Operating Instructions

PowerHouse IHF Motive Charger

Intelligent High Frequency

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1 General

1.1 Purpose of the operating instructions

These operating instructions serve to enable the secure operation of the charger IHF as intended. IHF is designated as charger for short.

The operating instructions must always be available and kept handy in the vicinity of the charger. The operating instructions must be read in addition to the CAUTION, WARNING and DANGER markings on the charger and observed by every person commissioned with performing tasks on the charger; this comprises transport, setup and installation, operator control, maintenance and dismantling.

In addition to the operating instructions, the valid applicable guidelines, standards and laws for safe and correct working at the place of installation must be observed in commercial use

Information in addition to these operating instructions can be obtained from the specialists of the manufacturer or supplier.

2 Safety

2.1 General

IMPORTANT OPERATING AND SAFETY INSTRUCTIONS

1. **SAVE THESE INSTRUCTIONS** – This manual contains safety and operating instructions for IHF battery charger models
2. Before using battery charger, read all instructions and cautionary markings on battery charger, battery, and product using battery.
3. Do not touch uninsulated parts of the DC output connector or the battery terminals, as there is a possibility of electrical shock.
4. You should never break the battery connection during a charging process, because this could produce sparks which might ignite the charging gases (hydrogen).
5. Only qualified technical personnel may operate or service the charger.
6. De-energize all AC and DC power connections before servicing the charger. If injury occurs, apply the prescribed treatment for electrical shock and obtain medical attention immediately.
7. The charger is not for outdoor use. Do not expose the charger to rain or snow.
8. This charger is factory set to charge rechargeable lead batteries only. The operating environment should not contain any contaminations that may cause corrosion or contamination that would degrade the performance of the charger.
9. Do not operate this charger if it has received a sharp blow, been dropped or otherwise damaged. Take it to a qualified service center.
10. Do not disassemble the charger. Have the charger examined by a qualified service facility. Incorrect re-assembly of the charger may result in an explosion, electric shock or fire.
11. These operating instructions are an essential part of the charger.
12. The operator will ensure that the operating instructions are always available on the charger and that the operating personnel will pay attention to these guidelines.

13. The operating instructions must be supplemented by the operator with operating instructions on the basis of existing national regulations for accident prevention and environmental protection including the information concerning supervisory and notification obligations for the consideration of special operational features for instance with regard to work organization, working processes and personnel employed.
14. In addition to the operating instructions and the valid regulations for accident prevention applicable in the country concerned and at the place of operation it is also necessary to observe the recognized special technical rules for safe and correct working.

2.2 Signs and symbols

The charger is manufactured according to the generally accepted rules and the current state of the art. Additional safety instructions are provided in order to guarantee the personnel adequate safety. Adequate safety when handling the charger is ensured only if these instructions are adhered to.

From time to time it is necessary to emphasize certain text passages. The passages marked thus have different meanings:

Note!

Notes contain additional information facilitating safe and efficient handling of the charger.

CAUTION!

This warning draws attention to possible damage to property which may result from a failure to adhere to precautionary measures or from incorrect handling.

Please observe all warnings and measures that prevent the occurrence of damage on the charger and other property. Proceed with particular care!

WARNING!

This warning refers to possible injuries to persons which may result due to a failure of adhering to precautionary measures or through incorrect handling.

Please observe all warnings and measures which prevent injuries to yourself or third parties. Proceed with particular care!

2.3 Personnel qualifications

Only qualified technical personnel may work on the charger. The competencies of the personnel for operation and for installation/maintenance must be clearly defined.

Qualified technical personnel in the sense of these basic instructions are persons who are familiar with the setting-up, installation, start-up, operation, maintenance, shutdown and disassembly and who have the qualifications *corresponding to their activity*.

The installation, initial start-up, maintenance and disassembly of the charger must only be performed by qualified *electricians* authorized for this purpose.

With qualified electricians it must be assumed that the applicable regulations of the local power supply company (PSC) and the safety instructions of the accident prevention regulations of the trade associations and all rules for safe and correct working (for instance NEC or other North American installation requirements) are observed and adhered to.

The manufacturer points out that the manufacturer will not accept any liability for damage and operating faults arising from a failure to observe the operating instructions.

2.3.1 Commercial use

If the charger is employed commercially, the following will apply in addition:

- The operator must be familiar with the charging process of lead-acid batteries and their handling through special instruction or training.
- Only authorized personnel may become active.

2.4 Use as intended

The charger IHF is intended for charging lead-acid batteries. Only flooded batteries which suit the selected charging program, or the corresponding sealed maintenance-free motive batteries, can be charged. The charger is not suitable for all other accumulators and non-rechargeable batteries!

The charger can be equipped with various types of charging plugs. Therefore it is the responsibility of the operator to prevent accidental connection of unsuitable battery types.

This can be achieved, for example, with corresponding color coding or mechanical keys of the charging plug.

The instructions of the battery manufacturer must be observed and adhered to!

For a charger with subsequently modified charging program the operator is responsible for ensuring that the suitable battery type is marked indelibly on the outside of the housing.

For proper utilization as intended, the specifications for the operating location (see Sections 2.5 and 5.2), the specifications on the nameplate and the specifications in the technical data (see the appendix) must be observed and complied with.

WARNING! Danger of injury!

Danger of serious injuries to persons and property may result from:

- **incorrect use or incorrect operation,**
- **impermissible opening of the charger,**
- **incorrect installation or incorrect maintenance and repair.**

All details concerning the use as intended, the residual risk, the installation, the operation and maintenance contained in these Operating instructions must therefore be observed and adhered to.

The charger may only be used for the applications provided in these operating instructions and in the technical description and only with the accessories or components recommended and approved by the manufacturer.

Use other than this or beyond this will not be considered as use as intended. The operator or user of the charger will carry the sole responsibility for damage resulting from such use.

2.5 Safety instructions concerning setting up and installation

Prior to commencing with the installation, check the scope of delivery for completeness using the enclosed delivery documents. Possible defects must be immediately reported to the manufacturer.

The charger is not for outdoor use. Do not expose the charger to rain or snow. The operating location must be dry and protected against the weather.

The ambient temperatures at the place of installation must not be less than 0 °C / 32 °F and not exceed 50 °C / 104 °F. Heat accumulation on the charger, e.g. produced by heat sources or blockage of the ventilation slits, must be prevented.

The operating location must be adequately ventilated so that the charging gases produced (acid fog, oxyhydrogen) can be adequately diluted to dependably prevent the appearance of explosive gas mixtures.

Unduly high dust levels must be avoided at the operating location. Electrically conducting dust types (soot, metals) must be prevented.

Do not allow any liquids to penetrate into the interior of the charging unit.

The charger must be installed on a floor of non-combustible material such as stone, brick, concrete or metal.

The distance between charger and flammable material must be minimum 2.5 m / 8.2 ft. The storage of flammable material, e.g. in racks, is as well not allowed as the use of flammable construction material above the charger. The minimum distance to areas potentially endangered by explosive materials must be 5.0 m / 16.5 ft.

The charger must be protected from impermissible loads. In particular, no components must be damaged during transport and handling. Avoid contact with electronic components.

The charger contains electrostatically susceptible components which can be easily damaged through incorrect handling. Electrical components may not be mechanically damaged or destroyed.

Perform the electrical installation (line cross sections, fuses, earth connections) according to the applicable regulations.

Prior to the electrical installation, compare the power details on the nameplate with the power data of the supply connections. The charger must be protected against excessive contact voltage by superposing a mains fuse. Adhere to the mains connection values of the nameplate (voltage and frequency).

A lateral min. distance of 30 cm / 12” between the devices or other obstacles must be maintained.

2.6 Safety instructions concerning operation

The charger may only be used in technically perfect condition and as intended under consideration of safety and hazards and adhering to these operating instructions. In particular, faults impairing the safety must be corrected immediately.

The information on the nameplate about the permissible battery voltage must be checked prior to the connection of the charging cables and adhered to. Correct connection of the charging cables to the battery poles must be ensured.

For connecting the batteries, the charging cables must be laid out such that no persons can stumble over them and interrupt the charging process prematurely by pulling out the charging plug. There is always a danger of fire and explosion caused by sparks if the running charging process is interrupted by pulling out the charging plug!

In the event of safety-relevant changes of the charger or the operating behavior, the charger must be stopped immediately and the fault reported to the responsible office.

2.7 Safety instructions concerning troubleshooting and repair

Before opening the housing for maintenance and repairs, consult the manufacturer or the supplier.

Before starting maintenance or repairs, disconnect the charger from the mains power supply and from the battery. De energize both AC and DC power connections.

After switching off, wait for at least five minutes before taking off the covers of the housing.

No changes, attachments and conversions which may impair the safety may be performed on the charger without the approval of the manufacturer! This applies also to the installation and adjustment of safety installations: Especially ensure that distances, creep and air gaps are not reduced.

Replacement parts used must satisfy the technical requirements determined by the manufacturer. This is always ensured when using original replacement parts.

3 Product details

3.1 Description of the product and its function

The charger IHF is intended for charging lead-acid batteries. Depending on the selected charging program, only wet batteries or sealed maintenance-free motive batteries can be charged.

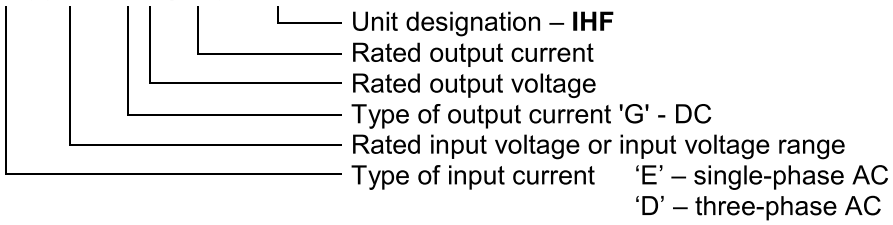
The unit comprises a controllable high-frequency power unit, microprocessor-controlled charging electronics and an operating and indicating panel with buttons and four light-emitting diodes (LED). The charging program for the respective battery type is preset in the factory. The preset charging program and the associated battery type are specified in more detail in Section 6.4.1 Charging program.

The individual assemblies of the unit are installed in a robust sheet metal housing. For the mains connection the charger is equipped with a mains cable and plug. Depending on the particular requirements, the charging cables can already be equipped with a battery-specific charging plug for making the battery connection.

3.2 Type designation

The charger IHF is available in different versions. In the following, a type designation (e.g. for a 24 V / 120 A charger) is explained by way of example:

Type E208-277G24/120B-IHF



For exact technical data please refer to the nameplate on the charger and to the information on technical data in the annex.

3.3 Description of the accessories and their function

3.3.1 Charging plug

Depending on the type of battery, different charging plugs have to be used. Thus the charger is delivered with a charging plug of your choice. Please see the attached delivery documents for information.

3.3.2 Aquamatik / Water replenishing system (optional)

If the charger is equipped with the Aquamatik option (water refill system), an automated water filling system can be connected in the charger. The corresponding relay contact is available inside the charger (see circuit diagram inside the housing).

WARNING! Danger of injury!

There is danger of severe personal injury and damage to property due to voltages dangerous to life.
The Aquamatik control may only be connected up by qualified electrical personnel.
Prior to opening the charger, the connections to the mains supply and to the battery must be interrupted.

The Aquamatik control functions as follows:
After reaching a voltage of 2.4 V/cell the Aquamatik contact is closed for a period of 7 minutes! The activation is in intervals controlled with following control times: 12 seconds ON and 4 seconds OFF.

A control transformer will provide 24VAC via the contact on the relay card that will be feed back into the automatic water filling system.

3.3.3 Radio interface BATCOM basic

The charger can be equipped ex factory with a radio interface for the communication with a battery controller BATCOM basic installed at the battery. For details, see section 6.2.

3.3.4 Battery Temperature Sensor (optional)

The charger can be equipped with a temperature sensor connection for measuring the battery temperature of the battery string during the charge cycle to prevent the batteries from overheating. The charge can then utilize this temperature measurement to control the output voltage based on the battery temperature. This compensation value is set as part of the internal programming of the charging curve.

This option requires the Euro Battery or SBX type Connector to be installed on the battery string and will use the “lower auxiliary contacts” per the manufacturer’s instructions.

If the charger was ordered with this option at the time of purchase this will already be installed from the charger connector(s) to the charger board. If used in conjunction with the BATCOM basic device the temperature probe will operate as a backup to the wireless interface. In order to use these devices for over temperature monitoring/control the associated selection must be made in the Traction Monitor Software.

If installed after receipt of the charger please follow the following steps after removing AC power to the charger:

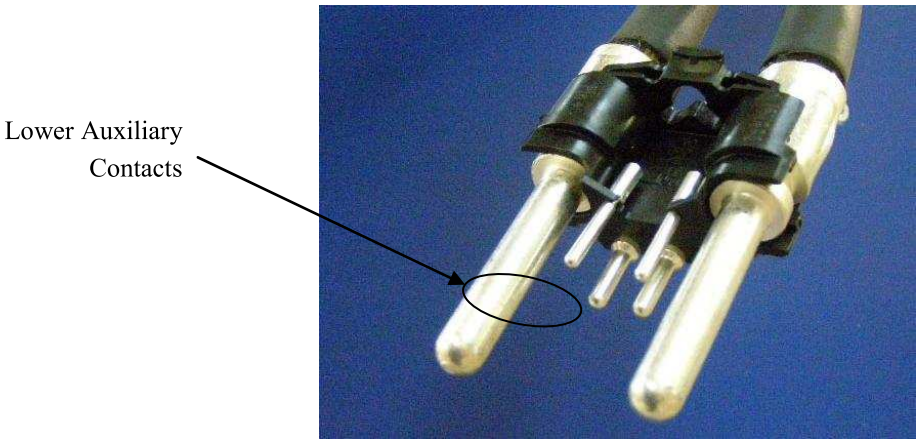
WARNING! Danger of injury!

There is danger of severe personal injury and damage to property due to voltages dangerous to life.

The Temperature Compensation connection to the charger may only be connected up by qualified electrical personnel.

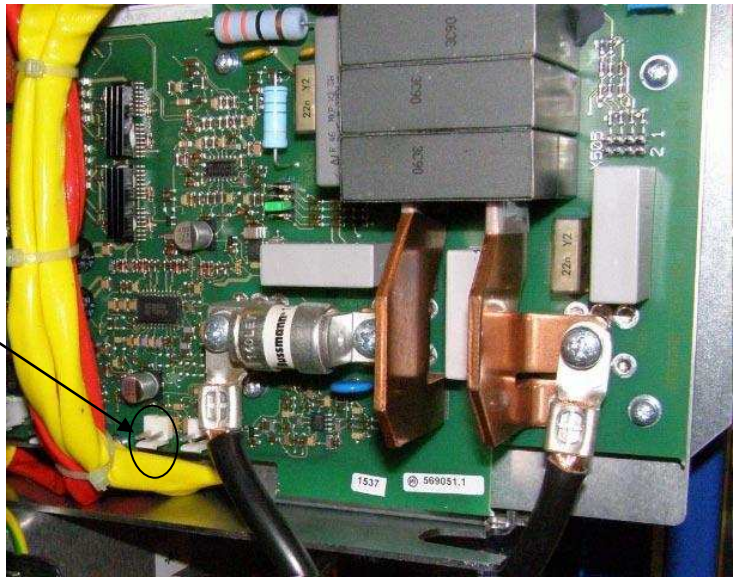
Prior to opening the charger, the connections to the mains supply and to the battery must be interrupted.

a. Install the Lower Auxiliary Contacts on the chargers connector via the manufacturer's instructions.



b. Install the supplied wire (two wire, gray jacket) from the output connector to the charger board (Master board in the multi-board chargers) via a two pin connector, X703.

Temperature Probe Input Connector, X703



c. The temperature sensor will be need placed on top of the battery string and secured to prevent any shifting that may occur during normal daily operation. Prevent temperature probe from resting against the battery cables as this will increase the likelihood of erroneous readings due to the cables heating during the charge cycle. The temperature probe is isolated but care should be taken to prevent the placement of the metal tip from shorting out the battery terminals.

3.3.5 Pilot Contacts (optional/standard)

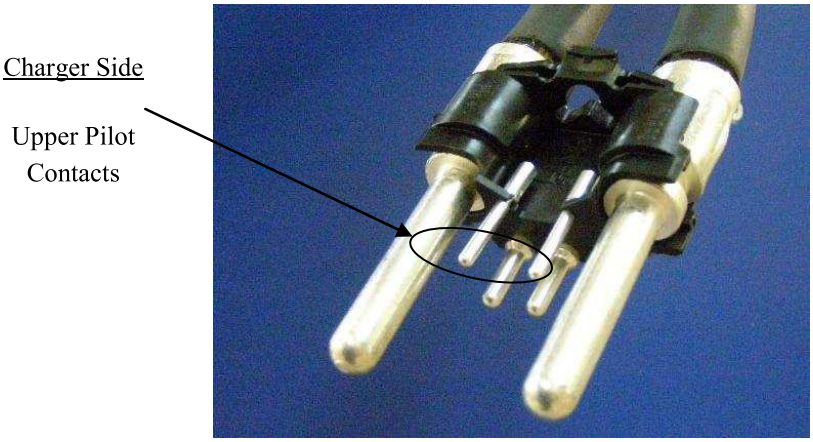
The charger can be equipped with optional pilot contacts that will prevent the charger from beginning the charge process until the connector(s) have been plugged in. With this option installed the charger will sense contact between the charger connector(s) and battery connector(s) and will prevent the beginning of the charge cycle until this loop is closed. In multiple connector chargers the connection of both connectors is required to close this loop. Therefore the charger will not start-up until both connectors have been plugged into both battery connectors.

The charger will end the charging process and switch-off in the event that the connector(s) are disconnected from the battery to prevent from having any voltage at the battery connector when the unit is not connected. In dual connector chargers this will prevent the charger from providing current to the battery via a single connector.

This option requires the Euro Battery Connector(s) to be installed on the battery string and will use the “upper pilot contacts” per the manufacturer’s instructions. See details below for both single and dual connector chargers:

Pilot Contacts for Single Connector Chargers*

On single connector chargers a loop of min 18AWG wire must be installed from + to – on this connector.



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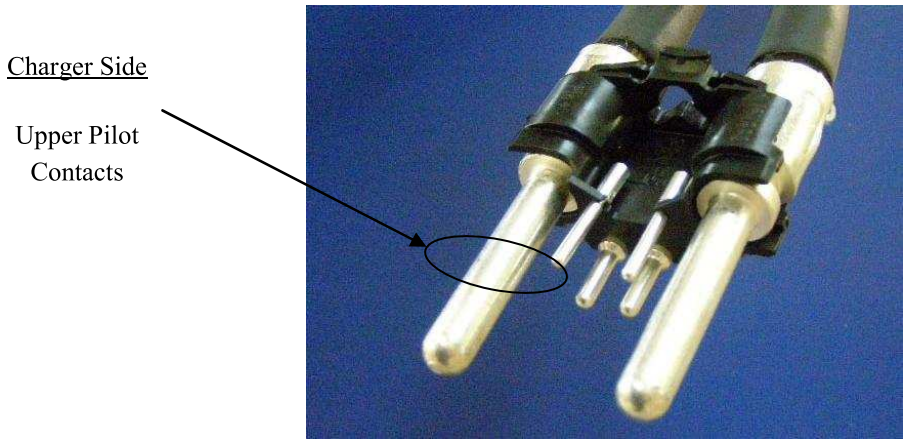
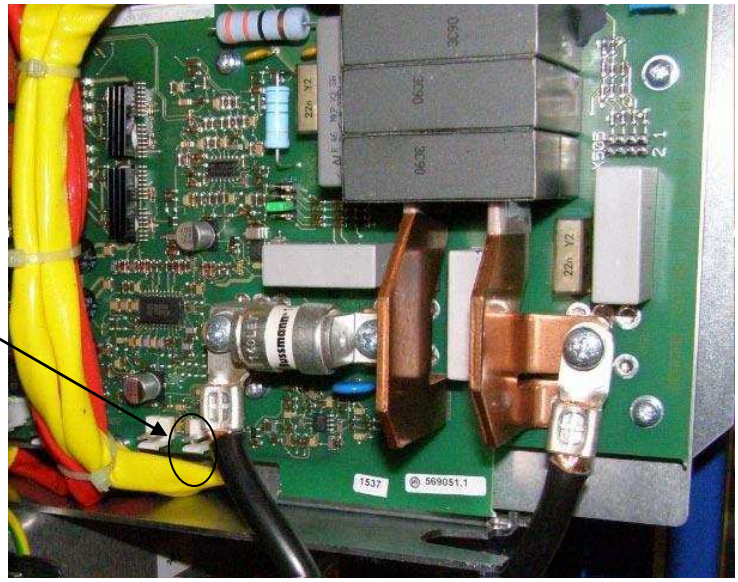
Pilot Contacts for Dual Connector Chargers

On dual connector systems a loop of min 18AWG wire must be installed from the + pilot contact on connector #1 to the same pilot contact on connector #2 and from the - pilot contact on connector #1 to the same pilot contact on connector #2.



On dual connector systems one connector (same connector as the Temperature Probe if installed) should have the supplied wire harness (two wire, gray jacket) installed from this set of pilot contacts back to the charger board (Master board in the multi-board chargers). On the second connector a loop of min 18AWG wire must be installed from the + pilot contact to the – pilot contact. See next figure for wiring instruction at the charger board.

If the charger was not ordered with this option the wire harness from the charger side output connector (above) will need to be connected to the charger board. Install the wiring (18 - 20 AWG) from the output connector to the charger board (Master board in the multi-board chargers) via a two pin connector, X707.



3.4 Remaining risk

WARNING! Dangerous electrical voltage warning!

The charger is a piece of electrical equipment carrying voltages and currents which are dangerous to human beings.

The charger must therefore only be operated by trained and qualified specialists.

For that reason, the charger may only be installed, opened, repaired and dismounted if required by qualified *electrical* personnel!

As a general rule, the mains supply and possibly one battery contact must be interrupted before performing any actions and work on the charger.

WARNING! Explosion hazard!

Explosive gases may escape during battery charging.

The operation of the charger is therefore permitted only in adequately ventilated rooms.

You should *never* break the battery connection during a charging process, because this could produce sparks which might ignite the charging gases (oxyhydrogen).

WARNING! Danger of tripping over charging cables!

Extended charging cables entail a danger of stumbling and the risk of interrupting a running charging process:
Persons can trip over extended loose cables, stumble and thereby pull the charging plug out of the battery during the charging process. The resulting sparks could ignite the charging gases, producing a fire or an explosion.

For the battery connections locate the charging cables such that nobody can stumble over them. After the end of the charging process, place the charging cables tidily on the holder.

CAUTION!

If a wrong battery is connected to the charger, damage to the charger and the battery can result. The battery could release unduly large amounts of gas, boil and even explode!

Always check whether the charger is set for your battery type. In the case of doubt, get in touch with the competent specialist staff.

CAUTION!

When batteries are being charged, caustic acid gases may be generated which can cause short-circuits in electrical equipment (fire hazard) and corrode components!

For this reason place your batteries always adjacent to charging stations so that the arising acid gas can spread (dilute) and escape freely at the site.

3.5 Description of protective installations

The charger has been designed and built according to the accepted rules of engineering. When used as intended there are no consequent safety and health hazards to operating personnel or third parties.

All live assemblies are equipped with housings, covers which can only be removed by means of tools. All cables and plugs are properly screened and earthed. The charger is designed in accordance with protective class IP 20.

All electric circuits have been equipped with primary and secondary fuses of defined amperage and tripping characteristic.

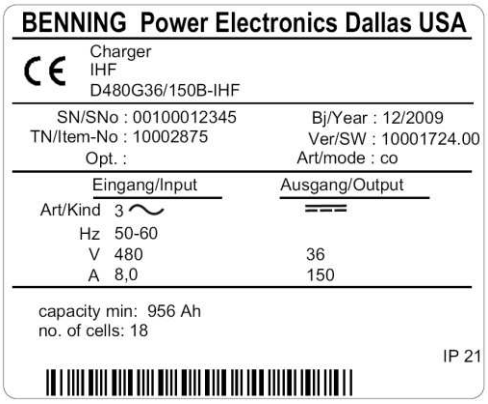
All metallic components are earthed via a protective circuit.

The charger is equipped with an automatic switch-off function which terminates the charging process when the preset maximum charged state of the battery is reached. This prevents excessive production of explosive charging gases.

The charger can be equiped with optional pilot contacts that will pevent the charger from beginning the charge process until all connectors have been plugged in. The charger will also end the charging process and switch-off in the event that the connectors are disconnected from the battery. See section 3.3.5 for details of this option.

The charger can be programmed to monitor the batteries via the Battery Temperature Probe and/or the BATCOM basic wireless device for elevated operating temperatures. If activated the charger will monitor the temperature of the batteries and reduce the current to 50% power until the temperature drops to a safe level. It will then automatically increase back to the appropriate level. If the temperature continues to increase the charger will turn off the output and continue to monitor the temperature of the batteries. Once the batteries drop below the level set in the charger the charger will start again at 50% power until the temperature drops back to a safe level. At this time the charger will begin operating again at the appropriate level. These levels can be adjusted via the Traction Monitor software. See section 6.6.2 for more details of this operation.

3.6 Identifications and signs on the charger



Nameplate (example)

Attached to the housing at the rear.

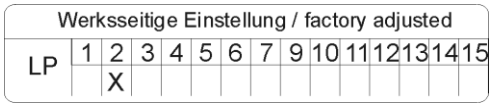


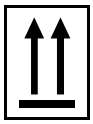
Plate with specification of the preset charging program (example)

Attached to the housing at the rear below the nameplate.

4 Transport, handling and storage

The charger is delivered packed in a carton.

Note the instructions on the carton with regard to transport, handling and storage:

 Protect from the effects of the weather!  Fragile!  Top!

5 Setting-up / installation / start-up

5.1 Scope of delivery

The delivery consists at least of the following parts:

- charger with preset charging program,
- the connected mains and battery cables,
- the operating instructions,
- an instruction note (attached to the charger),
- the delivery note.

The scope of delivery and the version of the charger may deviate from the above, depending on the customer request. Additional technical details are noted in the enclosed delivery documents (and in the order confirmation).

- Immediately after delivery, check for completeness and damage.
- By means of the delivery note and the nameplate, check to see if the data coincide.
- If there are defects, immediately contact the manufacturer and the transport company if applicable.
- Check the charger for loose screw connections and secure them if required.

5.2 Requirements regarding the installation site

The device may be used only in closed frost-free and adequately ventilated rooms with ambient temperatures up to 50°C / 104 °F: The installation site must be selected such that the ventilation apertures are not covered and the cooling air flow is not impeded. The unit must not be installed in the vicinity of radiators or other sources of heat.

Naked flames and smoking are forbidden in battery rooms.

No combustible substances and spark producing pieces of electrical equipment may be present within a radius of 2 m / 6,6 ft around the charging station.

When installing the device it must be ensured that:

- no aggressive gases such as acid gas,
- no electrically conducting dusts such as soot or metal dust,
- no excessive amounts of non-conducting dusts and
- no liquids can penetrate into the interior of the device.
- The mains connection and the battery connection must be possible within the cable length range.

5.3 Mains connections and mains fuses

WARNING! Dangerous electrical voltage warning!

The charger is a piece of electrical equipment carrying voltages and currents which are dangerous to human beings.

The charger must therefore only be operated by trained and qualified specialists.

For that reason, the charger may only be installed, opened, repaired and dismounted if required by qualified *electrical* personnel!

A mains connection is necessary at the intended place of operation of the charger. The mains voltage and frequency must correspond to the details on the nameplate. The mains connection must be earthed properly.

The charger should have a branch circuit breaker or fused disconnect switch, properly sized for the maximum AC input current rating per the National Electric Code (NEC). This device should have lockout capability so that the AC input can be de-energized for charger maintenance.

CAUTION! Risk of fire!

For all three phase charger types in cabinet B (see appendix "Technical data type table", for the cabinet types of your charger) use only on circuits provided with 20 amperes branch circuit protection in accordance with the NEC, NFPA 70!

– Superpose a mains fuse according to the following table:

Nominal current	Mains fuse	Remark
0 to 8 A	10 A	A time delay circuit breaker or slow-blow fuse is recommended.
>8 to 12 A	15 A	
>12 to 16 A	20 A	
>16 to 20 A	25 A	
>20 to 24 A	30 A	
>24 to 28 A	35 A	
>28 to 32 A	40 A	
>32 to 36 A	45 A	
>36 to 40 A	50 A	
>40 to 48 A	60 A	
>48 to 56 A	70 A	
>56 to 64 A	80 A	
>64 to 72 A	90 A	
>72 to 80 A	100 A	
>80 to 88 A	110 A	

5.4 Setting up and installation

The following prerequisites must be fulfilled for installation of the charger:

– For the mains connection an appropriate type of protected AC outlet or for hard wire connection an terminal with appropriately sized protective device must be accessible in the vicinity,

– A standing surface for the battery must be provided close to the charger.

Detailed specifications are contained in the technical data in the appendix.

5.5 Initial start-up and function test

Following correct setting up and installation the charger is commissioned for a function test.

– To do so, proceed as described in chapter 6 Operation.

After successful initial start-up, the charger must be marked indelibly and externally clearly visible with the specification of the permitted battery type:

CAUTION!

If a forbidden battery type is connected to the charger, the possible consequences are material damage to the battery and to the charger as well as to the vehicle!

The operator and responsible service personnel must take steps to prevent any possibility of confusion for the vehicle drivers when connecting the vehicle batteries!

- Mark the associated battery type on the front of the housing according to the charging plug and preset charging program!
- Also mark any subsequent change of the charging program on the front of the housing.
- Please also mark the housing accordingly if the actual rated current strength (I_n) is set to a lower value than is specified on the nameplate.

6 Operation

WARNING! Dangerous electrical voltage warning!

The charger is a piece of electrical equipment carrying voltages and currents which are dangerous to human beings.

The charger must therefore only be operated by trained and qualified specialists.

For that reason, the charger may only be installed, opened, repaired and dismounted if required by qualified *electrical* personnel!

Basically the charging process for a battery usually comprises the following action steps on the part of the operator:

- check whether the charger and the battery type are compatible,
- if still necessary, connect the charger to the mains.
- connect the battery,
- (charging process starts automatically,)
- (charging process ends automatically,)
- disconnect the battery,

The individual operating steps are explained in more detail in the following chapters. Prior to operating of the charger for the first time, carefully read these chapters.

6.1 Description of the operating and display unit

The following operating and display unit with charging status light, four light-emitting diodes (LED), a key and an optional blue LED are located on the front side of the charger:

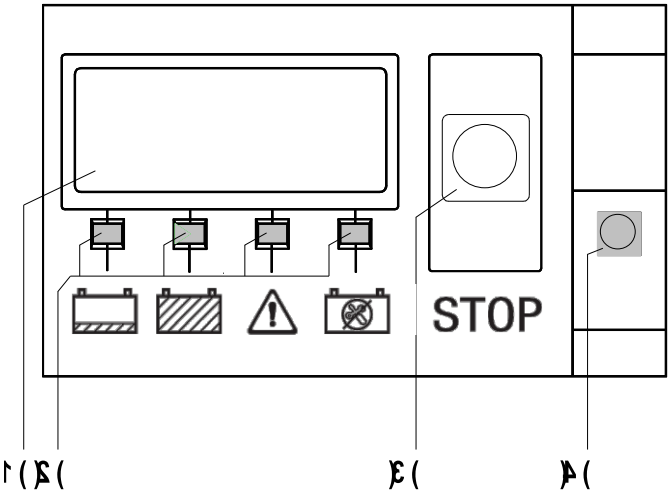


Figure1: Status light (1) with LEDs (2), STOP key (3) and blue LED (4, optional)

6.1.1 Meaning of the status light and the LEDs

Status light color	LED	Function	Description
yellow	yellow	*charge*	***lights up*** LED and status light: – during the main charge phase ***flashes*** LED: – in the case of equalizing charge during the gassing charge phase and together with the end of charge LED and in the case of LP 7 during the float charge (2nd U-branch) status light: – during gassing phase – alternating with the green color during the equalizing charge and in the case of LP 7 during the float charge (2nd U-branch)
green	green	*charge completed*	***lights up*** LED and status light – if the charging process is completed
red	red	*fault*	***Lights up*** LED and status light – in the case of failure or faulty operation – max. charging time exceeded – failure of the charging electronics ***flashes*** LED: – with 2 second period in the case of forced switch-over to gassing phase (final charge phase) – with 4 second period in the case of over temperature switch-off status light: – alternating with green and/or yellow color, depending on the charging state.

Status light color	LED	Function	Description
Color or flashing mode depends on the current state of charge	 yellow	*Maintenance -free*	***lights up*** LED: – when a charging program for maintenance-free, sealed batteries is preset (for charging program 2, 4, 5, and 9). status light: – the status light color depends on the current charging status and can be yellow, green or an alternating combination of the three colors **CAUTION! Maintenance-free batteries must not be charged when this LED is not lit!** ***flashes*** LED: – with 2 second period in the case of charge program 3 (LM pulse) status light: – the status light color depends on the current charging status and can be yellow, green or an alternating combination of the three colors

6.1.2 Meaning of the key

Symbol	Function	Color	Description
STOP	*Stop / Start*	light-grey	Press once to stop the charging process Press once to restart the charging process again

6.2 Graphic display with soft keys (option)

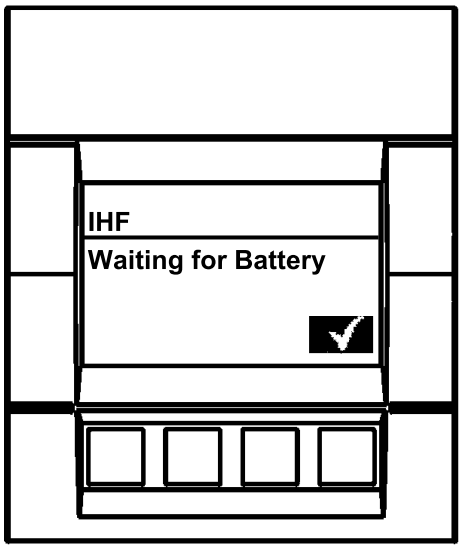


Figure 2: Graphic display with soft keys

The graphic display shows information as a symbol and/or in plain text for the unit and charging status. The charger is operated using the four soft keys positioned below or unit setting changes are made.

The assignment and function of the individual keys are displayed as a symbol in the lowest line in the graphic display. The following table explains the meaning of the symbols:

Symbol	Meaning	Description
⊗	Cancel	**During charging: Stop charging cycle** In the menu: changes from one menu level to the one below (changes are not adopted!)
✓	Confirm	**During charging: Continue charging cycle** In the menu: selects the next higher menu level or confirms and saves a parameter!
◀	Cursor left	Controls the display cursor to the left
▶	Cursor right	Controls the display cursor to the right
▲	Cursor up / increase value	Controls the display cursor upwards, or increases the value of the displayed parameter
▼	Cursor down / reduce value	Controls the display cursor downwards, or reduces the value of the displayed parameter

Table 1: Meaning of soft keys

6.2.1 Menu structure

Battery Menu	>	Battery Capacity		
		Charge Program		
		Secondary Charge Program***		
Settings	>	Language	>	German
				English US
				English GB
				others
		Clock	>	Set Date
				Set Time
				Show Date/Time
		Display	>	Brightness
				Contrast
		Version		Backlight Duration
Functions	>	Power On Delay		
History	>	End of Charge Data	>	Data Set 1
Service*				:
				Data Set 10
		BATCOM basic data**	>	Battery Code
				Remaining Capacity
				Batt.-Temperature
				Electrolyte OK?

Figure 3: Menu structure (main menu)

* service menu available via key code (for service only)

** only available with BATCOM basic option (see 6.3 for details)

*** only indicated if charge cycle 2 is active

6.2.2 Adjustable parameters

In the menu it is possible to make settings or change parameter values. The following table shows an overview of the possible adjustment ranges and the standard values:

Menu option	*Standard value*	Adjustment range
Language	*English US*	German English US English GB*
Set Date	*01/01/2000*	01/01/2000 - 31/12/2099
Set Time	*00:00*	00:00 - 23:59
Display / Brightness	*100 %*	0 - 100 %
Display / Contrast	*100 %*	60 - 100 %
Display / Backlight Duration	*30 s*	0 - 255 s
Power On Delay	*0 min.*	0 - 999 min.

* At this point an additional foreign language can be set at the factory.

Table 2: Adjustable parameters

6.2.3 Information in the graphic display

It is also possible to call information about the basic settings of the charger and charging connection data via the graphic display, see the following table:

Menu option	*Information*	Displayed value / example
Battery Capacity	*value of the programmed battery capacity*	250 Ah
Charge Program	*charge program*	Flooded Lead Acid (Std.)
Charge Program 2	*charge program for charge cycle 2* *(ask your service provider for details)*	Opportunity Charging
Show Date/Time	*current date and time*	08:00:00 / 01/08/2008
Version	*shows the installed software release of the charger*	V1.03 10001724.03
End of Charge Data	*memory for the last 10 end of charge data sets* *the right column shows the values that are saved for each data set with an example value*	start: 01/08/2008 16:00 stop: 02/08/2008 02:00 duration: 10:00 charging program: LP3 LM pulse charging voltage: 32.4 V 2700 mV/Z charging current: 30 % charging temperature: 30 C MAC address: 00-00-00-00 error messages
BATCOM basic data	*memory for the BATCOM basic data* *data's are only available if the charger is equipped with BATCOM basic option and a BATCOM basic controller was connected to the charger* *the right column shows the saved values*	battery code remaining capacity batt. temperature electrolyte OK?

Table 3: Information in the graphic display

Charging program

The charging program is preset at the factory to the corresponding charger. The following charging programs are defined in the charging electronics by default:

- LP1 Flooded Lead Acid (Std.)
- LP2 Sealed Lead Acid+Float
- LP3 Flooded Lead Acid, Pulse
- LP4 Sealed Lead Acid (Std.)
- LP5 Sealed Lead Acid + Maint.
- LP6 Opportunity Charging
- LP7 Equalize Charging
- LP8 IUI Charging
- LP9 Libra Battery

Explosion hazard!

There is the risk of severe personal injury and damage to property if an unsuitable charging program has been set for the unit. If the charging program is set incorrectly, it can result in excessive gassing of the battery and to a temperature increase of the battery.

In case of questions concerning the charging program, please contact the manufacturer or (battery) supplier!

End of charge data

The charger saves the measurement readings after charging is complete of the last 10 charging cycles. The following data can be indicated via the display: start and stop time with data, charging voltage, charging current, charging time, charging program, battery charging temperature (only if a BATCOM basic is connected to the unit or a separate temperature sensor is connected, otherwise the standard value of 30°C is displayed), possibly the MAC address of the BATCOM basic connected to the charger as a hexadecimal figure and any possible error messages. The MAC address is used to uniquely identify the BATCOM basic on the charger.

BATCOM basic data

The measurement readings of a BATCOM basic which is connected to the charger are stored in this menu option. The following information can be called: battery code, current remaining battery capacity, current battery temperature and whether the electrolyte level in the battery is too low. The MAC address is used to uniquely identify the BATCOM basic on the charger.

6.2.4 Secondary Charge Program

In general the charger starts charging with the standard charging program, for details see section 6.6.1. Via the service software Traction Monitor a secondary charge program can be enabled. This charge program starts automatically after the standard charge program has finished.

Ask your battery service for more information's.

6.3 BATCOM basic (optional)

The charger is equipped with a radio interface for the communication with an optional battery controller BATCOM basic installed at the battery. For charging, the charger tries automatically to connect with the BATCOM basic installed at the battery. Therefore, the charger records all BATCOM basic units within its range. The charger recognizes via an automatic selection process after connecting the battery if a BATCOM basic is installed at the battery. If a BATCOM basic is installed the charger connects with it. The BATCOM basic sends the charger the information about battery temperature, nominal capacity of the battery and electrolyte status. Furthermore the charger sends cyclically the recharged Ah to the battery controller. The total sum of recharged Ah is stored in the battery controller.

The charging process is affected by the value of the battery temperature which ensures a correct battery charging (temperature-controlled charging), even in temperature critical areas such as cold stores.

6.3.1 Electrolyte status display / blue LED

If a BATCOM basic is connected with the charger it sends information as soon as a too low electrolyte status has been recognized in the battery. The BATCOM basic is equipped by default with an electrolyte status sensor. As soon as the sensor recognizes a too low electrolyte status in the battery the blue LED at the BATCOM basic lights up. Additionally, the BATCOM basic sends the charger this information via radio after the level has remained consistently low for 1 hour to prevent any intermittent alarms. A blue LED lights on the charger at that time. This LED is located to the right of the stop key.

6.4 Connect the charger to the mains supply

WARNING! Dangerous electrical voltage warning!

Make sure the values of the voltage supply agree with the information on the nameplate.

- Insert the plug into the mains socket outlet. The charger is now ready for operation.
- If the charger is hard wired, switch on the mains power supply if necessary

6.5 Connect the battery

WARNING!

The battery contains sulphuric acid which is very corrosive. The exposed metal parts of a battery always carry voltage. Do not open any battery housings and do not touch any exposed metal parts!

Work on and with battery systems may therefore be carried out only

- **by correspondingly qualified personnel and**
- **complying with the operating instructions of the battery manufacturer.**

When batteries are being charged, caustic acid gases may be generated which can cause short-circuits in electrical equipment (fire hazard) and corrode components!

- **For this reason place your batteries always *adjacent* to charging stations so that the arising acid gas can spread (dilute) and escape freely at the site.**

WARNING! Explosion hazard!

If a wrong battery is connected to the charger, damage to the charger and the battery can result. The battery could release unduly large amounts of gas, boil and even explode!

Always check whether the charger is set for your battery type. When in doubt, contact the competent service station of the operator.

Battery connection with a charging plug is described below. Please keep in mind that the charging process starts automatically on connection of the battery.

Connect the battery as follows:

- Place the battery cable such that no persons can stumble over it and interrupt the charging process.
- Insert the charging plug into the associated jack of the battery cable.

Thereupon the automatic charging process starts.

6.6 Charging process starts automatically

The charging process starts automatically, when

- the charger is connected to mains voltage,
- the battery is connected to the charger with correct polarity,
- the battery voltage for single-phase devices is at least 5 V DC and for three-phase devices at least 24 V DC,
- the STOP key has not been operated.

With maintenance-free batteries the LED *maintenance-free* must be lit during the charging process. This applies to the charging programs 2, 4, 5 and 9.

6.6.1 Charging program is displayed

The preset charge program is automatically displayed for 10 seconds at the start of the charging process by flashing of the specified LEDs. With the help of the following table you can determine the charging program to which your charger is set.

Battery type	Flooded Lead Acid (Std.)	Sealed Lead Acid+Float	Flooded Lead Acid, Pulse	Sealed Lead Acid (Std.)	Sealed Lead Acid + Maint.	Opportunity Charging	Equalize Charging	IUI Charging	Libra Battery
Charging program	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
LED	**Flashing symbol**								
	–	–	–	–	–	–	–	⊗	⊗
	–	–	–	⊗	⊗	⊗	⊗	–	–
	–	⊗	⊗	–	–	⊗	⊗	–	–
	⊗	–	⊗	–	⊗	–	⊗	–	⊗

Legend: ⊗ LED flashes – LED off

You can find the number of the adjusted charging program on a label near the machine plate.

When all prerequisites are fulfilled, the charging process starts automatically and the charging status light lights yellow or the LED Charging is lit during the charging time.

6.6.2 Elevated Temperature Mode

Via the service software an elevated temperature mode can be enabled. This mode only has a function if a temperature sensor is connected to the charger or the battery is equipped with a BATCOM basic battery controller.

The battery temperature affects the charging process in two steps. If the battery temperature exceeds a first threshold value (default value 50°C / 122°F), the output current will be reduced to slow down the temperature development. This will be indicated in the status light with a 1 second On/Off blinking of the maintenance free LED. Additionally the display shows “Elevated Temperature Mode”. If the temperature sensor is damaged or not connected, the display shows “Elevated Temperature Mode no Battery Temperature Sensor”. The charger leaves the elevated temperature mode again if the temperature falls below a certain value (default value 48°C / 118.4°F). The maintenance free LED is off again and the display message disappears.

If the battery temperature exceeds a second threshold value (default value 60°C / 140°F) the charger switches off. The status light shows an interval of red color followed by the maintenance free LED for each one second. In the display the message “Charge Break” is indicated in combination with the current battery temperature and the temperature at which the charger goes back into the elevated temperature mode. The charger goes back into the elevated temperature mode if the battery temperature falls below a specific value (default value 58°C / 136.4°F).

6.7 Interrupting the charging process

The operation of the charger requires no interruptions during the charging process, but external influences may necessitate interrupting the charging process. However, please note the following:

WARNING! Explosion hazard!

There will be the risk of severe personal injury and damage to property, if the battery is disconnected during an ongoing charging process: The sparks generated thereby might ignite the gases forming during the charging process.

***Always* operate the STOP key first, if you have to interrupt the charging process.**

The charging plug may be disconnected from the battery only thereafter.

The charging process will be interrupted if the STOP key on the operator front is actuated.

– Press the STOP key once. The charging status light and all LEDs extinguish.

The charging process is continued as soon as the STOP key is pressed again.

– Press the STOP key again. The charging status light lights up yellow again and the LED *charging* starts to light up again.

Note!

In normal operation the charging process should not be terminated prior to the automatic switch-off. Early switch-off will result in inadequate charging, which can reduce the available capacity of the battery.

6.8 Charging process ends automatically

The charging process is finished automatically when the charge program is completed, i.e. the battery has fully been charged. The charging status light lights green and the LED *charging finished* lights up additionally. Thereafter the battery can be used.

6.9 Faults and error messages

Faults and the status of the charger are indicated via the charging status light and the four light-emitting diodes of the control and display unit. The following table gives an overview of the possible fault causes and their remedies:

Charging status light	LEDs	Cause	Test/repair
Off	No LED lights	Charge interrupted by pressing STOP key	Restart charge by pressing STOP key again
		Mains voltage failed	Check mains voltage! If OK, inform service.
		No battery voltage	Check charging cable, plug. If not OK, inform service!
		DC fuse failed	Inform service!
Flashes alternating red/yellow, red/green or red/yellow/green	LED *Fault* ⚠ flashes with 2 second period, the other LEDs are operating normally	Switch-over to boost charging phase by times safety function: Battery is not fully charged!	Charger size to low for the capacity of the connected battery. - check the rated current! Inform service!

Charging status light	LEDs	Cause	Test/repair
Flashes red	LED *Fault* ⚠ flashes with 4 second period, the other LEDs are off	Over temperature	Check ventilation. Let the charger cool down. If the charger does not restart after cool down, inform service!
Lights up red continuously	LED *Fault* ⚠ lights up continuously	Failure of the charging electronics	Battery defective? Disconnect the mains plug and plug it in again (reset charger status)! Inform service if the LED Fault ⚠ is still lit!

6.10 Charger switch off

The charger is powered via the mains cable. Disconnect the charger from the mains when:

- The charger is not continually required
- The charger needs to be reset to the initial state, e.g. to cancel a fault indication

7 Maintenance

WARNING! Dangerous electrical voltage warning!

The charger is a piece of electrical equipment carrying voltages and currents which are dangerous to human beings.

For that reason, the charger may only be installed, opened, repaired and dismantled if required by qualified electrical personnel!

As a general rule, the mains supply and possibly one battery contact must be interrupted before performing any actions and work on the charger.

7.1 Cleaning, inspection and maintenance

The charger is maintenance-free and will allow faultless operation if used in an expert manner.

- Dust or dirt on the charger can be removed with a dry cloth.

Check at least once per month that

- the mains connection is undamaged,
- the housing shows no damage,
- that the insulation of the charging cables is undamaged,
- the charging plug is undamaged,
- all screw connections are firmly tightened.

If defects are found, immediately discontinue operation of the charger and get all defects remedies by the competent specialist personnel.

If it is unavoidable to open the housing for maintenance and repair tasks, first consult the manufacturer or supplier of the charger.

7.2 Changing the charging program

WARNING!

Dangerous electric voltages inside the devices constitute a danger to life!

Do not remove any covers and housings. Do not touch any structural components which are carrying voltage.

Set-up, installation, maintenance and dismantling of the charger may be carried out only by qualified electrical engineering personnel.

The charging program has been preset in the factory. If it is necessary to change the charging program, please first consult the manufacturer or supplier.

7.3 Replacement parts

Please contact the manufacturer or supplier quoting the unit data from the nameplate should your require replacement parts.

8 Disposal

If the charger is finally taken out of service at the end of its life, adhere to the laws and regulations concerning disposal applicable at that time.

Detailed information in this regard can be obtained from the specialist disposal operations or the responsible authorities.

CAUTION!

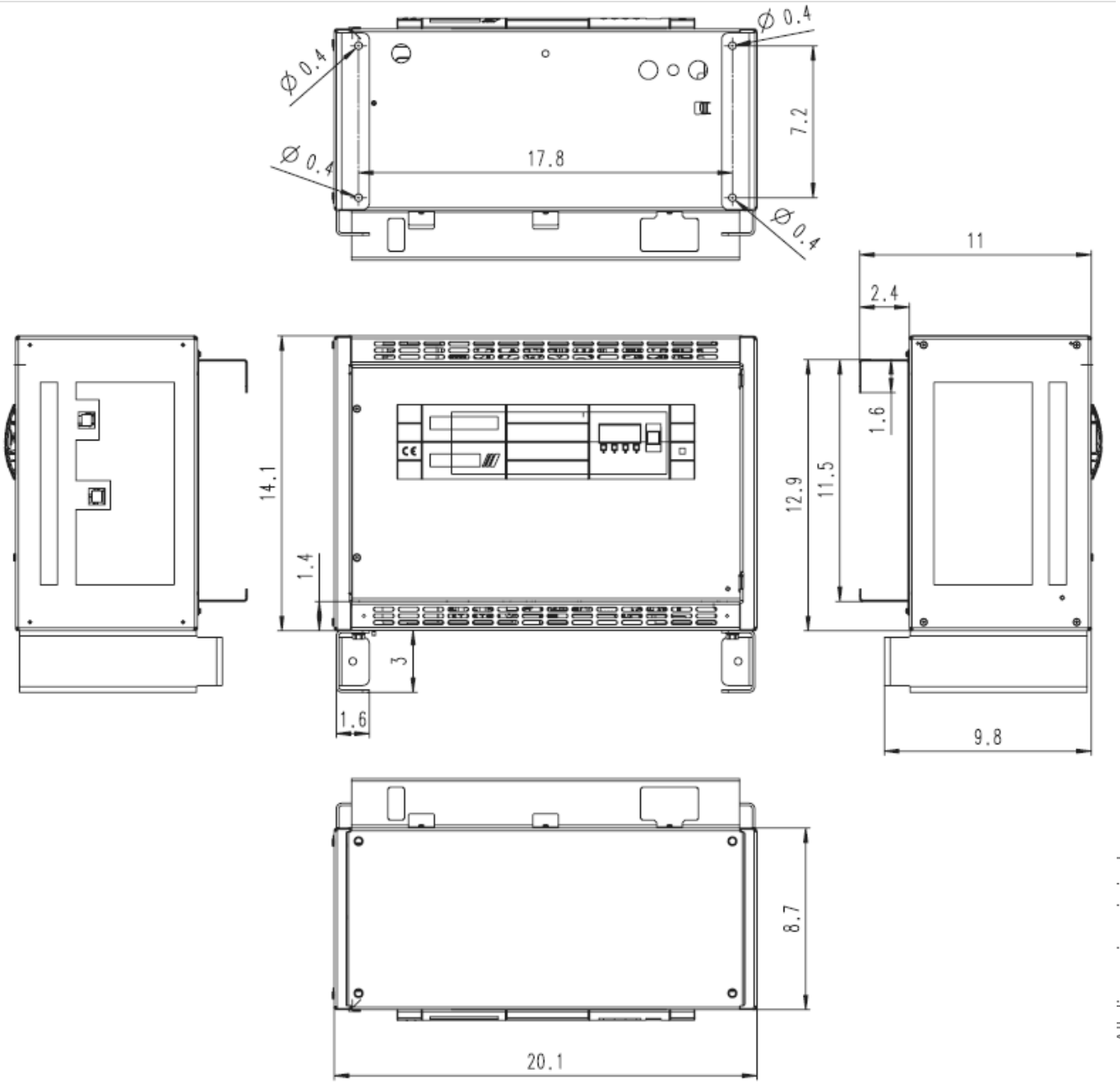
Electronic scrap with its various plastic, metal and heavy metal components possesses a high hazard potential for the environment. For this reason electronic scrap must be collected and disposed off separately from domestic and commercial waste.

Electronic scrap should be disposed of to the internal disposal section who will pass on the scrap to special companies (specialist disposal operations).

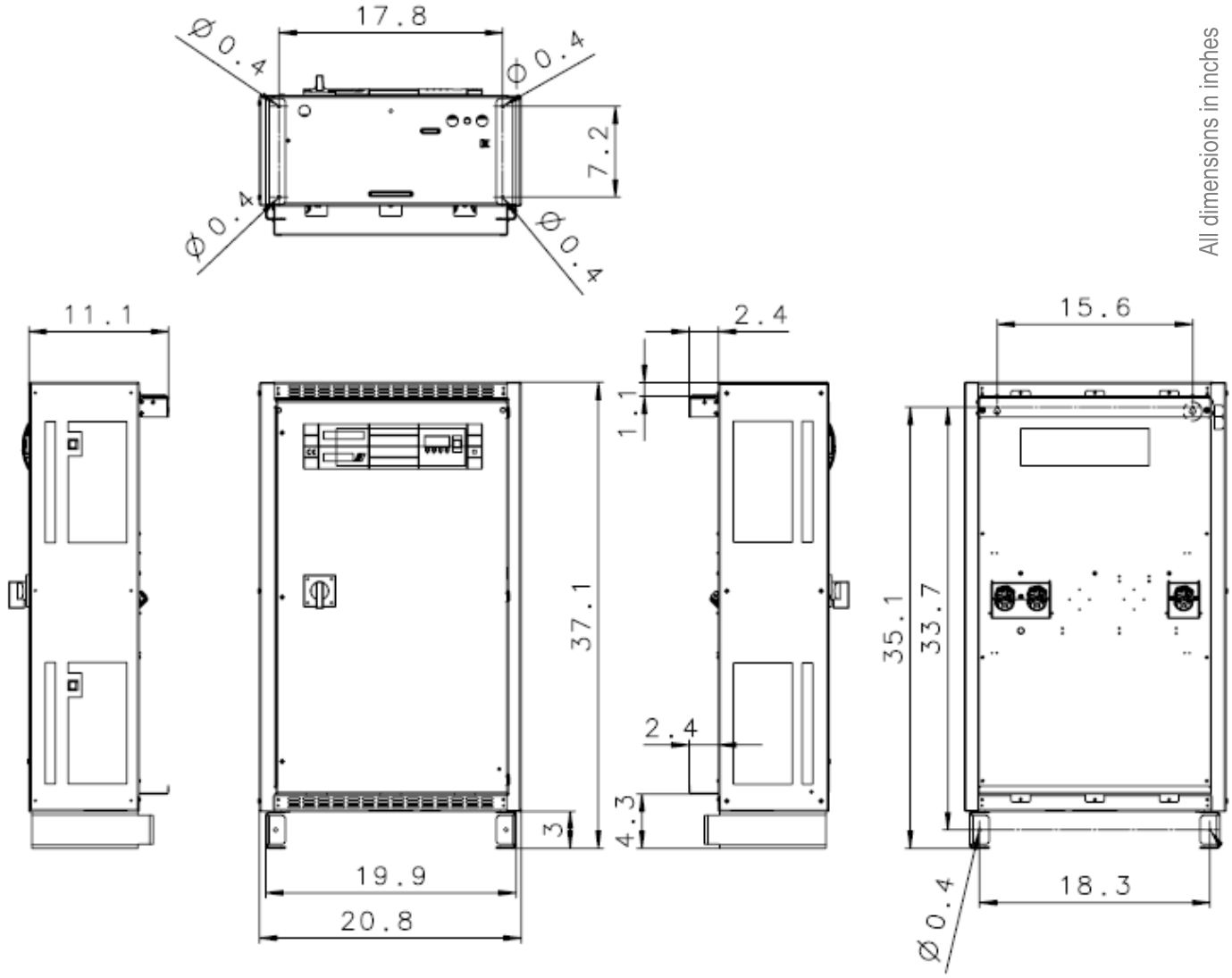
The packaging of the charger must be disposed of separately. Paper, cardboard and plastics must be recycled.

Appendix

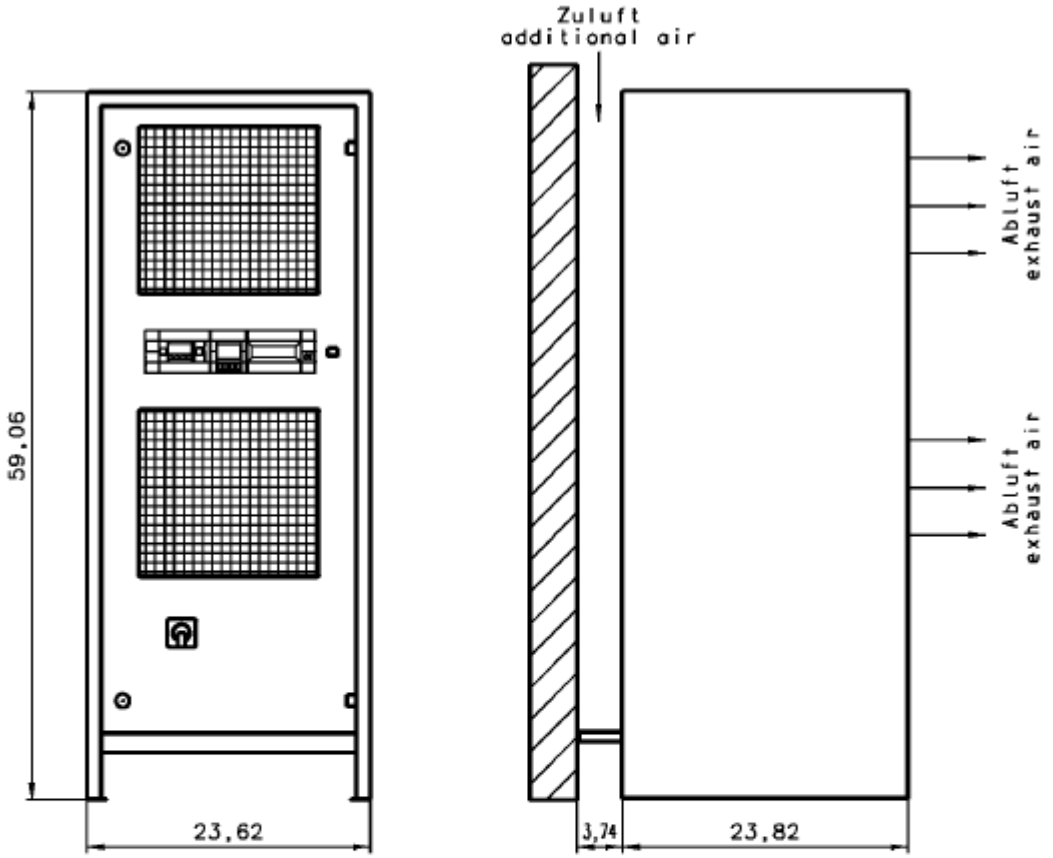
Dimension and view drawings

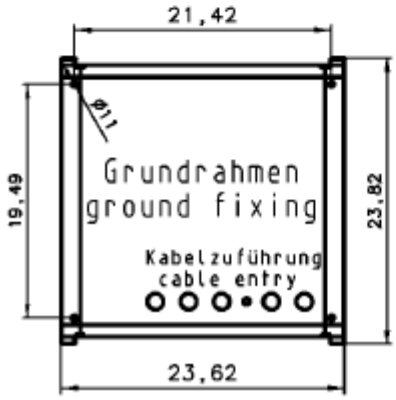


Cabinet type “A”



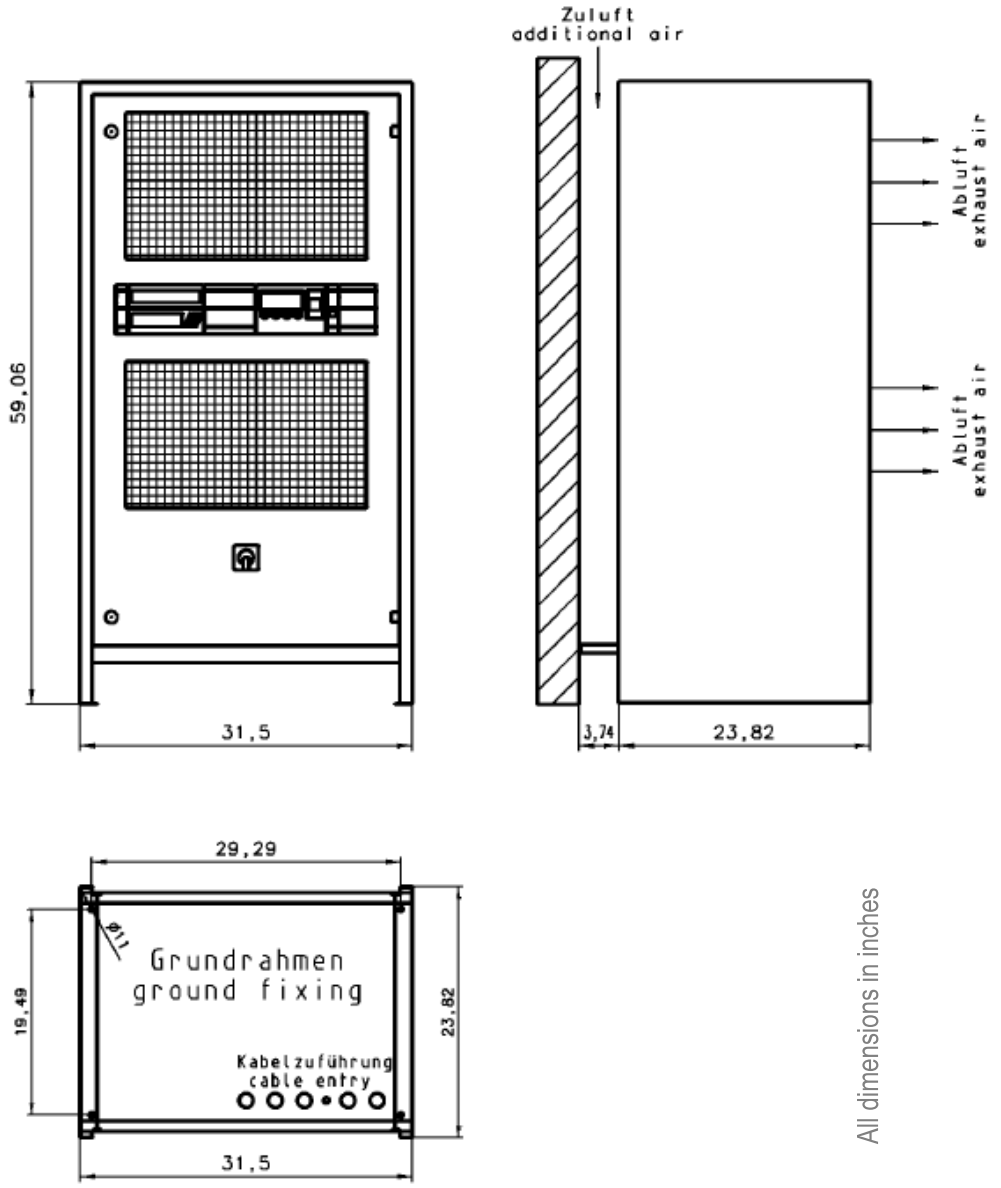
Cabinet type “B”





All dimensions in inches

Cabinet type “C”



Cabinet type “D”

Cabinet-type	Dimensions			Weight
	Height	Width	Depth	lb / kg
A (3kW)	17,1” 432 mm	20,1” 511 mm	11,0” 280 mm	33 / 15
A (6kW)	17,1” 432 mm	20,1” 511 mm	11,0” 280 mm	66 / 30
B	37.1” 943 mm	20.8” 529 mm	11.1” 282 mm	155 / 70
C	59.06” 1500 mm	23.62” 600 mm	23.82” 605 mm	D1: 300 / 135 D2: 354 / 160
D	59.06” 1500 mm	31.5” 800 mm	23.82” 605 mm	D3: 465 / 210 D4: 630 / 285

Cabinet dimensions and weight

List of symbols and abbreviations

All abbreviations used in these Instructions are listed below together with their meanings.

- A Ampere
- AC Alternating current
- Ah Ampere-hour
- ANSI American National Standards Institution
- BCIS Battery Council International Standard
- CSA Canadian Standards Association
- °C degree Celsius
- DC Direct current
- EC Electrolyte circulation
- e.g. for example
- EMC Electromagnetic compatibility
- °F degree Fahrenheit
- ft foot (1 ft = 0.305 m)
- Hz Hertz
- IEC International Electrotechnical Commission
- “ inch (1” = 25.4 mm)
- IP Ingress Protection (protection classification according to IEC 60529)
- kg kilogram (1 kg = 2,2 lb)
- lb pound (1 lb = 0,45 kg)
- LED Light Emitting Diode
- MAC Media Access Control
- m meter (1 m = 3.28 ft)
- mm millimeter (1 mm = 3,94”)
- min. minutes
- NEC National Electric Code
- NFPA National Fire Protection Association
- PSC Power Supply Company
- s seconds
- UL Underwriters Laboratories Inc.
- V Volt
- V/cell Volt per cell (voltage of a battery cell)

Technical Data

General information

Series	**IHF**
Serial No.	See nameplate
Battery type	Flooded or maintenance-free lead battery
Charging characteristic	See section 6.4.1
Temperature range	0 to 50°C / 32 – 104°F
Rated mains frequency	50/60 Hz
Protective class	IP 20 according to IEC 60529
Housing	See appendix *'Dimension and view drawings'*
Standards	UL 1564 ANSI C 84.1: American National Standard for Electrical Power systems. BCIS-18rev 01 CSA 107.2 IEC 60950 – Safety IEC 61558 – Transformers IEC 60146 – Semiconductors power converter IEC 61000-6-2 and IEC 61000-6-3 – EMC IEC 61000-3-2 – Mains pollution IEC 61000-3-3 – Voltage fluctuation and flickering IEC 61000-4-4 – Burst and surge

Technical Data Type table

The unit type can be clearly identified by the type designation shown on the nameplate. Special units may deviate from this information. In such case, the data on the nameplate shall apply exclusively!

VAC in	AC phase	Battery voltage (V)	Battery capacity (Ah)	Charging current (A)	Cabinet type	Crown Model Number
208 - 277	1	24	750	120	A	CR12HF1-120
480	3	24	965	150	A	CR12HF3-150
480	3	24	1800	300	B	CR12HF3-300
600	3	24	965	150	B	CR12HF3-150C
600	3	24	1800	300	B	CR12HF3-300C
480	3	24	Rapid charging	150	B	2-CR12HF3-150
480	3	24	Rapid charging	300	C	2-CR12HF3-300
480	3	24	Rapid Charging	150	C	4-CR12HF3-150
208 - 277	1	36	510	80	A	CR18HF1-80
480	3	36	965	150	A	CR18HF3-150
480	3	36	1980	300	B	CR18HF3-300
480	3	36	Rapid charging	450	C	CR18HF3-450
480	3	36	Rapid charging	600	C	CR18HF3-600
480	3	36	Rapid Charging	750	D	CR18HF3-750
600	3	36	965	150	B	CR18HF3-150C
600	3	36	1980	300	C	CR18HF3-300C
600	3	36	Rapid charging	450	C	CR18HF3-450C
480	3	36	Rapid charging	150	B	2CR18HF3-150
480	3	36	Rapid charging	300	C	2CR18HF3-300
208 - 277	1	48	360	60	A	CR24HF1-60
480	3	48	750	120	A	CR24HF3-120
480	3	48	1440	240	B	CR24HF3-240
480	3	48	Rapid Charging	360	C	CR24HF3-360
480	3	48	Rapid Charging	480	C	CR24HF3-480
480	3	48	Rapid Charging	600	D	CR24HF3-600
600	3	48	750	120	B	CR24HF3-120C
600	3	48	1440	240	B	CR24HF3-240C
480	3	48	Rapid Charging	240	C	2-CR24HF3-240
208 - 277	1	80	210	35	A	CR40HF1-35
480	3	80	480	80	A	CR40HF3-80
480	3	80	600	160	B	CR40HF3-160
480	3	80	Rapid Charging	240	B	CR40HF3-240
480	3	80	Rapid Charging	320	C	CR40HF3-320
480	3	80	Rapid Charging	400	D	CR40HF3-400
480	3	80	Rapid Charging	480	D	CR40HF3-480

Type table