDI" (O)

The CDI display indicates the battery's cooling down phase after the charging process. It begins after the charging has ended and takes 30 min.

The cooling down phase will be indicated by a permanently lit blue LED and the flashing green LED. After the end of the cooling down phase, only the green LED keeps lighting up.

5.10.10 Pilot contact "Safety Disconnect" (O)

The pilot contact is an auxiliary contact which closes lagging when inserting the charging plug and it activates the advanced opening when the plug is pulled out. The advanced opening of the pilot contact will automatically stop the charging process, so that the charging current doesn't flow anymore. This will prevent the formation of sparks when the battery is separated from the charger.

5.10.11 ID chip (O)

The ID chip is used to automatically configure the charger to match the connected battery. The parameters stored in the ID chip for charging the battery are transferred to the charger via the pilot or auxiliary contacts of the charging plug. Information on the number of cells/nominal voltage, capacity, type of characteristic curve and other charging parameters are stored on the ID chip.

If the nominal voltage on the ID chip is lower than that of the charger, the charger starts charging at the nominal voltage correctly adapted to the battery.

In chargers with the ID chip option, alternative characteristic curves may be stored in the other program locations in order to carry out charging without the ID chip if necessary. In this case, make sure that the charger/characteristic curve and the battery are correctly assigned.

5.10.12 Timer (O)

The timer is used for delayed start of charging after connecting the charger to the battery. The charge start delay can be set in 5-minute steps from 5 minutes to 23 hours and 55 minutes. The set time remains stored even after disconnection from mains or battery.

Proceed as follows to enter the timer setting menu.

Requirements:

- Battery charger is switched on.

Procedure:

- Press the "Arrow" button on the right side of the display.
- Enter the service password via the numeric field that appears.
- Select the "Charge settings" button.
- Select the "Timer" button.
- Set up the timer values, save changes and and leave the menu.

5.11 Malfunctions and error messages

If the charger's operational conditions cannot be restored after the following corrective measures have been taken or if the LED display signals a fault or defect in the electronic system, please inform the manufacturer's Customer Service. All further trouble-shooting measures must only be carried out by the manufacturer's Customer Service, the personnel of which are specifically trained and qualified for this job.

The Customer Service finds the following information important and helpful, in order to be able to respond quickly and professionally to the fault reported:

- serial number of the charger
- display on the LED screen
- error description
- current location of the charger.

The five LEDs of the operating and display unit indicate malfunctions and the status of the charger:

LED display	Error group	Description
	BAT	battery fault - incorrect battery voltage established
	TIME	time or capacity fault - preliminary charging takes too long (battery voltage <1.5 V/cell for longer than 30 min) - constant current phase (I1) is too long - constant voltage phase (U1) is too long - capacity monitoring has been triggered
	SYSTEM	system fault - problem with the internal data bus

LED display	Error group	Description
	MODULE	module error - red LED flashes quickly: one or more power modules have an error - red LED lights up alternating with the white LED: pilot contact on at least one power module not plugged in or pilot line interrupted
	COM	external communications fault - communication with connected peripheral devices impaired
	TEMP	temperature fault - internal temperature fault - external temperature fault (optional)

The following table provides an overview over possible causes of faults and their rectification:

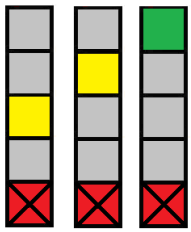
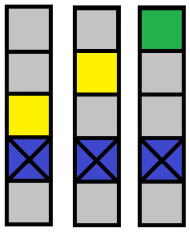
Error group	Corrective measures
BAT	Starting point: the battery must be connected. Check the battery allocation. Check the battery's polarity and correct it, if applicable. Measure the battery voltage: - Battery voltage is under 0.5 V/cell. - Raise the battery voltage with suitable measures above 0,5 V/cell. Check the battery, whether there is an internal short circuit. Check the output fuse of the appliance. If the fault continues, do contact the service technician.
TIME	Check the battery allocation. Check the battery itself. - Battery too hot: if a battery defect can be excluded, continue the charging process after a sufficient cooling down phase. - Battery defective (e.g. internal short circuit). - Battery was deeply discharged: re-start the charging process. Compare the battery's rated voltage and capacity with the setting in the charger. - If there is no suitable setting for charging the battery, the charger cannot be used for this battery. - If the battery capacity is only slightly higher (max. 25%) than stated on the charger, the charging is possible to a limited extent, which cannot be recommended for a longer period. Besides, you must expect the same error message every time you charge a battery. Check the preliminary charging current. - If the measured current is clearly lower than the preliminary charging current specified by the charging characteristic, there is a fault in the charger. - If the fault re-occurs after 30 min., do get in touch with the service technician.
SYSTEM / MODULE	Disconnect the charger from the mains and re-start it after 1 min. in order to confirm the fault. Check the charger to identify the connection that may possibly be loose, after you have disconnected charger and battery. If the power module is defective, the defective module will be indicated, if the charger is equipped with a display. If the fault continues, do get in touch with the manufacturer of the charger.
COM	Check the connected peripheral devices. Check the connections between the peripheral devices and the charger.
TEMP	Check the inlet and outlet air openings.

Error group	Corrective measures
	- The openings of the charger must not be obstructed. - If dust filters have been installed, clean or replace them, if necessary. - Select a site of deployment for the charger, where an unobstructed air flow is ensured. - Maintain a sufficient distance to other chargers or heat sources. - A too high ambient temperature may affect the charging process. - Check the ventilators' function during the charging process. Check the battery itself. - It must not be hot when being touched; if so, let it cool down. If all these causes can be excluded, do get in touch with the service technician.

5.12 Warnings

Warnings will not interrupt the charging process; they merely draw the user's attention to that fact that there is a problem which is affecting the charging process.

The following (and other) warnings may be received:

LED display	Warning	Behavior of the charger without interference	Corrective measures
 x = flashing	temperature sensor defective or not connected	The battery temperature can no longer be monitored. A fixed battery temperature of 30° C will be set for the charger.	Check the connection of the temperature sensor and especially, whether it is externally damaged. Inform the manufacturer of the charger, if necessary. Once the fault has been rectified, the red LED will go out and the charging process will again be adapted to the current battery temperature. If the fault continues, do get in touch with the service technician.
 x = flashing	EC pump cannot build up pressure	The charging process will be continued without electrolyte circulation (EC), which extends the charging time by up to three hours.	Check the hose connection and make sure that the air hose leading to the battery is properly connected. Check, whether the air hose is damaged and if so, get it repaired. If the fault continues, do get in touch with the service technician.

5.13 Disconnecting the charger from the mains

The charger is supplied with power by the cable connected with the mains.

Disconnect the charger from the mains, if:

- the charger has a defect,
- the charger's electronic system is to be put into its starting condition (reset), e.g. when a fault has been indicated.

6 Maintenance

6.1 Cleaning, inspection and maintenance

The battery charger's professional and thorough maintenance is important, so that its safe use can be ensured. If the regular maintenance jobs are not carried out, the charger may develop malfunctions that pose a danger to people and the charger's operation.

Check before commencing each charging operation, whether:

- ⇨ the connection with the mains is undamaged,
- ⇨ the housing is free from damage,
- ⇨ the insulation of the charging cables and that of the connection cables with the mains does not show signs of damage,
- ⇨ the charging plug is undamaged, and
- ⇨ all screwed connections are tight.

Note

A charger's general conditions of use will have a considerable effect on the wear and tear of those components that require maintenance. The maintenance intervals referred to herein are based on normal operating conditions.

- ⇨ More unfavorable operating conditions, such as heavy contamination with dust or severe temperature fluctuations, require that the maintenance intervals are reasonably shortened. In cases of doubt contact the competent specialists.
- ⇨ Remove dust or dirt on the charger with a dry cloth.

Note

The heat sink in the charger is forced-air ventilated, so that the air is not channeled directly across the electronic components. It is nevertheless possible that dust gets into the charger. The maintenance intervals referred to herein are based on normal operating conditions.

- ⇨ The room, in which the charger is located, must be ventilated.
- ⇨ Keep the room, in which the charger is located, clean and tidy.
- ⇨ Check the inside of the charger at least every half year to identify any contamination and clean the appliance. Work inside the charger must only be carried out by duly qualified electricians.
- ⇨ More unfavorable operating conditions, such as heavy contamination with dust or severe temperature fluctuations, require that the maintenance intervals are reasonably shortened. In cases of doubt contact the competent specialists.

! Warning

Warning against dangerous voltage!
The charger is an electrical appliance that conducts electricity, the current and voltage of which is dangerous.

- ⇨ The charger must only be operated by duly qualified personnel.
- ⇨ Disconnect the power supply and, where applicable, the connection with the battery, before working on the charger.
- ⇨ The charger must only be opened and repaired by duly qualified electricians.

! Warning

Damage to or other defects on the charger can result in accidents!
If safety-relevant modifications, damage or other defects are found at the charger or while it is operated, it must no longer be used until the charger has been properly repaired.

- ⇨ Report any identified defects immediately to the superior.
- ⇨ Mark the defective charger as such and take it out of service.
- ⇨ Re-use the charger only after the defect has been localized and eliminated.

6.2 Spare parts and service

In case of service, please contact your service partner with the charger data from the name plate. They will also supply you with spare parts.

6.3 Disposal

Once the charger is permanently taken out of service, the laws and regulations for the disposal applicable at that point in time shall be observed.

More detailed information can be obtained from specialist disposal firms or from the competent authorities.

Note

Electronic scrap contains various plastic, metal and heavy metal components which pose a high danger potential for the environment.

⇨ Collect and dispose of electronic scrap separately from household refuse or commercial waste.

⇨ Deliver electronic scrap to your company's internal disposal department, if there is one, which will see that the scrap is passed on the relevant specialist disposal firms.

The packaging of the charger shall be disposed of separately. Paper, cardboard and plastic can be recycled.

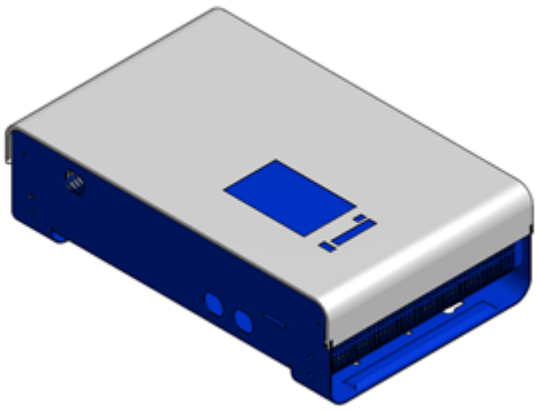
7 Annex

7.1 Technical Information

Appliance series	FILON FUTURE
Appliance number.	see name plate
Charging characteristic	see technical data sheet
Temperature range	0°C – 40°C [32°F – 104°F]
Rated input frequency	47 – 63 Hz
Degree of protection	see technical data sheet
Housing	see dimensions and housings
Directive (EU)	2014/35/EU – Low Voltage Directive 2014/30/EU – EMC Directive 2011/65/EU – RoHS Detailed information can be found in the Declaration of Conformity.
Standard (US)	UL 1564 – Standard for Industrial Battery Chargers Detailed information can be found in the Declaration of Conformity.

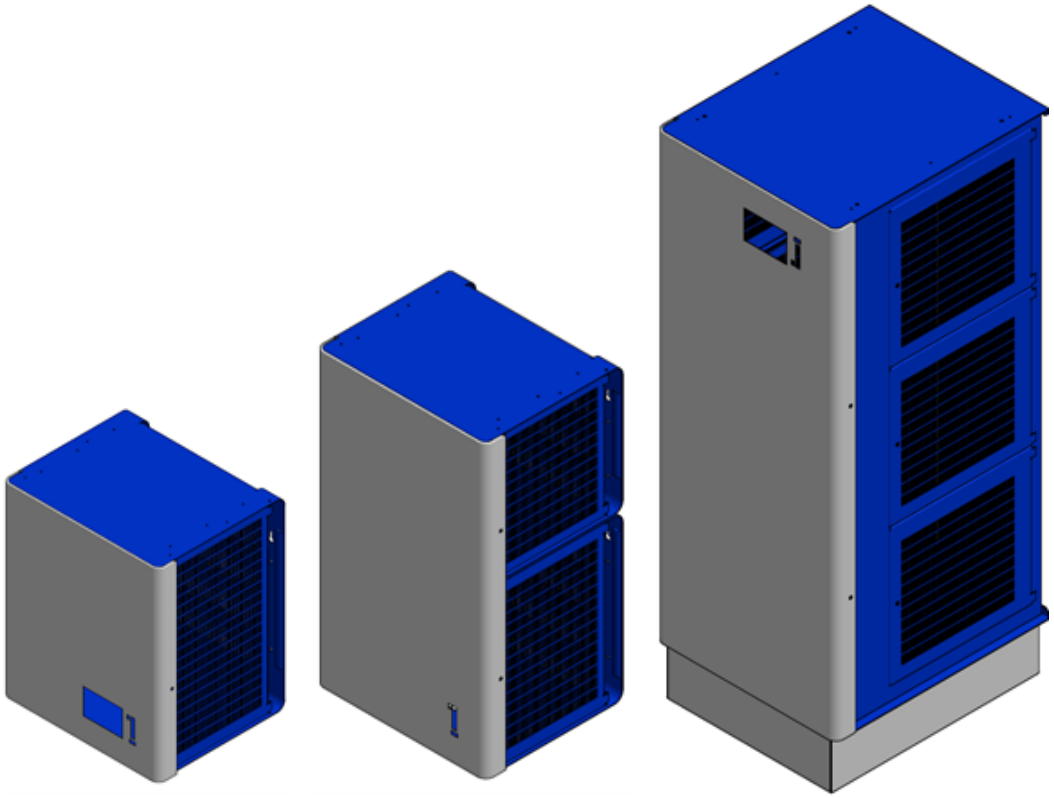
7.2 Dimensions and housings

Housing	Dimensions (in mm) [in inch]			Weight (in kg) [in lbs]
	Width	Heigth	Depth	
RF450 (only EU)	430 [17.0]	270 [10.7]	125 [5.0]	min. 12.0 [27]
RF455 (only EU)	430 [17.0]	430 [17.0]	170 [6.7]	min. 13.5 [30]
RF460 (only EU)	290 [11.5]	550 [21.7]	100 [4.0]	min. 12.5 [28]
RF480 (only US)	430 [17.0]	305 [12.1]	145 [5.8]	min. 14.5 [32]



Example of the housing RF450

Housing	Dimensions (in mm) [in inch]			Weight (in kg) [in lbs]
	Width	Height	Depth	
RF550	430 [17.0]	415 [16.4]	355 [14.0]	min. 30.0 [67]
RF560	430 [17.0]	510 [20.1]	355 [14.0]	min. 45.0 [100]
RF650	430 [17.0]	735 [29.0]	355 [14.0]	min. 65.0 [144]
RF750	430 [17.0]	840 [33.1]	355 [14.0]	min. 80.0 [177]
RF950	430 [17.0]	1015 [40.0]	355 [14.0]	min. 89.0 [197]
RF1250 (standing device)	460 [18.2]	1300 [51.2]	550 [21.7]	min. 127.0 [280]



Examples of housings RF560, RF650 and RF1250

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