elsteam
HUMIDIFIERS

VEH Series

Immersed electrode humidifiers for air handling units

⚠ WARNING

Read and fully understand the manual before using this device.

Non-observance of these instructions may result in death or serious injury.

Operating and maintenance manual

924VEHE4.03 - 12/2023

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IMPORTANT INFORMATION

Liability and residual risks

ELSTEAM assumes no liability for any damage caused by the following (by way of example; this is not an exhaustive list):

- Installation/use for purposes other than those specified and, in particular, not adhering to the safety provisions set out by current regulations in the country in which the product is installed and/or contained in this manual;
- Use in appliances that do not guarantee sufficient protection against electric shocks, water and dust within the installation conditions created;
- Use in appliances that allow access to hazardous parts without the use of a keyed or tooled locking mechanism when accessing the instrument;
- Tampering and/or modifying the product;
- Installation/use in appliances which do not comply with current regulations in the country in which the product is installed.

The customer/manufacturer is responsible for ensuring their machine complies with these regulations.
ELSTEAM's responsibility is limited to the correct and professional use of the product in accordance with regulations and the instructions contained in this manual and other product support documents.

To comply with EMC standards, observe all the electrical connection instructions. As it depends on the wiring configuration as well as the load and the installation type, compliance must be verified for the final machine as specified by the relevant product standard.

Disclaimer

This document is the exclusive property of ELSTEAM. It contains a general description and/or a description of the technical specifications for the services offered by the products listed herein. This document should not be used to determine the suitability or reliability of these products in relation to specific user applications. Each user or integration specialist should conduct their own complete and appropriate risk analysis, in addition to carrying out a product evaluation and test in relation to its specific application or use. Users can send us comments and suggestions on how to improve or correct this publication.

Neither ELSTEAM nor any of its associates or subsidiaries shall be held responsible or liable for improper use of the information contained herein.

ELSTEAM has a policy of continuous development; therefore, ELSTEAM reserves the right to make changes and improvements to any product described in this document without prior notice.

The images in this document and other documentation supplied with the product are provided for illustrative purposes only and may differ from the product itself.

The technical data in this manual is subject to change without prior notice.

Terms and Conditions of use

Permitted use

The device should only be used for humidification inside the air treatment unit (AHU).

The device must be installed and used in accordance with the instructions provided and, in particular, hazardous live parts or highly pressurised water must not be accessible under normal conditions.

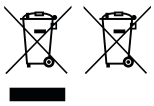
The device must be suitably protected from water and dust with regard to its application and must also only be accessible with the aid of a tool.
Only qualified personnel may install the product or perform technical support procedures on it.

The customer must only use the product as described in the documentation relating to that product.

Prohibited use

Any use other than those described in the "**Permitted use**" section and in the product support documentation is prohibited.

Disposal



The device must be disposed of in accordance with local regulations regarding the collection of electrical and electronic appliances.

Consider the environment

The company works towards protecting the environment, while taking account of customer requirements, technological innovations in materials and the expectations of the community to which we belong. ELSTEAM places great importance on respecting the environment, encouraging all associates to become involved with company values and guaranteeing safe, healthy and functional working conditions and workplaces.
Please consider the environment before printing this document.

IMPORTANT SAFETY INFORMATION

Please read this document carefully before installation; study all the warnings before using the device. Only use the device in accordance with the methods described in this document. The following safety messages may be repeated several times in the document, to provide information regarding potential hazards or to attract attention to information which may be useful in explaining or clarifying a procedure.

SYMBOLS

This symbol is used to indicate a risk of electric shock.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

This symbol is used to indicate a risk of serious personal injury.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

This symbol is used to indicate a serious risk of exposure to biological agents.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

This symbol is used to indicate a serious risk of scalding from steam.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

This symbol is used to indicate a risk of serious burns.
It is a safety indication and as such, should be observed to avoid potential accidents or fatalities.

SAFETY MESSAGES

DANGER

DANGER indicates a situation of imminent danger which, if not avoided, **will lead to death or serious injury**.

WARNING

WARNING indicates a situation of imminent danger which, if not avoided, **may lead to death or serious injury**.

WARNING

WARNING indicates a situation of imminent danger which, if not avoided, **may lead to death or serious injury**.

CAUTION

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

NOTICE

NOTICE indicates a situation not related to physical injuries but which, if not avoided, could damage the equipment.

NOTE: The maintenance, repair, installation and use of the equipment must only be entrusted to qualified personnel.

QUALIFIED PERSONNEL

Only suitably trained and experienced personnel capable of understanding the content of this manual and all documentation regarding the product are authorised to work on and with this equipment. Furthermore, the personnel must have completed courses in safety and must be able to recognise and prevent the implied dangers. The personnel must have suitable training, knowledge and experience at a technical level, and be capable of anticipating and detecting potential risks caused by using the product, as well as changing the settings and modifying the mechanical, electric and electronic equipment for the entire system in which the product is used. All personnel working on and with the product must be entirely familiar with the relevant standards and directives, as well as safety regulations.

UNAUTHORIZED PERSONNEL

The humidifier must **not** be used by persons (including children) with reduced physical, sensory or mental capabilities or persons with no experience or knowledge.

SAFETY INFORMATION RELATING TO THE PRODUCT

VEH series humidifiers are defined as "**NOT ACCESSIBLE TO THE PUBLIC**".

Before carrying out any work on the equipment, read these instructions carefully, making sure you understand everything.

DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Only use electrically insulated measuring devices and equipment.
- Do not install the equipment while the power supply is connected.
- Cut off the power supply to all equipment, including any connected devices, before removing any covers or hatches, or before installing/uninstalling accessories, hardware, cables or wires.
- Provide safety interlocks (isolators) of a suitable size between the power supply and the humidifier, with a contact opening distance of at least 3 mm for each pole.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.
- The maintenance, repair, installation and use of the equipment must only be entrusted to qualified personnel.
- Do not touch the unshielded components or the terminals while they are live.
- Do not open, disassemble, repair or modify the product.
- Do not expose the equipment to liquids or chemicals.
- Make sure there is an effective earth connection.
- Before applying voltage to the equipment:
  - Make sure all protective elements, such as covers, hatches and grilles, are fitted and/or closed using a tool (e.g. a spanner).
  - Check all wiring connections.

DANGER

RISK OF ELECTRIC SHOCK AND FIRE

- Do not use the device with loads greater than those indicated in the technical data section.
- Do not exceed the temperature and humidity ranges indicated in the technical data section.
- Provide safety interlocks (isolators) of a suitable size between the power supply and the humidifier.
- Only use cables with a suitable cross-section as indicated in the section “Wiring best practices”.

WARNING

MALFUNCTIONING OF THE EQUIPMENT

- Perform the wiring carefully, in compliance with electromagnetic compatibility and safety requirements.
- Carry out a full start-up test.
- Make sure the wiring is correct for the end application.
- Minimise the length of the connections as much as possible, to avoid winding the cables around electrically connected parts.
- Before applying the power supply, check all the wiring connections.
- Do not connect wires to unused terminals and/or terminals marked with the text “No connection” (“N.C.”).

The humidifier produces steam at 100 °C (212 °F) and discharges water at a temperature of approximately 98 °C (208.4 °F).

WARNING

HOT WATER VAPOUR

Do not touch the equipment while it is running.

WARNING

RISK OF BURNS

Before carrying out any work on the system, place the equipment out of service and wait for the machine to cool down (< 50 °C (122 °F)).

WARNING

REGULATORY INCOMPATIBILITY

Make sure all the equipment used and systems designed conform to current local, regional and national standards.

SAFETY INFORMATION RELATED TO HEALTH AND HYGIENE

The **VEH** humidifier features:

- Automatic draining for inactivity;
- Periodic automatic cleaning;
- Plastic material on whose surface bacterial colonies do not proliferate.

Inadequate use and/or poor maintenance of the humidifier can damage your health.

⚠ ⚠ WARNING

BIOLOGICAL RISK

- In the event of poor maintenance/cleaning after the humidifier has been shut-down for a long time, microorganisms (including the bacteria that cause Legionellosis) may proliferate and be transferred into the air treatment system.
- The humidifier must be used properly and be maintained and cleaned properly at prescribed intervals, as described in the ***MAINTENANCE*** chapter.

Thoroughly remove limescale and biofilm residues from the reservoir and drain (rinse the inside of the reservoir with 20% citric acid and appropriate biocides, and clean the limescale off the surface).

1. INTRODUCTION

1.1 Description

The **VEH** series is ELSTEAM's solution for immersed electrode humidification systems dedicated to installations within air handling units (AHUs).

The **VEH** series consists of 2 elements:

- Electric panel;
- Hydraulic unit.

VEH series humidifiers generate humidity (steam) by means of a current passing between 4 or more electrodes immersed in drinking water and bringing it to boiling point.

The steam is controlled by adjusting the intensity of the current transferred to the water by the immersed electrodes, which indirectly controls the boiling of the water.

Steam is produced and pumped directly into an AHU (air handling unit) or into an air conditioning duct by positioning the hydraulic module inside the unit.

VEH series humidifiers do not require a technical area if installed outdoors, as the hydraulic unit is installed inside the AHU; plus, it is not affected by condensation in the steam supply pipe, as it introduces steam from the hydraulic unit directly into the AHU, also overcoming differences in pressure. The hydraulic unit is not subject to drops in energy efficiency caused by condensation and low outdoor temperatures.

To prevent the ice from forming during winter, use heating cables for the water supply and discharge pipes.

NOTE: **VEH** series humidifiers are defined as "**NOT ACCESSIBLE TO THE PUBLIC**".

1.2 Product overview

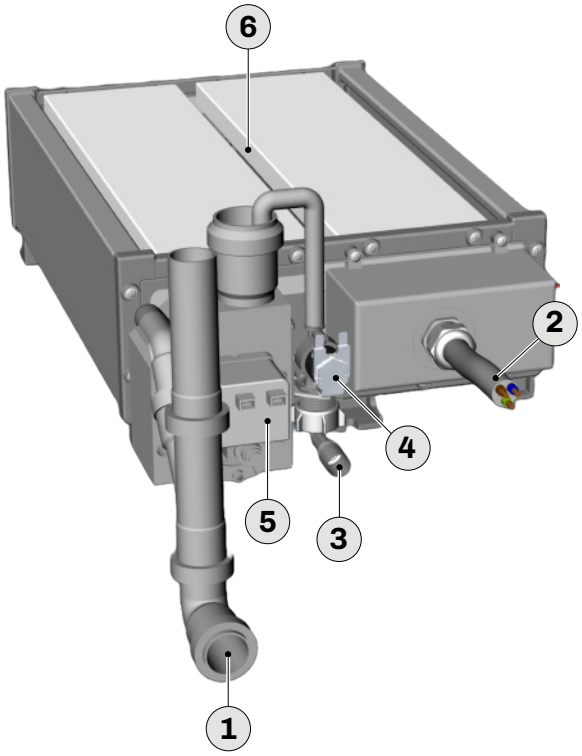


Fig. 1. *Hydraulic unit overview*

Reference	Description	Reference	Description
①	Water drain outlet	④	Water filling solenoid valve
②	Power supply wiring input from electrical panel	⑤	Water outlet pump
③	Water filling inlet	⑥	Steam outlet

1.3 Why choosing VEH?

Compared to a traditional immersed electrode humidifier on the market, **VEH** has several advantages, including::

- *Absence of back pressure phenomena:* Steam production takes place in the hydraulic unit located inside the AHU.
- *Better thermal efficiency:* There are no pipes and steam distributors subjected to condensation phenomena due to the connection between the boiler and the distributor.
- *Simple and quick maintenance:* The boiler is made up of a low-height parallelepiped tank; once the two covers are removed it is easy to clean.
- *It does not require a technical protection compartment:* The hydraulic part is inserted inside the AHU itself, while the electrical panel, to be positioned outside the AHU, has an IP65 protection rating.

1.4 Main features

- Isothermal humidifier;
- Sterile steam (steam with a temperature of approximately 100 °C (212 °F));
- Automatic limescale removal from the electrodes and tank;
- Broad range of steam production (10...100 kg/h);
- Integrated electronic control via probe or humidistat (with external ON/OFF signal, or proportional mode from external signal 0...10 V / 4...20 mA or internal configuration);
- Stainless steel water drainage tray (on request);
- Stainless steel condensate collection tank for AHUs (on request).

1.4.1 Electronic control features

- Proportional microprocessor control of steam production:
  - High efficiency;
  - Rapid response to changes in requirements;
  - Precise production control.
- Automatic electrode and tank cleaning system:
  - Reduced maintenance frequency;
  - High performance levels;
  - Longer electrode and tank life.
- Automatic hydraulic unit discharge:
  - Removal of limescale residues deposited in the manifold sleeve facilitated by the action of the drainage pump, which can even eliminate medium-sized clusters and grind them down;
  - Longer tank life.
- Operating status signalling via a user interface with a 2-line, 16-character display:
  - Continuous monitoring of the operating status;
  - Automatic analysis of malfunctions.

1.5 Applications

The **VEH** series is mainly used in applications requiring sterile steam, including:

- Hospital settings;
- Medical settings;
- Commercial settings (offices, industrial premises, etc.);
- Industrial processes which use AHUs.

1.6 Available models

P/n	Name	Description
EHKD010T4XS	VEH 10XS	**VEH** immersed electrode humidifier, 10 kg/h, 400 Vac three-phase, extra small size (XS)
EHKD020T4XS	VEH 20XS	**VEH** immersed electrode humidifier, 20 kg/h, 400 Vac three-phase, extra small size (XS)
EHKD020T4S	VEH 20S	**VEH** immersed electrode humidifier, 20 kg/h, 400 Vac three-phase, small size (S)
EHKD030T4S	VEH 30S	**VEH** immersed electrode humidifier, 30 kg/h, 400 Vac three-phase, small size (S)
EHKD030T4M	VEH 30M	**VEH** immersed electrode humidifier, 30 kg/h, 400 Vac three-phase, medium size (M)
EHKD040T4S	VEH 40S	**VEH** immersed electrode humidifier, 40 kg/h, 400 Vac three-phase, small size (S)
EHKD040T4L	VEH 40L	**VEH** immersed electrode humidifier, 40 kg/h, 400 Vac three-phase, large size (L)
EHKD060T4M	VEH 60M	**VEH** immersed electrode humidifier, 60 kg/h, 400 Vac three-phase, medium size (M)
EHKD060T4XL	VEH 60XL	**VEH** immersed electrode humidifier, 60 kg/h, 400 Vac three-phase, extra large size (XL)
EHKD080T4L	VEH 80L	**VEH** immersed electrode humidifier, 80 kg/h, 400 Vac three-phase, large size (L)
EHKD100T4XL	VEH 100XL	**VEH** immersed electrode humidifier, 100 kg/h, 400 Vac three-phase, extra large size (XL)

1.7 Accessories

The following accessories for use with **VEH** series immersed electrode humidifiers are available:

P/n	Description
EHKD0K20	VEH hydraulic unit removal flange kit
EHKD0K21	D40 drainage unit kit
EHKD0K18	5 m power cable kit for running from electric panel to hydraulic module **VEH10-20-30-40**
EHKD0K19	5 m power cable kit for running from electric panel to hydraulic module **VEH60-80-100**
EHKD0K22	Hydraulic connections feedthrough kit
EHKD0K23	Filling/discharge unit kit external to AHU
0031000048	3/4"G Female water inlet hose
EHVI	Water drainage tray
0016020018	Condensate collection tank 490x690x70 AISI304
0016020019	Condensate collection tank 490x950x70AISI304
0016020020	Condensate collection tank 490x1350x70 AISI304
EVHP523	Humidity probe 4...20 mA
EVTPNW30F200	NTC temperature probe, IP68
EV3411M7	Universal controller, 1 output, 230 Vac power supply

1.7.1 VEH hydraulic unit removal flange

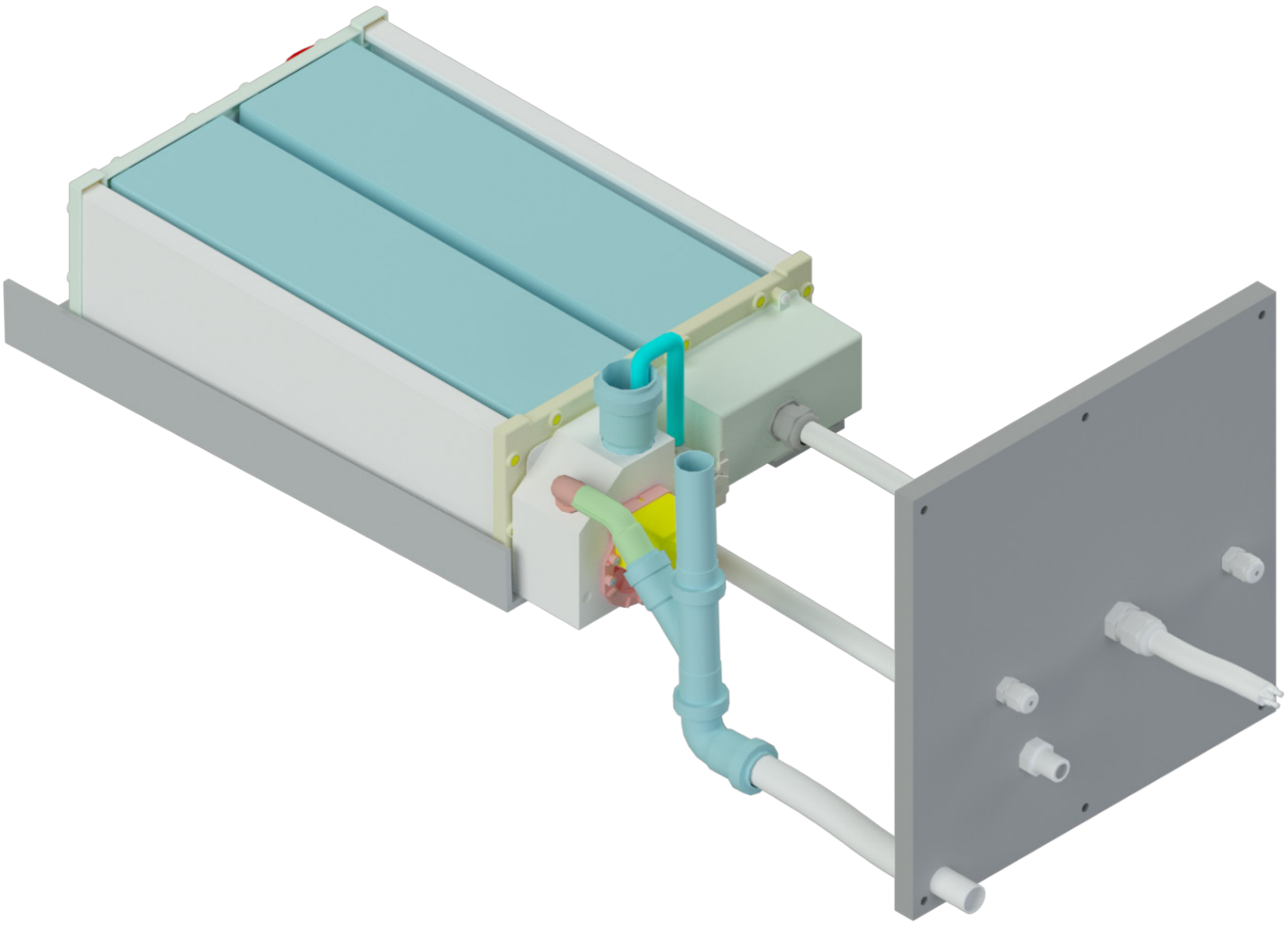


Fig. 2. *VEH hydraulic unit removal flange*

THE **EHKD0K20** KIT allows you to have, in the AHU, an extraction window for the hydraulic unit by preparing a rectangular hole on the AHU panel and applying the KIT.

The hydraulic unit must be positioned on the L-shaped guides, making sure to block it using the fixing screws.

The installation of the extraction flange allows the user not to turn off the CTA/AHU to carry out maintenance on the **VEH** humidifier. Simply remove the panel (flange), release the hydraulic unit from the fixing screws in the guides, extract it by sliding it in the L-Shaped guides and finally reposition the panel (flange) until maintenance is completed.

Hole dimensions for EHKD0K20 KIT

mm (ft.)

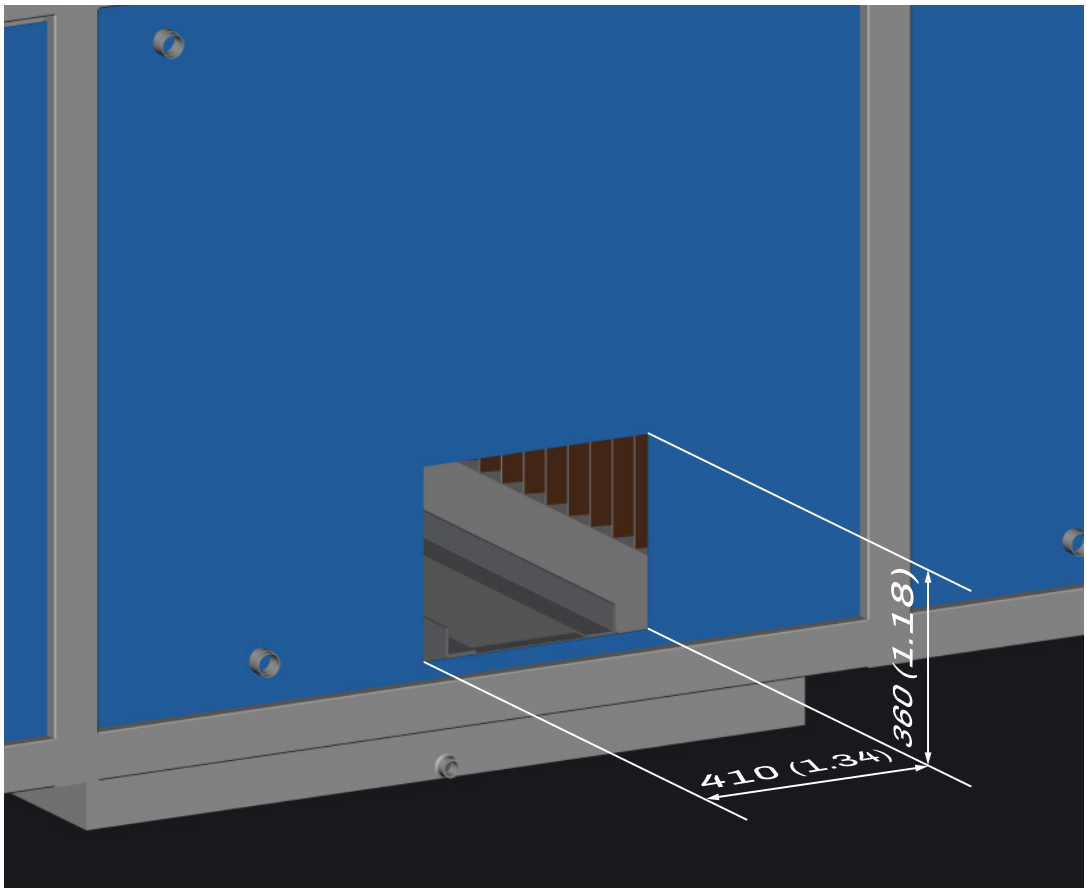


Fig. 3. *Hole dimensions for* ***EHKD0K20*** *KIT*

Dimensions of L-shaped fixing guide

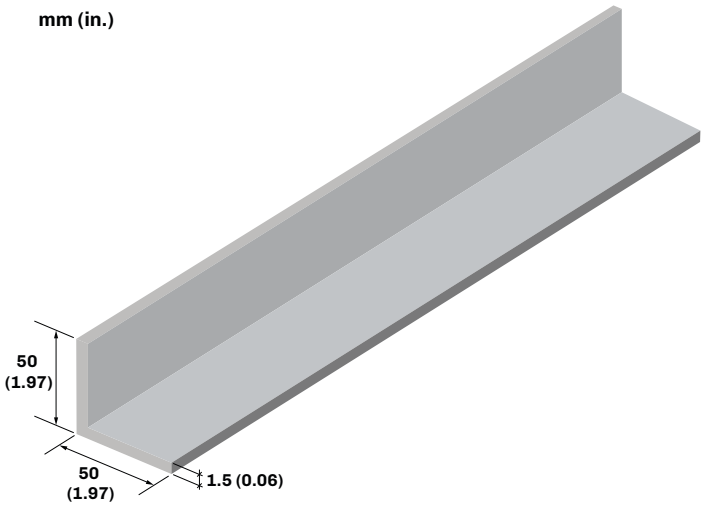


Fig. 4. *Dimensions of L-shaped fixing guide*

L-shaped guide 50x50 mm (1.97x1.97 in.) with a thickness of at least 1.5 mm (0.06 in.) in AISI 304 stainless steel or in polypropylene-based technopolymer material suitable for bacterial non-proliferation.
The L-shaped fixing guide must be positioned inside the condensate (or leak) collection tray.

2. TECHNICAL DATA

2.1 Technical specifications

Description	MU	VEH 10XS	VEH 20••	VEH 30••	VEH 40•	VEH 60••	VEH 80L	VEH 100XL
Steam production								
Production capacity:	kg/h	10	20	30	40	60	80	100
Pressure limits:	Pa/bar	There are no pressure limits (*)						
Electrical properties								
Power absorbed:	kW	7.5	15	22.5	30	45	60	75
Power supply:	V, Hz	400 Vac, 50/60						
Phases:	Ph	3						
Absorption per phase:	A	11	22	32	43	65	87	108
Water properties								
Supply water quality:	---	See section ***"5.2.1 WATER SPECIFICATIONS" ON PAGE 21***						
Supply water conductivity:	µS*cm	70...1250						
Supply water hardness:	°f	5...50						
Minimum inlet flow rate:	l/h	300						
Supply water pressure:	MPa/bar	0.02...1/0.2...10						
Supply water connection:	---	M 3/4" GAS						
Water drain outside diameter:	mm (in.)	40 (1.57)						
General specifications								
Dimensions:	mm (in.)	See section ***"4.1 DIMENSIONS" ON PAGE 16***						
Weight (hydraulic unit):	kg	15	18	20	24	26	31	33
IP protection level of the electric panel:	---	IP65						
IP protection level of the hydraulic unit:	---	IPX0						
Maximum installation altitude:	m (ft.)	≤2000 (6561.6)						
Electrical panel ambient conditions								
Ambient operating conditions:	°C (°F), %	-10...40 (14...104), 10...80%						
Transportation and storage conditions:	°C (°F), %	-20...70 (-4...185), 5...95%						
Hydraulic unit ambient conditions								
Ambient operating conditions:	°C (°F), %	1...40 (33.8...104), 10...80%						
Transportation and storage conditions:	°C (°F), %	-10...70 (14...185), 5...95%						
Regulation								
Control type/Command signal:	---	ON/OFF Proportional Probe						
Supervision/Configuration:	---	RS-485 MODBUS Supervision Wi-Fi						
Compliance								
EC:	---	Yes, with self-certification						

NOTE: The • symbol indicates that the data applies to every p/n; for further information please contact the ELSTEAM sales office.

(*): Steam production occurs inside the AHU and therefore under equivalent pressure conditions.

3. RECEIVING THE PRODUCT

⚠ CAUTION

IMPROPER HANDLING

- Use all necessary personal protective equipment (PPE), such as safety gloves and shoes, while handling packaging and unpacking.
- Follow the handling instruction given in this manual and any other documentation associated with the product.
- Handle and store the product in its original packaging.
- Do not handle or store the product if the packaging is or seems to be damaged.
- Take all necessary measures to avoid damaging the product and prevent other hazards while handling or opening the packaging.

NOTICE

UNEXPECTED EQUIPMENT OPERATION

- Droppages and shocks can damage the humidifier beyond repair.
- Tampering with or removing the identification stickers invalidates the warranty.

3.1 Checking the packaging

- Make sure the packaging is intact (one package for each electric panel and one dedicated to the hydraulic unit);
- Make sure the humidifier is intact (both the electric panel and the hydraulic unit) upon delivery and inform the courier immediately, in writing, of any problems caused by careless or improper transportation (accept the package conditionally).

3.1.1 Opening the packaging

- Take the packages to the humidifier installation site;
- Open the cardboard boxes, removing the corner protectors;
- Take the electric panel and the hydraulic unit out of their packaging.

3.1.2 Checking the packaging contents

The product package contains:

- **VEH** series humidifier, consisting of
  - Hydraulic unit;
  - Electric panel;
- Instruction sheet;
- Water inlet connection pipe for use between the main supply and the solenoid valve at the humidifier inlet;
- Cables connecting the hydraulic unit and electric panel;
- Hydraulic unit discharge;
- Key for opening the electric panel.

4. DIMENSIONS AND MECHANICAL ASSEMBLY

4.1 Dimensions

4.1.1 Hydraulic unit

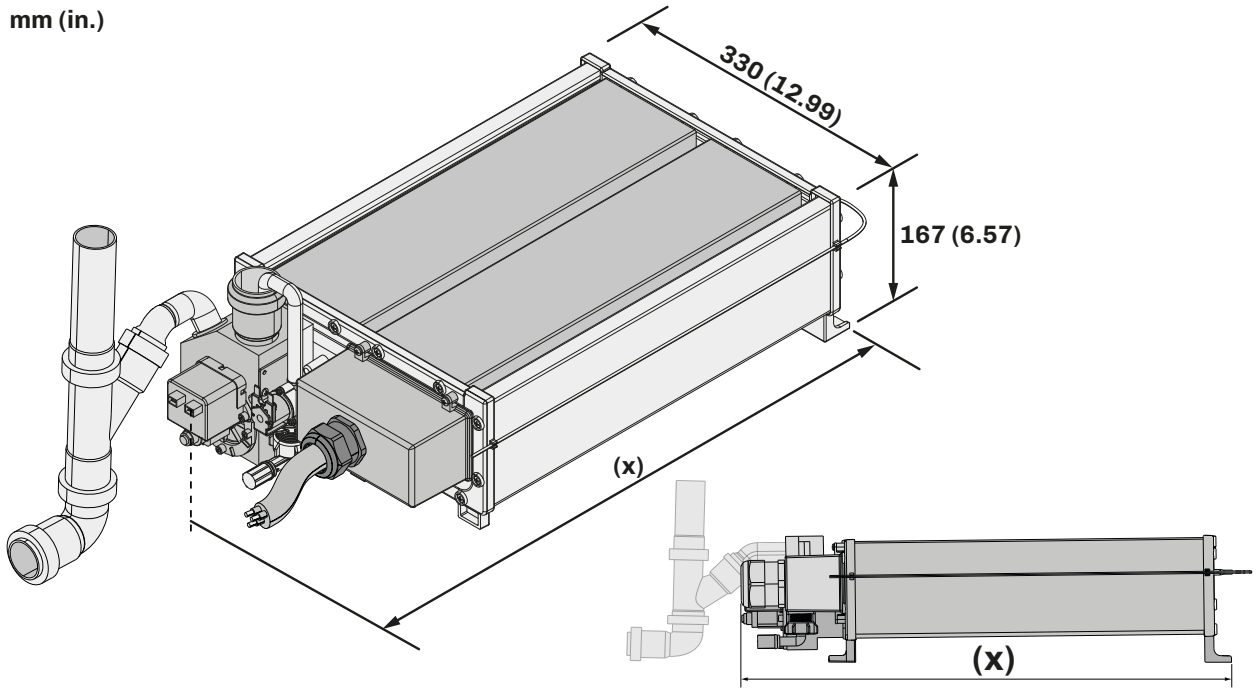


Fig. 5. *Hydraulic unit dimensions*

Dimension (X) for models [mm (ft.)]	VEH10XS	VEH20S	VEH20XS	VEH30M	VEH30S	VEH40L	VEH40S	VEH60XL	VEH60M	VEH80L	VEH100XL
4 electrodes	635 (2.08)	785 (2.57)	---	985 (3.23)	---	1185 (3.89)	---	1385 (4.54)	---	---	---
7 electrodes	---	---	635 (2.08)	---	785 (2.57)	---	785 (2.57)	---	985 (3.23)	1185 (3.89)	1385 (4.54)

4.1.2 Electric panel

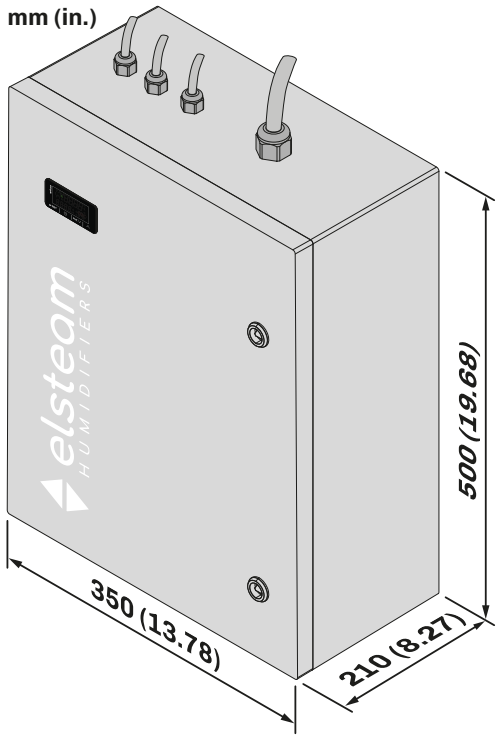


Fig. 6. *Electric panel dimensions*

4.2 Hydraulic unit installation

4.2.1 Installation instructions

- Place the hydraulic unit inside the condensate tank inside the AHU;
- Secure the hydraulic unit with 3 screws inserted into the anchoring hooks (see ***"FIG. 7. HYDRAULIC UNIT INSTALLATION" ON PAGE 17***) (not mandatory):
- Connect the inlet solenoid valve to the pipe provided;
- Connect the discharge unit using special water drainage pipes (Ø 40 mm (1.57 in.));
- Restore the connection between the hydraulic unit and the electric panel, keeping the power cables separate from the other service cables.

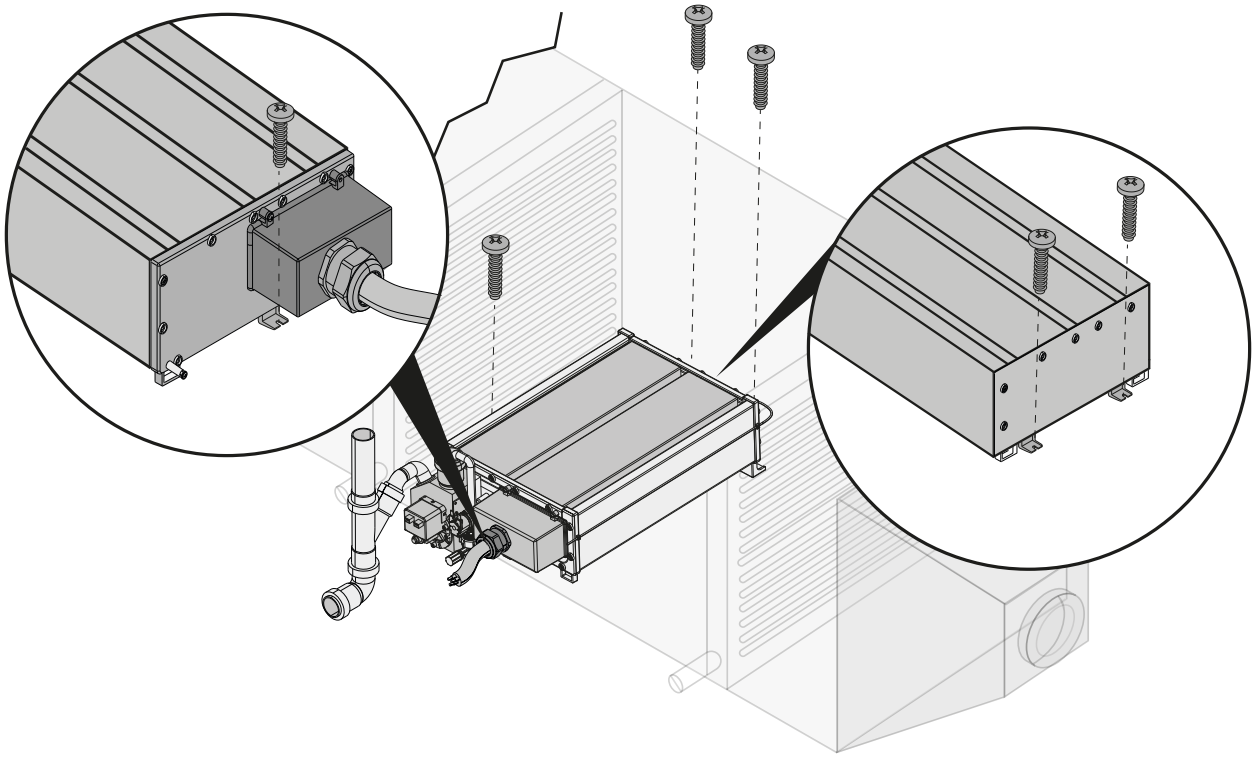


Fig. 7. *Hydraulic unit installation*

4.2.2 Minimum installation dimensions

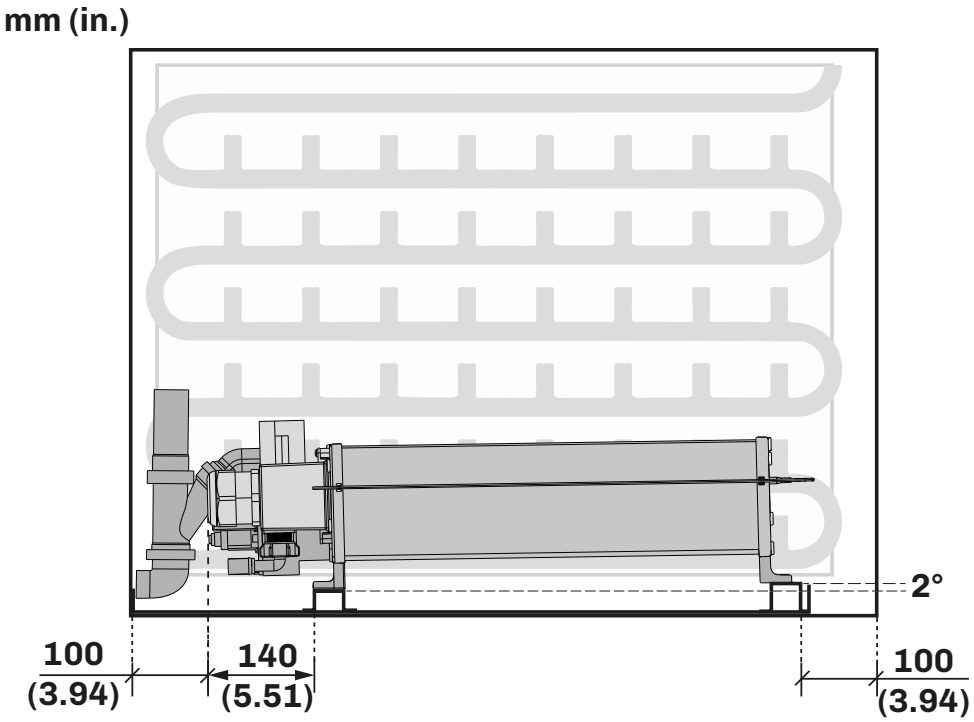


Fig. 8. *Minimum installation distances*

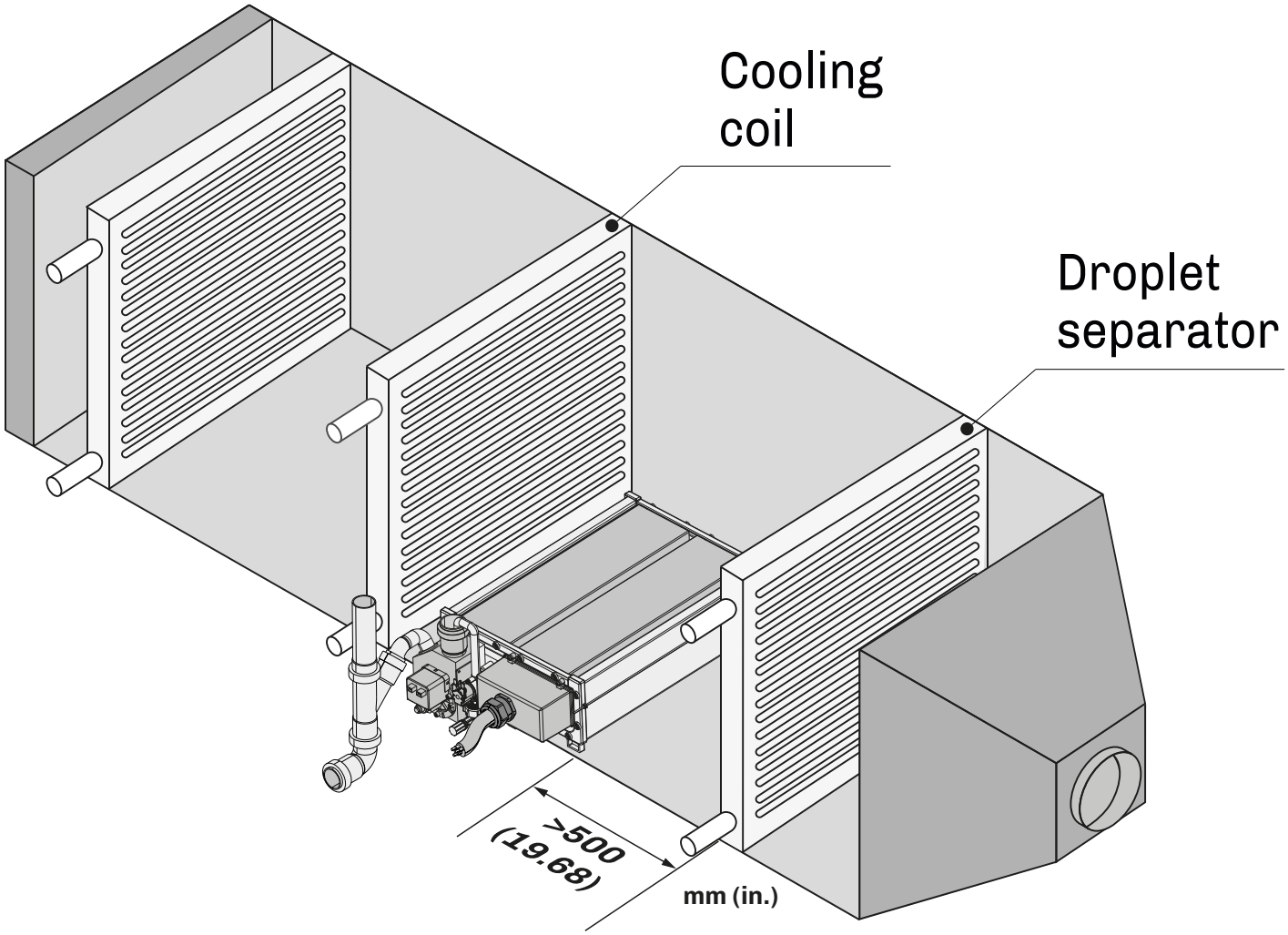


Fig. 9. *Minimum installation distances from the coil*

4.3 Electric panel installation

⚠⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

Make sure there is an effective earth connection.

NOTICE

FAULTY INSTALLATION

When installing the electric panel, only use the hooks provided.

4.3.1 Installation instructions

- Make 4 holes in the wall;
- Insert the hooks into the rear of the electric panel (in the pre-prepared holes) and secure them using the screws provided;
- Secure the electric panel to the wall.

NOTICE

FAULTY INSTALLATION

- The electric panel must be installed in accordance with best practices.
- Make sure the electric panel is properly secured to the wall on which it is installed.

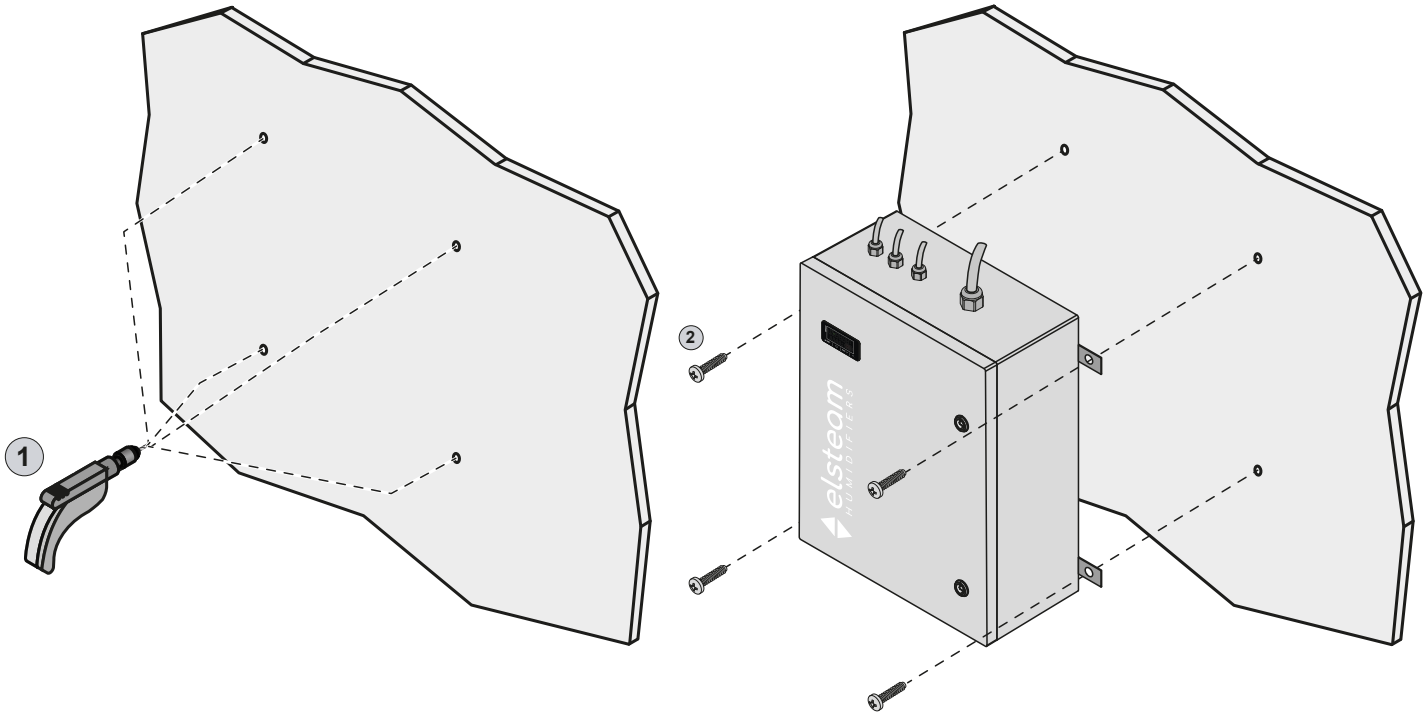


Fig. 10. *Electric panel installation*

4.3.2 Minimum installation dimensions

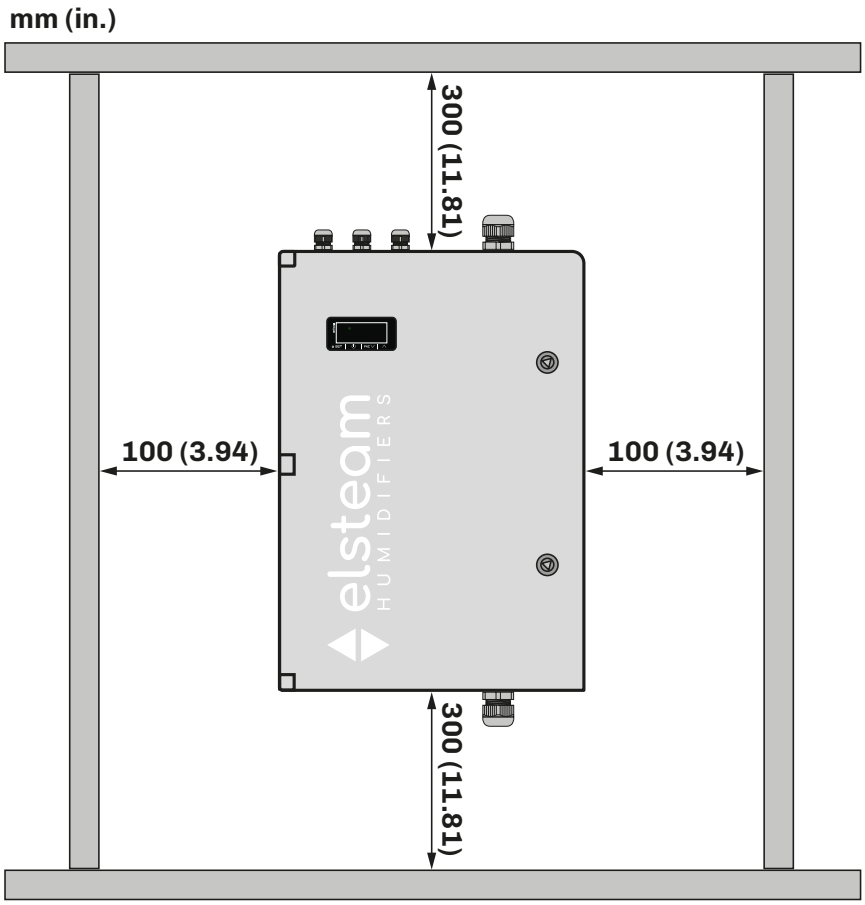


Fig. 11. *Minimum installation distances*

5. INSTALLATION

VEH series humidifiers are defined as "**NOT ACCESSIBLE TO THE PUBLIC**".

5.1 Hydraulic unit structure

5.1.1 Top

- Steam outlet;

5.1.2 Front

- Water drain for connection to waste water drainage pipes (Ø 40 mm (1.57 in.));
- Tear resistant cable gland for power supply cables;
- 3/4" GAS male water supply fitting.
- Electrical connections (Fastons) for filling solenoid valve and electric drain pump.

5.1.3 Rear

- Maximum level sensor connection.

5.2 Hydraulic installation

For correct hydraulic installation, the following should be provided outside the AHU and in the immediate surroundings of the hydraulic unit installation site:

- A shut-off tap;
- A filter supplementing the one already present inside the solenoid valve;
- A pressure reducer (if the mains pressure exceeds1 MPa (10 bar)).

If using metal pipes, make sure they are properly earthed.

Do not use pre-existing system pipework or used materials. Only use the materials supplied with the product.

NOTE: if using a pressure reducer, make sure is it effective and does not cause drastic pressure drops when the mains pressure is very low.

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

- The water supply must have a minimum pressure of 0.02 MPa (0.2 bar).
- Connect the solenoid valve to the mains using the hose supplied in order to reduce water hammer in the water supply to the humidifier.
- During installation, take care not to damage the plastic thread on the solenoid valve.
- The water connection should allow access to the mechanical filter in the inlet solenoid valve in order to clean it.
- Connect the drainage circuit using exclusively the D40 mm (1.57 in.) pipes provided.
- If the AHU is exposed to atmospheric agents, fit heating cables to the water supply and discharge pipes.

5.2.1 Water specifications

- Water pressure between 0.02...1 MPa (0.2...10 bar) inclusive;
- Temperature between 1...50 °C (33.8...122 °F) inclusive;
- Conductivity between 75...1250 µS/cm inclusive;
- Maximum water hardness between 5...50 °f.

NOTE: higher water hardness or a higher level of organic matter does not preclude proper equipment operation, nevertheless these factors mean that more frequent maintenance will be required.

What should you do?

- Let the water flow through the drain for a few hours before making the final connection.
- Check the retention status of the hydraulic circuit regularly to prevent faults and consequent water leakage into the room.
- Make sure the hydraulic unit is always installed within a condensate collection tank with drainage.

What should you NOT do?

- Soften the water. If the water hardness is over 50 °f or if the hardness level requires frequent maintenance, use demineralised water mixed with drinking water in a percentage that ensures minimum conductivity of 200 µS/cm and hardness of at least 10 °f;

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

- Do not use softened water.
- Once the humidifier has been installed, let the remaining water in the pipes flow out to prevent the filter from becoming clogged.
- Make sure the humidifier parts are perfectly intact.
- If any of the humidifier parts are not intact, do not proceed with installation.

5.3 Water drainage system

The drainage system must be able to drain a water flow of at least 60 l/minute.

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

Size the drain pipe correctly in order to prevent blockages and clogging during automatic cleaning.

NOTE: the drain pipes are not supplied (except for the initial Ø40 section, see ***"FIG. 8. MINIMUM INSTALLATION DISTANCES" ON PAGE 17***).
NOTE: a fixed drain connection must be used.

5.3.1 Connection specifications

- Minimum diameter 40 mm (1.57 in.);
- Maximum bend radius 300 mm (0.98 ft.);
- Minimum average incline of 45° and without traps (outside the AHU, inside refer to the accessories kits).

If the installation does not comply with these specifications, install a water and limescale collection tank at the drain outlet point outside the AHU (*p/n* **EHVI**) (contact the Elsteam sales office for further information).

Discharge tank features

- Discharge (drainage) tank with trap for limescale collection.

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

If the water hardness is over 40 °f, carry out maintenance/manual cleaning of the tank at least twice a year.

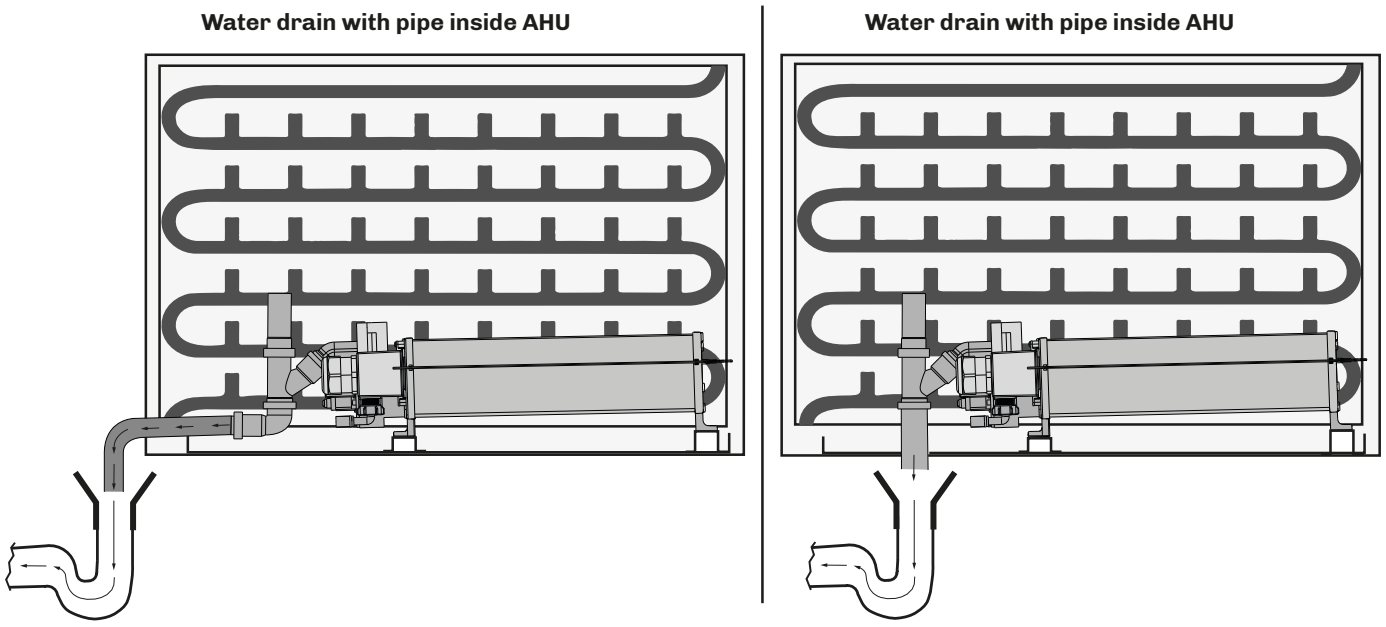


Fig. 12. *Drainage tank features*

If the water hardness reflects the optimal specifications indicated in sub-section ***"5.2.1 WATER SPECIFICATIONS" ON PAGE 21,*** the tank will only need cleaning once a year.

If the drainage network or drainage tank is made of electrically conductive material, safety standards require it to be electrically earthed.

DANGER

RISK OF ELECTRIC SHOCK

If the drainage tank is made using electrically conductive material, the tank or the drainage network must be earthed.

Drained water may reach a temperature of 98 °C (208.4 °F) or higher.

WARNING

RISK OF BURNS

- Before starting to drain the water, wear all necessary personal protective equipment (PPE).
- Do not touch the equipment when draining the water.

5.4 Steam distribution in the AHU

⚠ ⚠ WARNING

RISK OF BURNS

- The hydraulic unit must be installed so that it cannot be accessed by unauthorised persons.
- The inside of the air treatment unit (where the hydraulic unit is installed) must only be accessed by qualified personnel using a tool (e.g. a spanner).

⚠ ⚠ WARNING

HOT WATER VAPOUR

Do not touch the equipment while it is running.

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

- Install the equipment in a position which ensures the minimum distances from all adjacent structures and equipment as indicated in this document.
- Install all equipment in compliance with the technical specifications indicated in the relevant documentation.

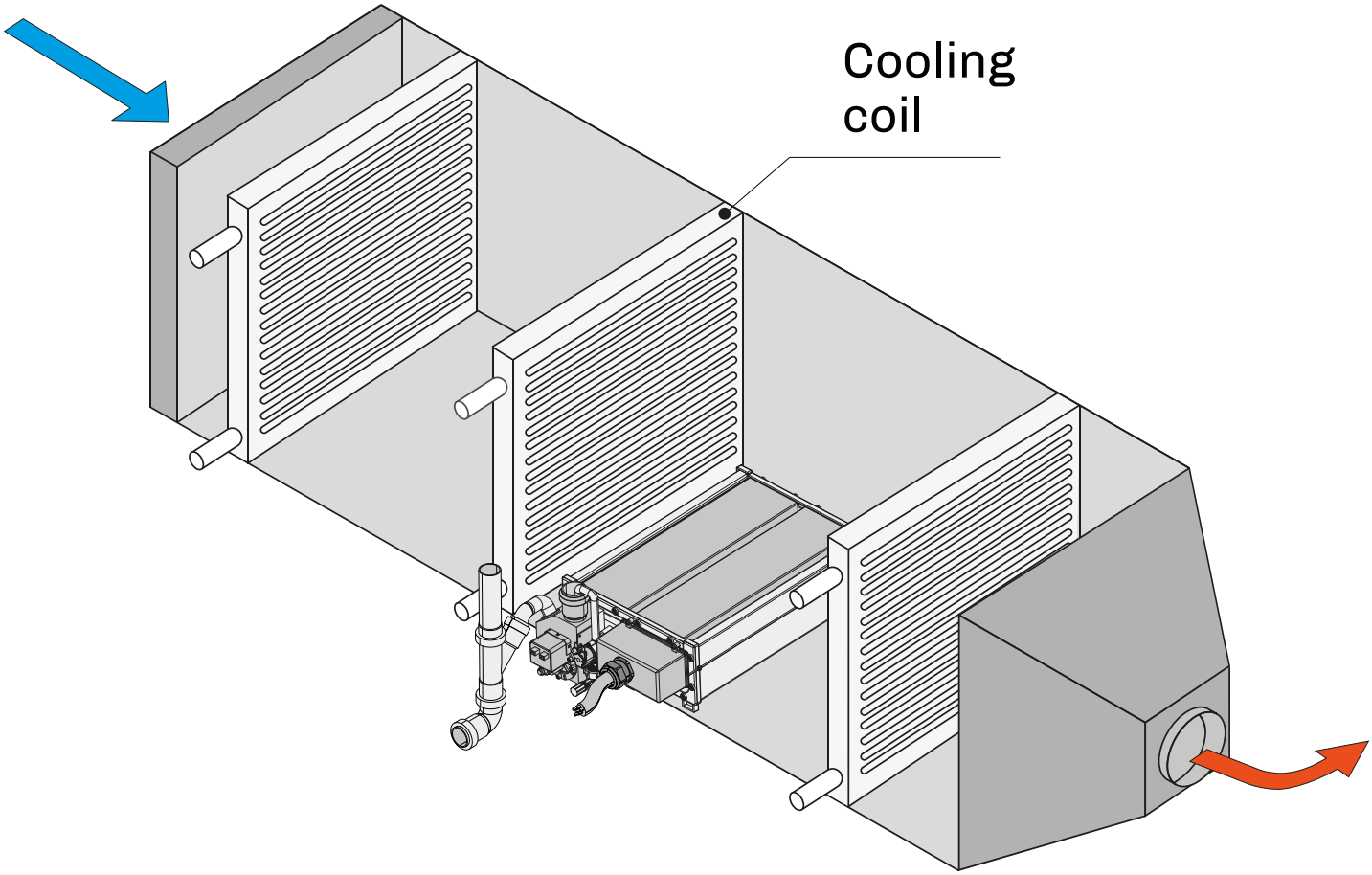


Fig. 13. *Positioning the hydraulic unit in the AHU*

NOTE: in ambient temperature conditions which may lead to the formation of ice, it is wise to take all necessary precautions to prevent the supply water and the drain water from freezing and causing the humidifier to malfunction.

6. ELECTRICAL CONNECTIONS

6.1 Before you start

Read this manual carefully before installing the equipment.

In particular, the safety instructions, electrical requirements and current regulations for the machine or the process in which this device is involved must be observed.

The use and application of the information contained herein requires experience in the design and installation of humidification systems. Only the user, integrator or manufacturer of the machine can be familiar with all the conditions and factors which arise during installation and configuration, operation and maintenance of the machine or the process, and as such can identify the relevant automation equipment and the corresponding interlocks and safety systems which can be used effectively and appropriately. When selecting automation and control equipment and other connected equipment and software, for a particular application, you must consider all applicable local, regional and national standards and/or regulations.

⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Only use electrically insulated measuring devices and equipment.
- Do not install the equipment while the power supply is connected.
- Cut off the power supply to all equipment, including any connected devices, before removing any covers or hatches, or before installing/uninstalling accessories, hardware, cables or wires.
- Provide safety interlocks (isolators) of a suitable size between the power supply and the humidifier, with a contact opening distance of at least 3 mm for each pole.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.
- The maintenance, repair, installation and use of the equipment must only be entrusted to qualified personnel.
- Do not touch the unshielded components or the terminals while they are live.
- Do not open, disassemble, repair or modify the product.
- Do not expose the equipment to liquids or chemicals.
- Make sure there is an effective earth connection.
- Before applying voltage to the equipment:
  - Make sure all protective elements, such as covers, hatches and grilles, are fitted and/or closed using a tool (e.g. a spanner).
  - Check all wiring connections.

⚠ WARNING

REGULATORY INCOMPATIBILITY

Make sure all the equipment used and systems designed conform to current local, regional and national standards.

6.2 Connection best practice

6.2.1 Wiring best practices

⚠ DANGER

RISK OF ELECTRIC SHOCK AND FIRE

- Do not use the device with loads greater than those indicated in the technical data section.
- Do not exceed the temperature and humidity ranges indicated in the technical data section.
- Provide safety interlocks (isolators) of a suitable size between the power supply and the humidifier.
- Only use cables with a suitable cross-section as indicated in the section “Wiring best practices”.

When wiring the humidifiers, observe the following instructions:

- Make sure the operating environment and conditions fall within the specified values.
- Use cables with the correct diameter, suited to the voltage and current requirements.
- Use double-insulated cables suitable for outdoor use (minimum requirement: H05RN-F) which also include an earth wire.

⚠ DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCKS AND OVERHEATING

Tighten the connections in compliance with the technical specifications relating to tightening torques.

⚠ WARNING

MALFUNCTIONING OF THE EQUIPMENT

- Perform the wiring carefully, in compliance with electromagnetic compatibility and safety requirements.
- Carry out a full start-up test.
- Make sure the wiring is correct for the end application.
- Minimise the length of the connections as much as possible, to avoid winding the cables around electrically connected parts.
- Before applying the power supply, check all the wiring connections.
- Do not connect cables to unused terminals and/or terminals marked with the text “No connection” (N.C.).

⚠ WARNING

REGULATORY INCOMPATIBILITY

Make sure all the equipment used and systems designed conform to current local, regional and national standards.

Suitable wiring for the power supply

Step 17.8 mm (0.70 in.)

mm / in. 7 / 0.28			
mm²	4	4	4
AWG	*10*	*10*	*10*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 2,5 | *lb-in 22.12*

Fig. 14. *Suitable wiring for the power supply -* ***VEH10***

Step 17.8 mm (0.70 in.)

mm / in. 7 / 0.28			
mm²	6	6	6
AWG	*8*	*8*	*8*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 2,5 | *lb-in 22.12*

Fig. 15. *Suitable wiring for the power supply -* ***VEH20***

Step 26.5 mm (1.04 in.)

mm / in. 7 / 0.28			
mm²	10	10	10
AWG	*7*	*7*	*7*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 3 | *lb-in 26.55*

Fig. 16. *Suitable wiring for the power supply -* ***VEH30***

Step 26.5 mm (1.04 in.)

mm / in. 7 / 0.28			
mm²	16	16	16
AWG	*5*	*5*	*5*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 3 | *lb-in 26.55*

Fig. 17. *Suitable wiring for the power supply -* ***VEH40***

Step 35.5 mm (1.40 in.)

mm / in. 7 / 0.28			
mm²	16	16	16
AWG	*5*	*5*	*5*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 4 | *lb-in 35.40*

Fig. 18. *Suitable wiring for the power supply -* ***VEH60***

Step 35.5 mm (1.40 in.)

mm / in. 7 / 0.28			
mm²	25	25	25
AWG	*7*	*7*	*7*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 4 | *lb-in 35.40*

Fig. 19. *Suitable wiring for the power supply -* ***VEH80***

Step 35.5 mm (1.40 in.)

mm / in. 7 / 0.28			
mm²	25	25	25
AWG	*3*	*3*	*3*
no. of conductors	*3+G*		

Ø 3.5 mm (*0.14 in.*) | C | N•m 4 | *lb-in 35.40*

Fig. 20. *Suitable wiring for the power supply -* ***VEH100***

6.2.2 Cable glands and cable routing

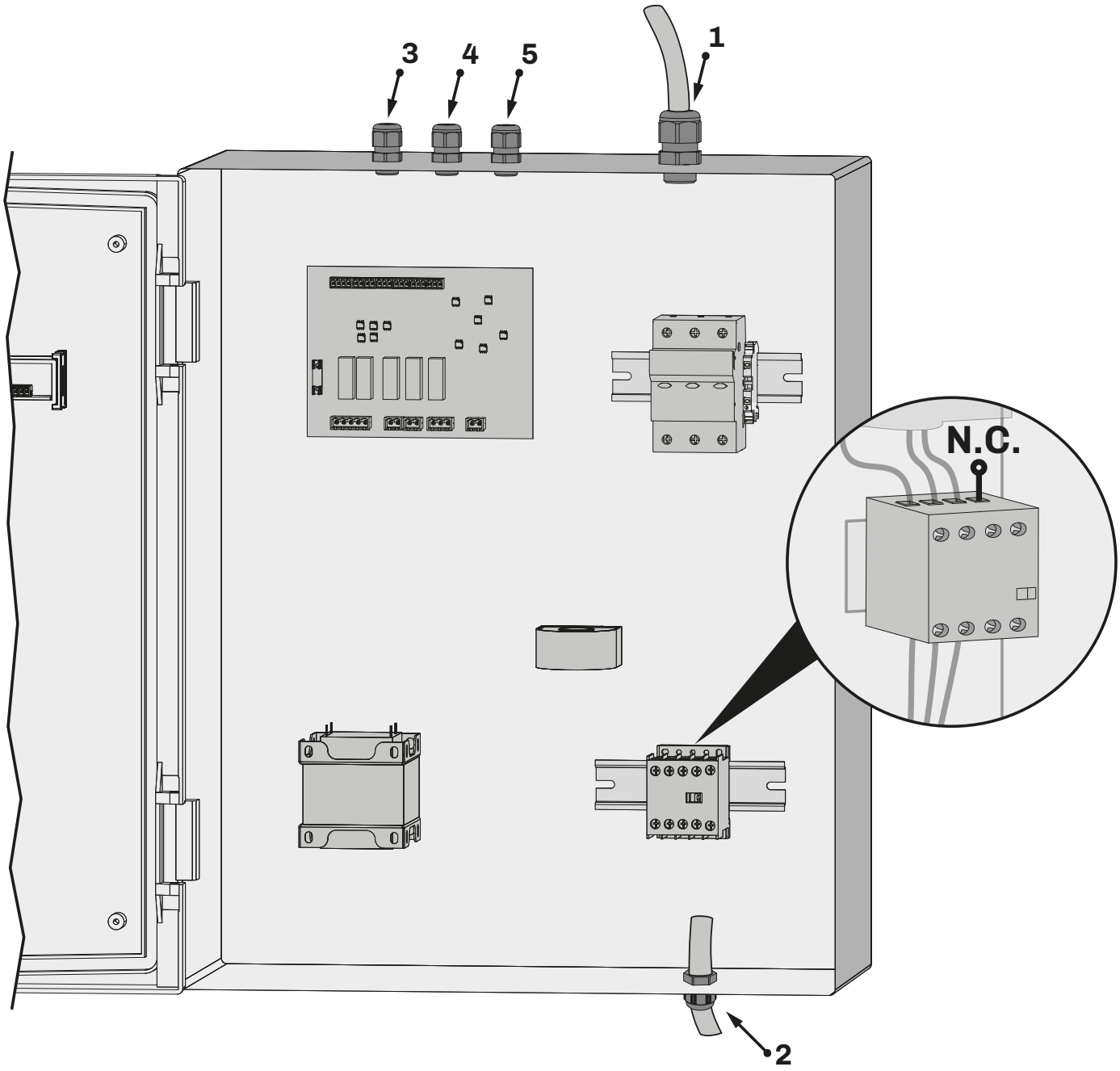


Fig. 21. *Suitable wiring for the power supply -* ***VEH100***

Ref.	Description
1	Power cable entry on cable gland (**PGx** depending on model)
2	Power cable exit on cable gland (**PGx** depending on model)
3	Solenoid valve and electric pump power cable exit on cable gland PG9
4	Level sensor wiring exit on cable gland PG9
5	I/O regulation wiring entry on cable gland PG9

NOTE: when using an auxiliary contact outside the remote control switch, please contact the Elsteam sales office.

Suitable personal protective equipment for the power supply

⚠⚠ DANGER

RISK OF ELECTRIC SHOCK

- Cut off the power supply to all equipment, including any connected devices, before removing any covers or hatches, or before installing/uninstalling accessories, hardware, fuses, cables or wires.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.

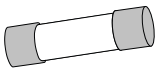
	*VEH10*	*VEH20*	*VEH30*	*VEH40*	*VEH60*	*VEH80*	*VEH100*
Current (A)	16	32	50	50	80	100	125
Type	Rapid	Rapid	Rapid	Rapid	Rapid	Rapid	Rapid
Size	10x38	10x38	14x51	14x51	22x58	22x58	22x58

Fig. 22. *Overload protection devices according to model*

6.2.3 Replacing fuses - Fuse box

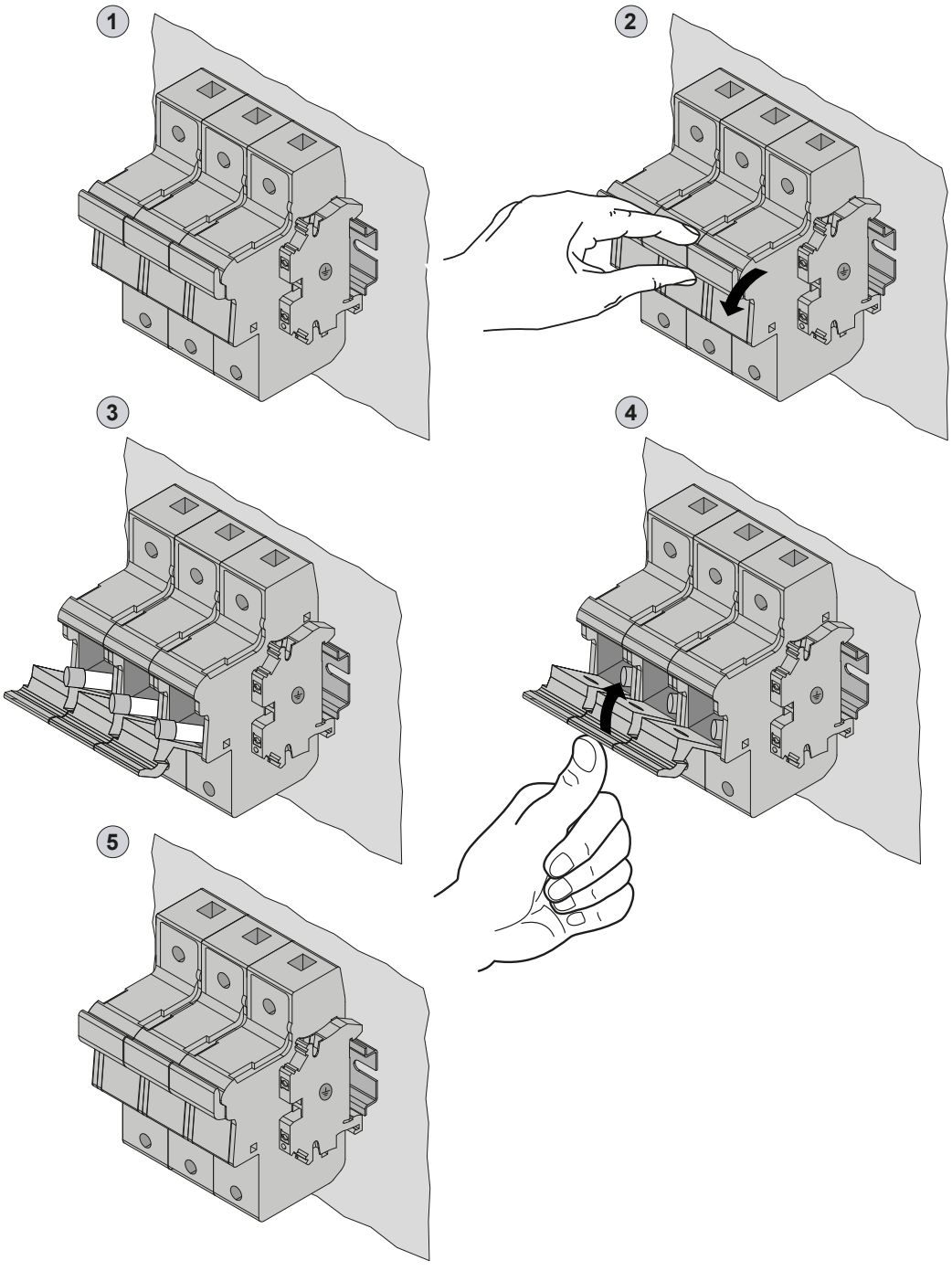


Fig. 23. Overload protection device

6.3 Electrical connections

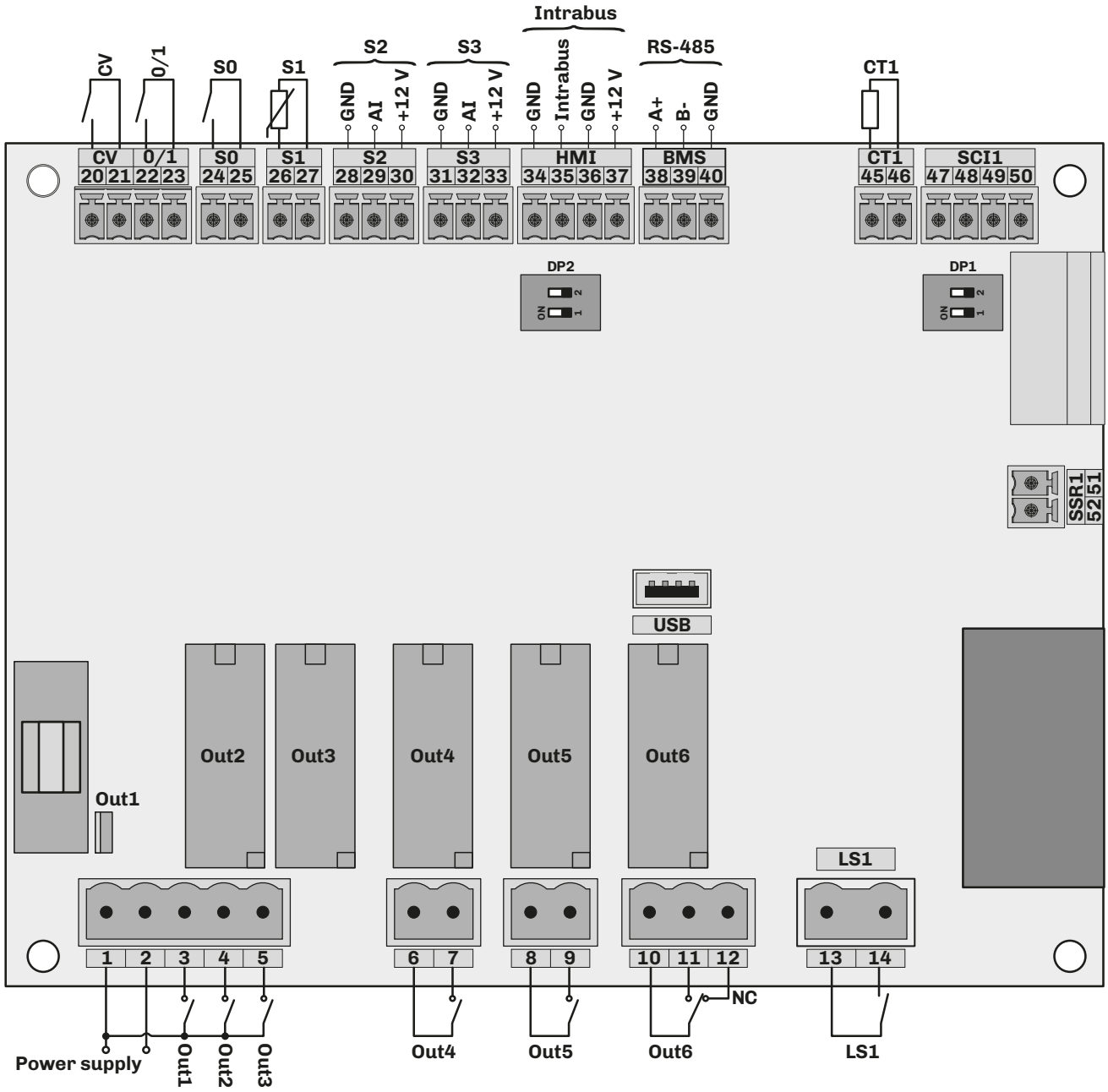


Fig. 24. *Control board electrical connections*

TERMINALS			
1-2	24 Vac power supply	**24-25**	Digital input: humidistat (**CFG** = 0-1) (**S0**)
1-3	Digital output: water filling solenoid valve	**26-27**	**S1** analogue input: temperature (anti-freezing and hold)
1-4	Digital output: water outlet pump	**28...30**	**S2** analogue input: humidity sensor
1-5	Digital output: contactor (steam generation)	**31...33**	**S3** analogue input: humidity limit sensor
6-7	Digital output: dehumidification enable	**34...36**	Serial line connection: HMI Intrabus
8-9	Digital output: ventilated distributor control	**38...40**	Serial line connection: RS-485 modbus for BMS slave
10...12	Digital output: alarm	**45-46**	Analogue connection: external current sensor **CT1** (TA)
13-14	Hazardous voltage digital input: level sensor **LS1**	**47...52**	Reserved
20-21	Digital input: fan enable (**CV**)	**DP1**	Activate termination resistor on **SCI1 RS-485** serial line. **1** = **SCI1** RS-485 serial termination; **2** = Reserved
22-23	Digital input: remote ON/OFF (**0/1**)	**DP2**	Termination resistor on **BMS** / **CANBUS** RS-485. **1** = **BMS** RS-485 serial termination **2** = **CANBUS** serial termination

6.4 Configurations

To start up humidity production, contacts **CV** and **0/1** must be closed in all the configurations below.

6.4.1 ON/OFF connection with humidistat or external contact (CFG = 0-1)

Parameter configuration
CFG = 0-1

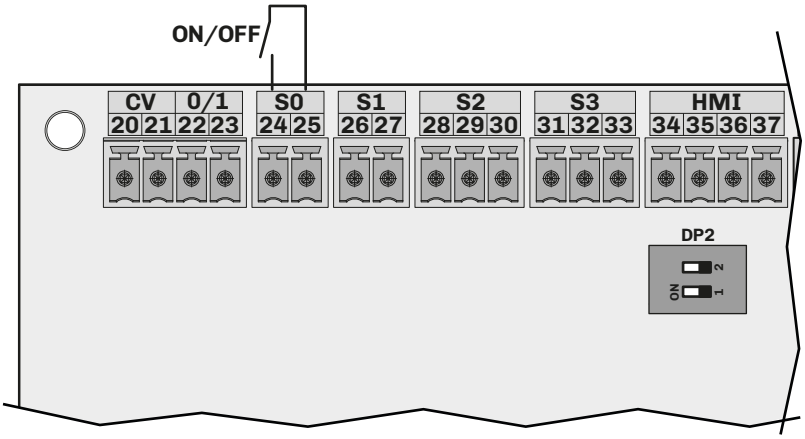


Fig. 25. *ON/OFF connection with humidistat or external contact (**CFG** = 0-1)*

6.4.2 External proportional humidistat connection (CFG = PROP)

Parameter configuration
CFG = PROP
P2 = 0-10 **P2** = 0-5 **P2** = 0.20 **P2** = 4.20

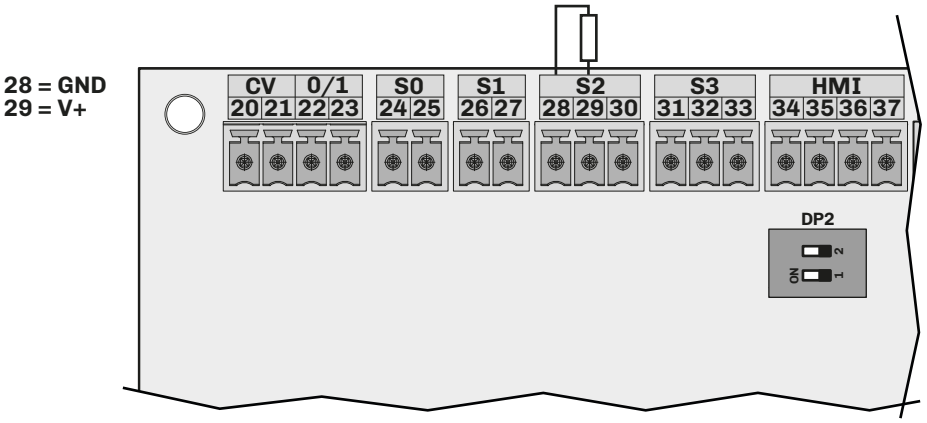


Fig. 26. *External proportional humidistat connection (**CFG** = PROP)*

6.4.3 Humidity sensor connection (CFG = HUM)

Parameter configuration
CFG = HUM
P2 = 0-10 **P2** = 0-5 **P2** = 0.20 **P2** = 4.20

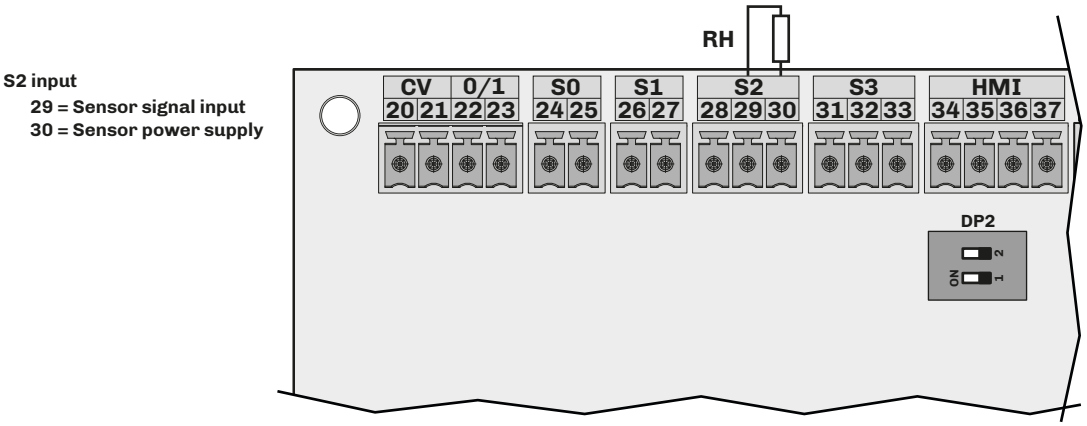


Fig. 27. *Humidity sensor connection (**CFG** = HUM)*

6.4.4 Humidity sensor connection EVHTP520 (CFG = HUM)

Parameter configuration
CFG = HUM
P2 = E520

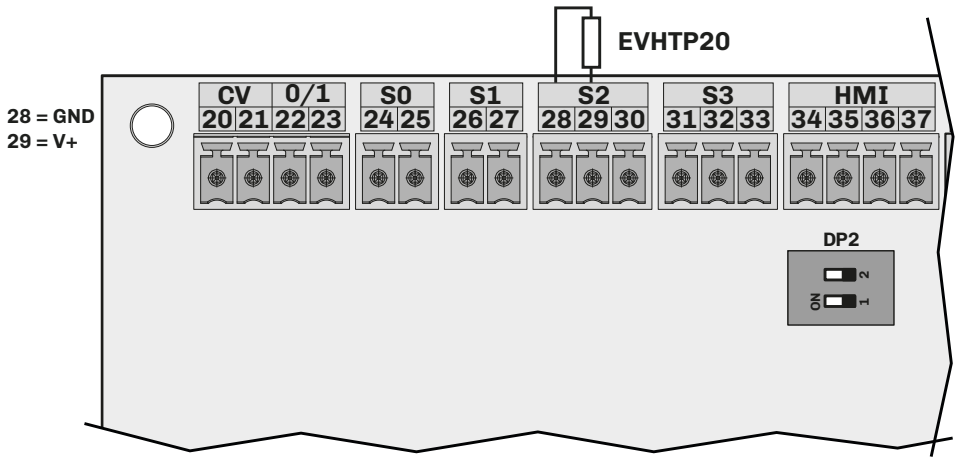


Fig. 28. *Humidity sensor connection EVHTP520 (**CFG** = HUM)*

6.4.5 Connection for humidity sensor and limit sensor (CFG = HUML)

Parameter configuration
CFG = HUML
P2 = 0.20 **P2** = 4.20 **P2** = E520
P7 = 0.20 **P7** = 4.20

S2 input
29 = Sensor signal input
30 = Sensor power supply

S3 input
32 = Sensor signal input
33 = Sensor power supply

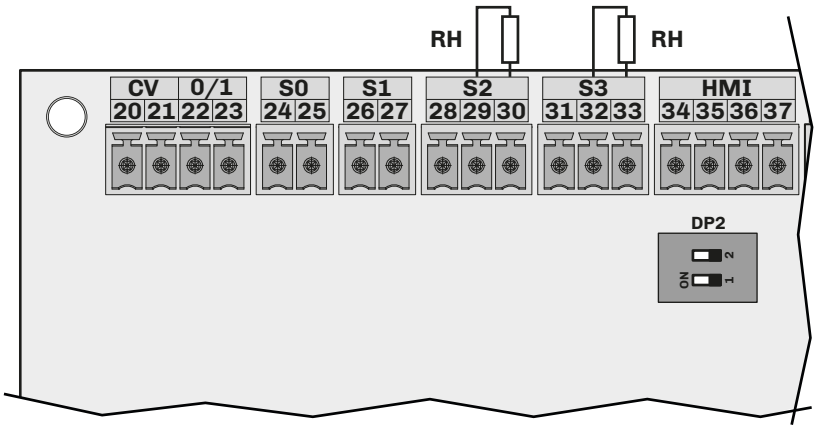


Fig. 29. *Connection for humidity sensor and limit sensor (**CFG** = HUML)*

6.4.6 Temperature sensor connection (CFG = 1T)

Parameter configuration
CFG = 1T
P2 = PTC **P2** = 1000 **P2** = NTC

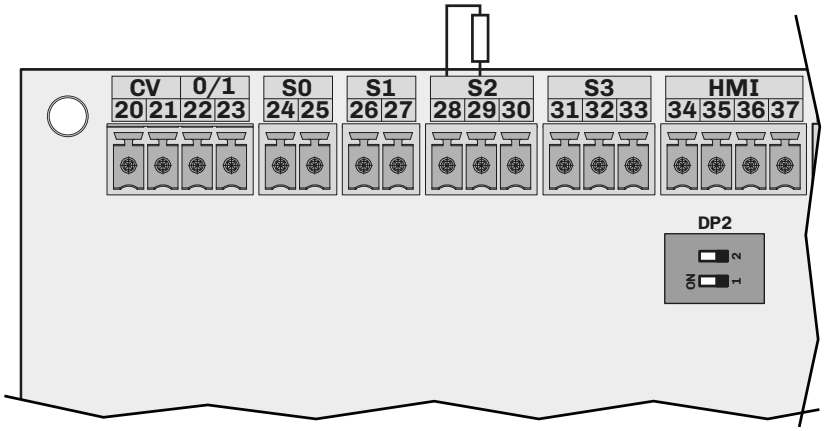


Fig. 30. *Temperature sensor connection (**CFG** = 1T)*

6.4.7 Connection for two temperature sensors (CFG = 2T)

Parameter configuration
CFG = 2T
P2 = PTC **P2** = 1000 **P2** = NTC
P7 = PTC **P7** = 1000 **P7** = NTC

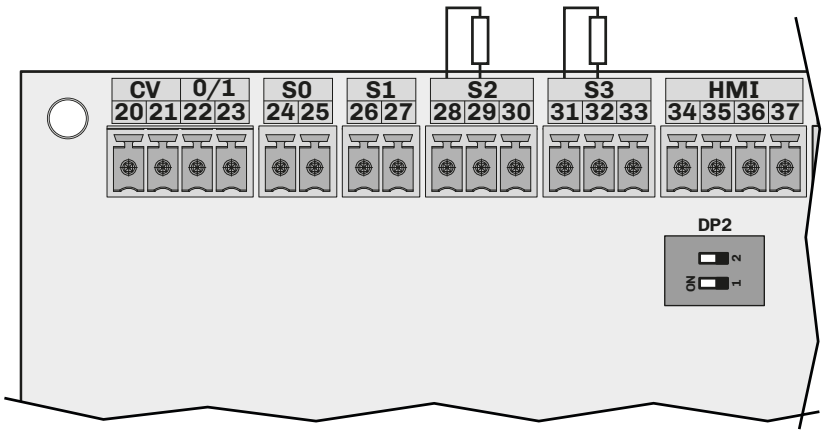


Fig. 31. *Temperature sensor connection (**CFG** = 2T)*

6.4.8 Humidity sensor connection 0...5 V / 0...10 V

Parameter configuration
CFG = HUM **CFG** = HUML
P2 = 0-5 **P2** = 0-10
P7 = 0-5 **P7** = 0-10

S2 input
28 = GND
29 = V+
30 = Sensor power supply

S3 input
31 = GND
32 = V+
33 = Sensor power supply

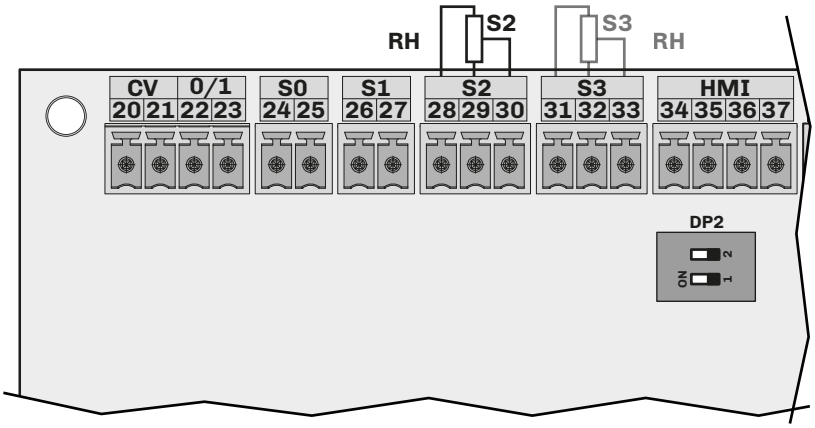


Fig. 32. *Humidity sensor connection 0...5 V*

6.5 Power supply and earth wiring connection

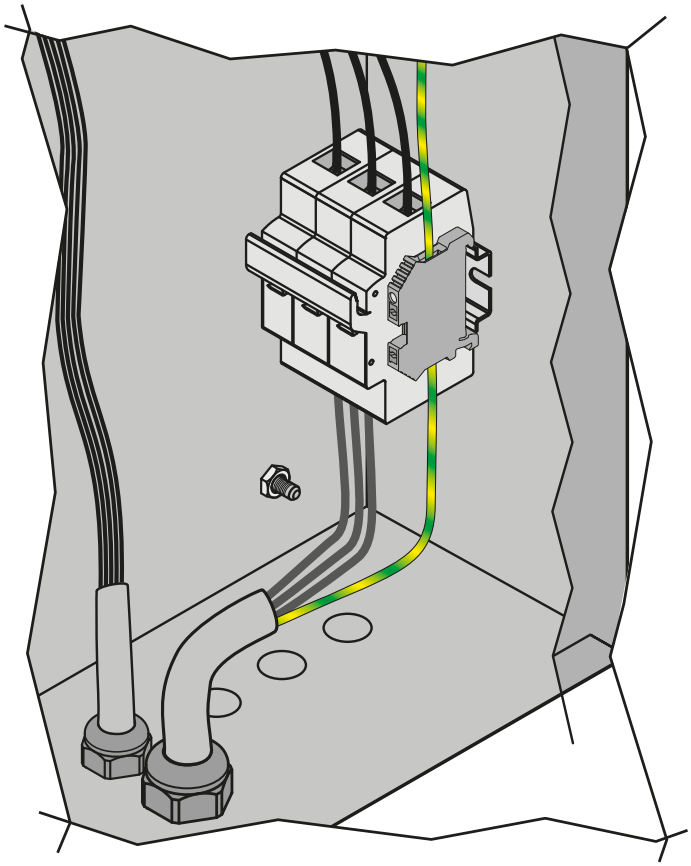


Fig. 33. *Power supply connections - three-phase models*

7. USER INTERFACE

Make sure the humidifier and all the installed components are properly connected before start-up, in accordance with regulations, criteria and all applicable local, regional and national standards.

7.1 User interface

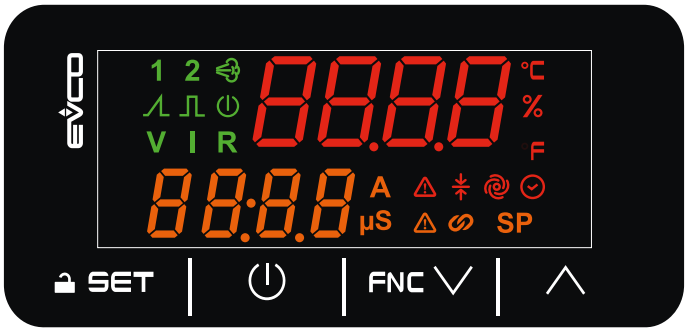


Fig. 34. ***VEH*** *humidifier user interface*

7.1.1 Icons

Icon	Lit steadily	OFF
1	• Main sensor configured and present • **CFG** = 1T (one temperature probe)	In all other cases
2	• Limit sensor configured and present • **CFG** = 2T (two temperature probes)	In all other cases
	Steam request	In all other cases
	Proportional operating mode	In all other cases
	ON/OFF operating mode	In all other cases
	Humidifier OFF	Humidifier ON
V	Voltage sensor operating mode	In all other cases
I	Current sensor operating mode	In all other cases
R	Resistive sensor operating mode	In all other cases
A	Display shows the current absorbed by the electrodes	In all other cases
µS	Changing value of **P1** in progress	In all other cases

Icon	Lit steadily	OFF
	Warning in progress	No warning in progress
	CV input closed (enable signal given)	**CV** input open (enable signal not given)
SP	Changing humidity setpoint in progress	In all other cases
	Alarm in progress	No alert in progress
	Contactor ON	Contactor OFF
	Washing or draining in progress	In all other cases
	Displayed value is operating hours	In all other cases
F	Display shows temperature in °F	In all other cases
%	Display shows humidity in %	In all other cases
°C	Display shows temperature in °C	In all other cases

7.1.2 Keys

Key...	Tap and release to...	Tap and hold for at least 3 seconds to...
	Go back a level	Humidifier ON/OFF
FNC	• Scroll down through the values • Navigate within the menu	Go to the maintenance and reset operating hours menu
	• Scroll up through the values • Navigate within the menu	Activate manual draining
SET	• Confirm the values on the display • Set/change the humidity setpoint	Enter the main menu

7.1.3 First start-up

Make sure the humidifier and all the installed components are properly connected before start-up, in accordance with regulations, criteria and all applicable local, regional and national standards.

At the first start-up, the machine is disabled until the inlet water electrical conductivity has been entered, after which the humidifier OFF screen will open automatically.

NOTE: If you do not have the electrical conductivity value of the water, it can be obtained from the website of the drinking water supplier.

Fig. 35. *First start-up - Setting the electrical conductivity*

Fig. 36. *Humidifier OFF*

7.2 User interface menu

7.2.1 Home screen

HOME screen with ON/OFF regulation from digital input (CFG = 0-1)

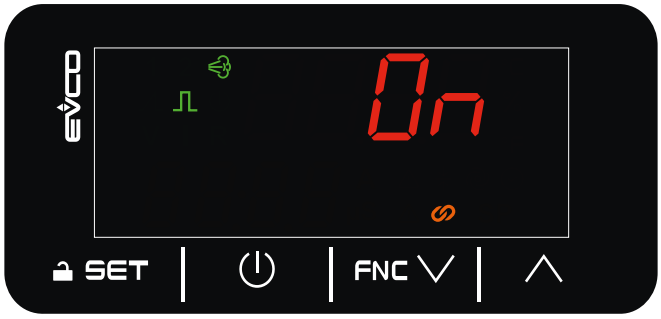


Fig. 37. *Home screen with ON/OFF regulation from digital input (**CFG** = 0-1)*

Top line: Shows the state of the digital control input (**S0**).
NOTE: The **CV** and **0/1** contacts must be closed to produce humidity.

HOME screen with proportional regulation (CFG = PROP)

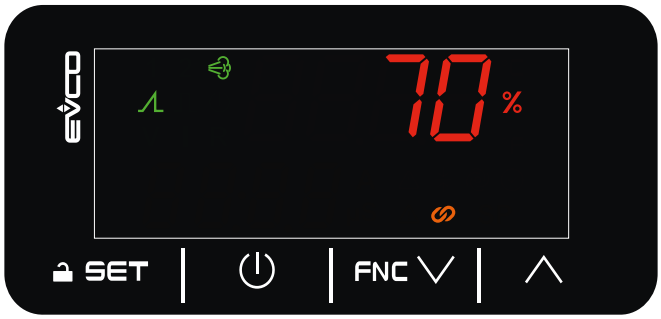


Fig. 38. *Home screen with proportional regulation (**CFG** = PROP)*

Top line: Actual humidity request in %.
NOTE: The **CV** and **0/1** contacts must be closed to produce humidity.

HOME screen with regulation via humidity sensor (CFG = HUM) or humidity sensor and limit sensor (CFG = HUML)

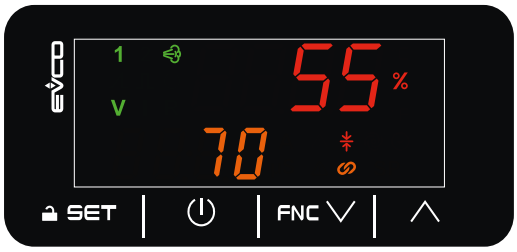


Fig. 39. Home screen with humidity sensor alone

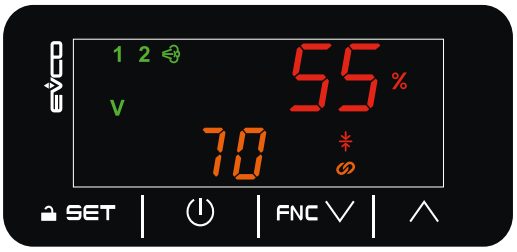


Fig. 40. Home screen with humidity sensor and limit sensor

Top line: Humidity measured by the room humidity sensor.
Bottom line: Humidity setpoint.
NOTE: The **CV** and **0/1** contacts must be closed to produce humidity.

7.2.2 Changing the main sensor humidity setpoint

With **CFG** = HUM or **CFG** = HUML only.

To change the humidity setpoint:

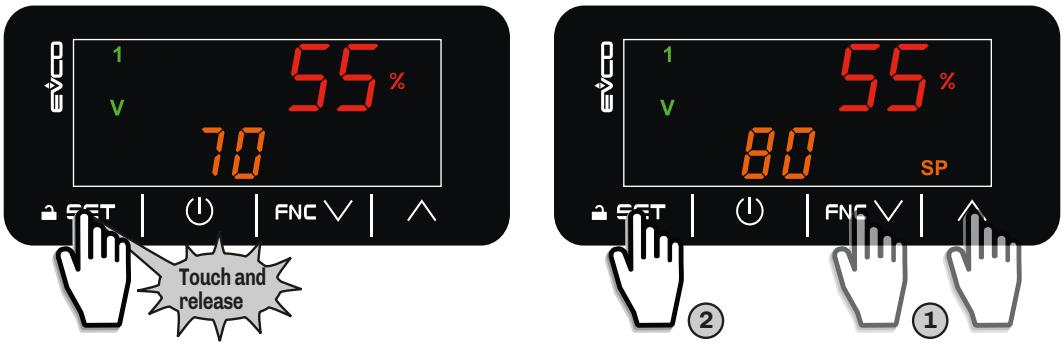


Fig. 41. Changing the humidity setpoint

7.2.3 Changing the temperature setpoint

With **CFG** = 1T or **CFG** = 2T only.

To change the temperature setpoint:

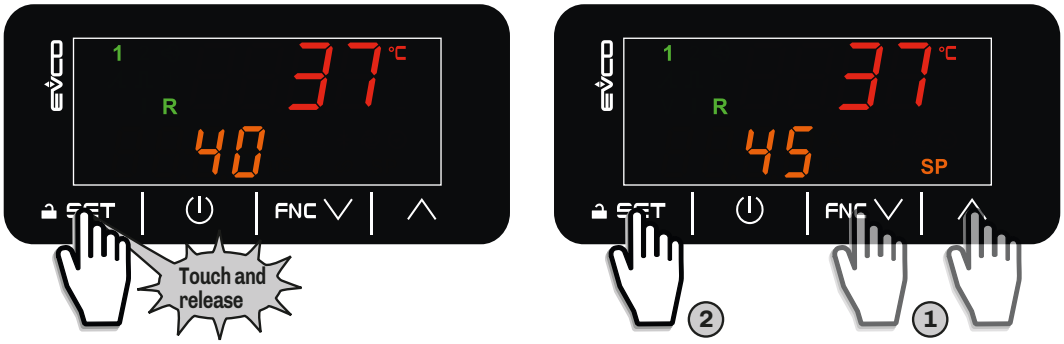


Fig. 42. Changing the temperature setpoint

7.2.4 Manual draining

To start manual draining:

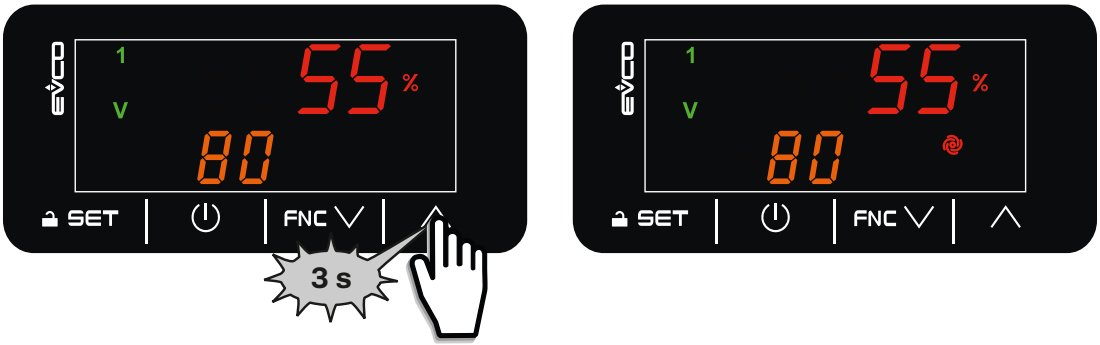


Fig. 43. Manual draining

7.2.5 Menu

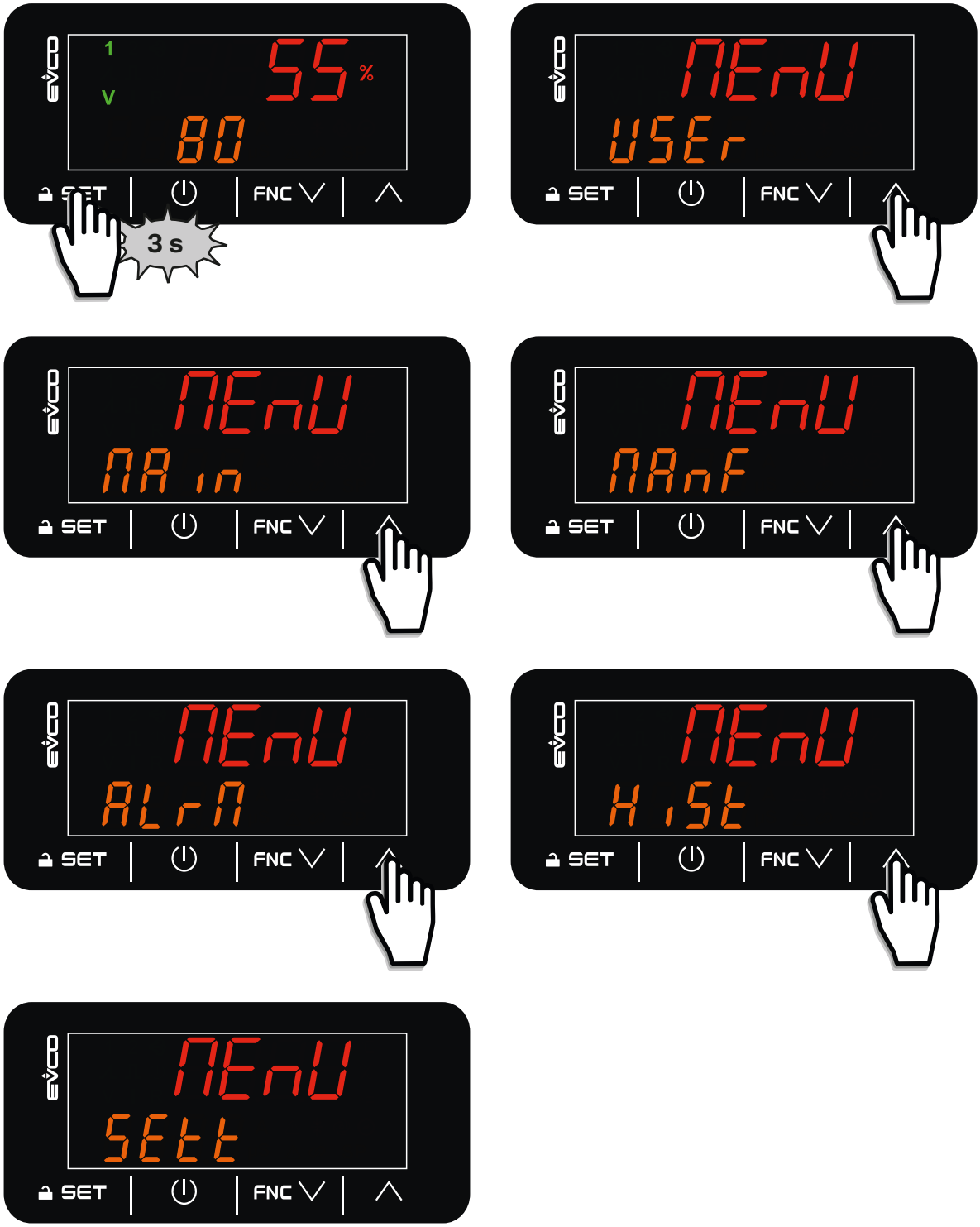


Fig. 44. *Menu*

Menu	Description
USEr	Access the user menu
MAIn	Access the maintenance technician menu
MANF	**RESERVED. NOT ACCESSIBLE TO THE PUBLIC.**
ALrM	Currently accessing alarm control
HISt	Access the alarm log
SEtt	Reset parameters to factory settings

7.2.6 User Menu

The user menu can be used to display and change user parameters.

To access the user menu:

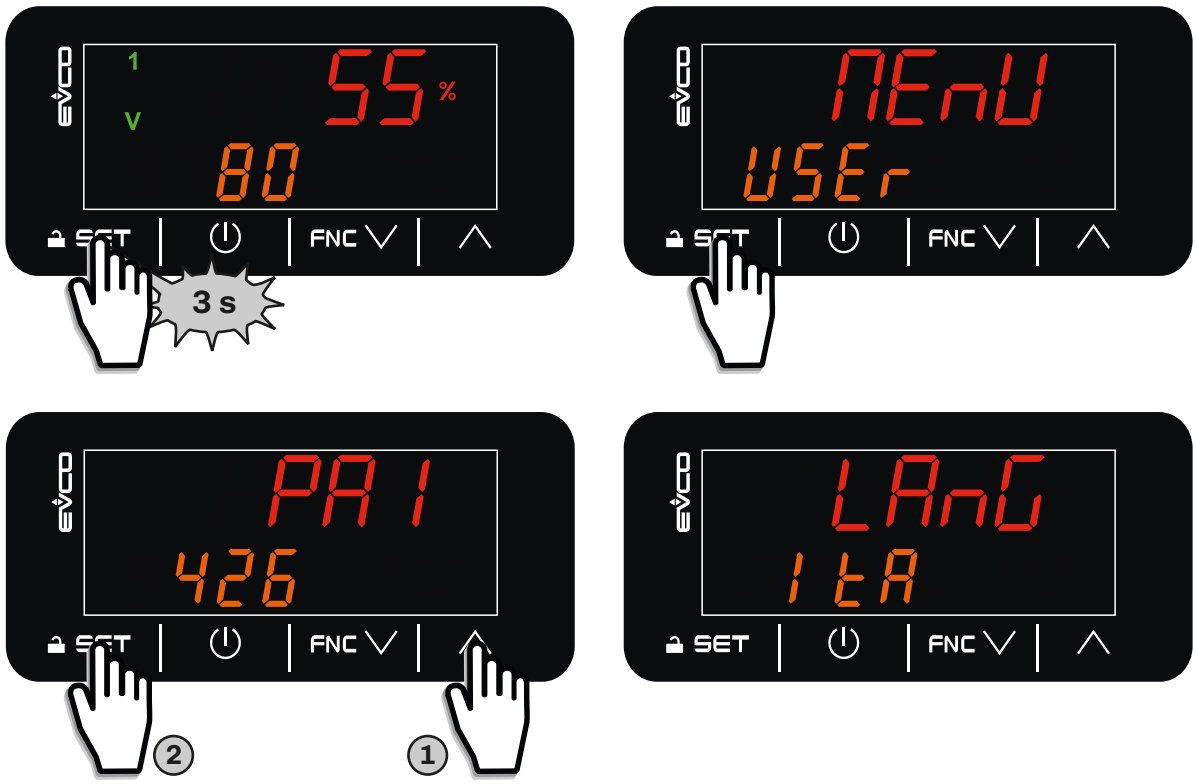


Fig. 45. *User menu*

Top line	Bottom line	Description
LAnG	Set language	Sets the display language. **EnG** = English; **Ita** = Italian.
SP1	Humidity setpoint	Sets the humidity setpoint. See ***"9.10 TABLE OF ADJUSTMENT PARAMETERS" ON PAGE 49***
SP2	Humidity limit setpoint	Sets the humidity limit setpoint`. See ***"9.10 TABLE OF ADJUSTMENT PARAMETERS" ON PAGE 49***
SP3	Temperature setpoint	Sets the temperature setpoint (wellness application). See ***"9.10 TABLE OF ADJUSTMENT PARAMETERS" ON PAGE 49***

7.2.7 Maintenance menu

To access the maintenance menu:

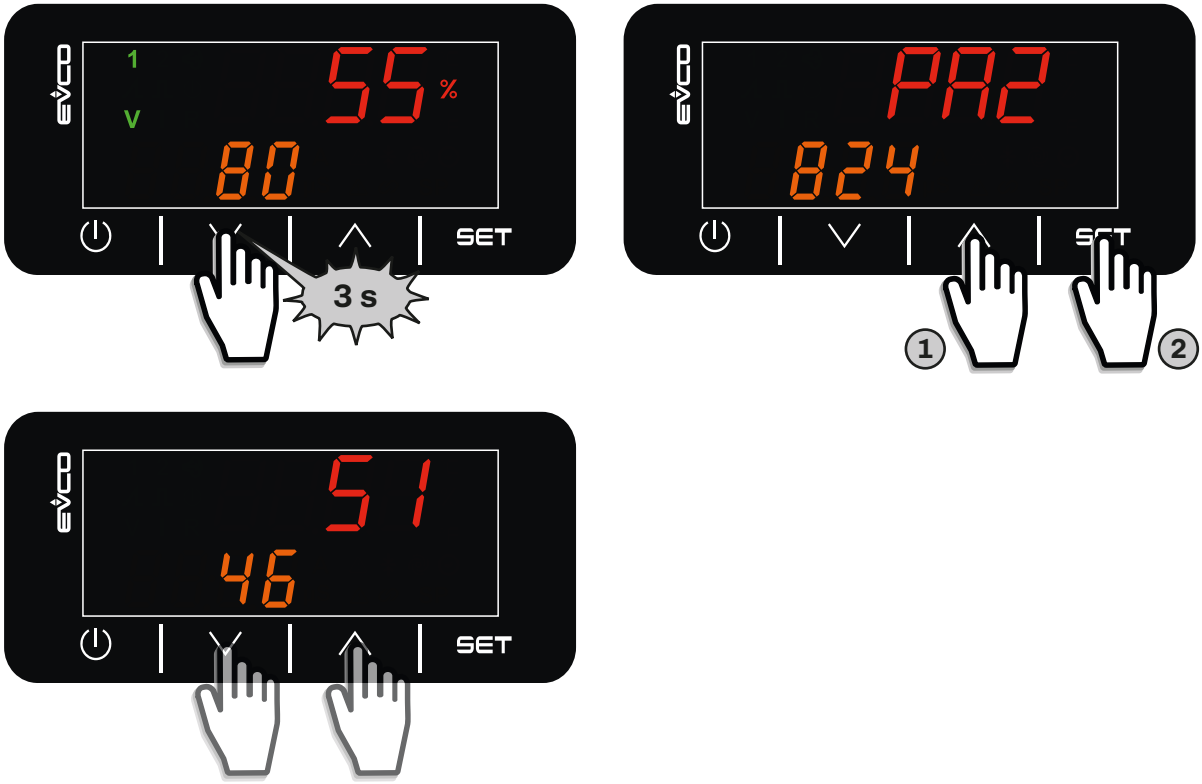


Fig. 46. *Maintenance menu*

The following is a table with the labels shown on the display and their description:

Top line	Bottom line	Description
SP1	Setpoint **SP1** value	Displays the value of setpoint **SP1**.
SP2	Setpoint **SP2** value	Displays the value of setpoint **SP2**.
SP3	Setpoint **SP3** value	Displays the value of setpoint **SP3**.
CFG	Set operating mode	Sets the operating mode See ***"9.10 TABLE OF ADJUSTMENT PARAMETERS" ON PAGE 49***
c0...c11	Parameter value	See ***"9.10 TABLE OF ADJUSTMENT PARAMETERS" ON PAGE 49***
S1	Sensor S1 value	Displays the value read by sensor S1 if it is connected.
S2	Sensor S2 value	Displays the value read by sensor S2 if it is connected.
S3	Sensor S3 value	Displays the value read by sensor S3 if it is connected.
tA	Sensor tA value	Displays the value read by sensor CT1 if it is connected.
CU	**CV** input status.	Displays the status of the **CV** digital input (fan enable) if it is connected. **OFF** = **CV** input closed; **On** = **CV** input open.
OI	**0/1** input status	Displays the status of the **0/1** digital input (remote ON/OFF) if it is connected. **OFF** = **0/1** input closed; **On** = **0/1** input open.
SO	**S0** input status	Displays the status of the **S0** digital input (remote humidistat enable) if it is connected. **OFF** = **S0** input closed; **On** = **S0** input open.
LS	**LS1** input status	Displays the status of the **LS1** digital input (level sensor) if it is connected. **OFF** = **LS1** input closed; **On** = **LS1** input open.
oEU	Inlet solenoid valve output status	Displays the status of the inlet solenoid valve. **OFF** = Inlet solenoid valve output OFF; **ON** = Inlet solenoid valve output ON.
oP	Outlet pump status	Displays the status of the outlet pump. **OFF** = Outlet pump output OFF; **ON** = Outlet pump output ON.

Top line	Bottom line	Description
oS	Steam generation contactor status	Displays the status of the steam generator contactor. **OFF** = Steam generator electrode output OFF; **ON** = Steam generator electrode output ON.
od	Dehumidification enable output status	Displays the status of the dehumidification enable output. **OFF** = Dehumidification enable output OFF; **ON** = Dehumidification enable output ON.
oF	Fan output status	Displays the status of the fan digital output. **OFF** = Fan output OFF; **ON** = Fan output ON.
oAL	General alarm output status	Displays the status of the general alarm output. **OFF** = General alarm output OFF; **ON** = General alarm ON.
HrS	Operating hours management page	Enters the page that displays the operating hours of the humidifier and its parts. To access the page: Double tap the SET key, enter password **PA2** using the FNC ∨ or ∧ keys, and tap SET to confirm.
MAnu	Output forcing page	Enters the output forcing page. To access the page: Double tap the SET key, enter password **PA2** using the FNC ∨ or ∧ keys, and tap SET to confirm.

7.2.8 Displaying/resetting the operating hours

The operating hours can be displayed and reset from the maintenance menu.

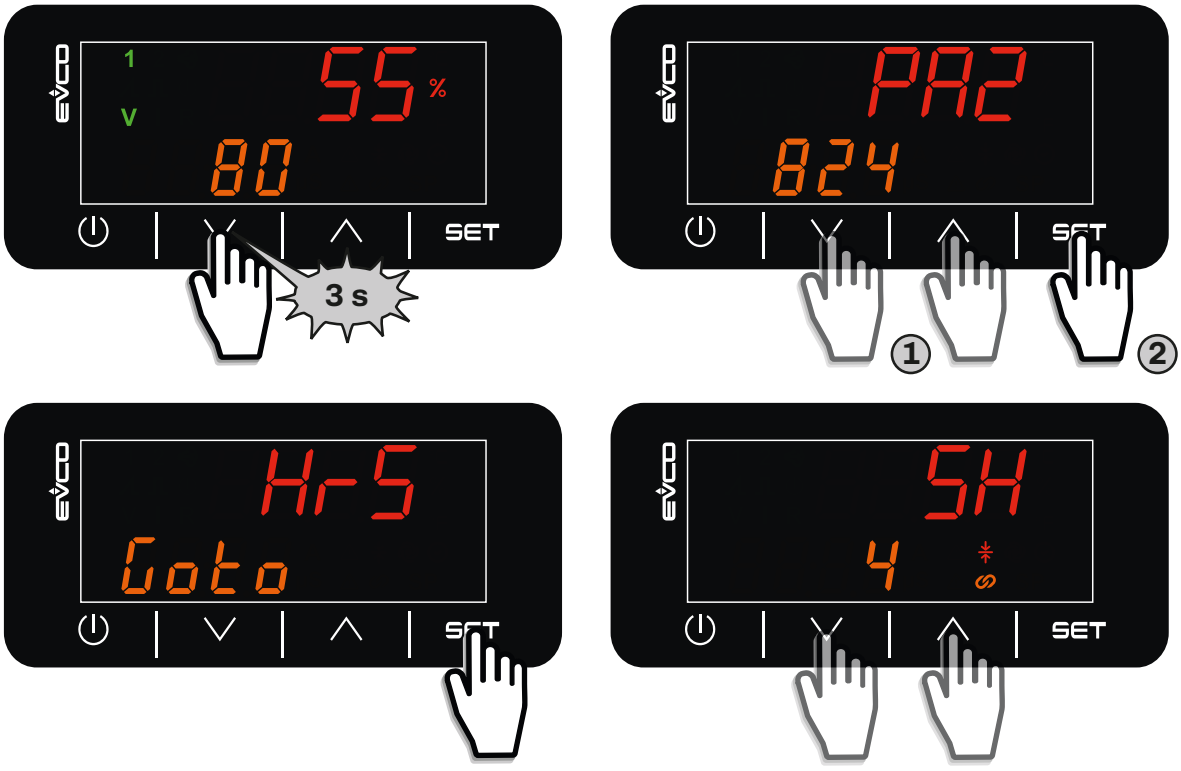


Fig. 47. *Displaying the operating hours*

The following is a table with the labels shown on the display and their description:

Top line	Bottom line	Description
SH	Humidifier hours	Displays the hours of humidifier operation.
PbH	Partial H.U. hours	Displays the partial hours of hydraulic unit operation.
tbH	Total H.U. hours	Displays the total hours of hydraulic unit operation.
EUH	Inlet SV hours	Displays the hours of outlet solenoid valve operation.
PH	Outlet pump hours	Displays the hours of outlet pump operation.
FH	Fan hours	Displays the hours of fan operation.

Resetting the operating hours

The operating hours can be reset by setting the parameters to 0.

7.2.9 Output functional test

The output functional test page can be accessed from the maintenance menu. Here the outputs can be forced on or off:

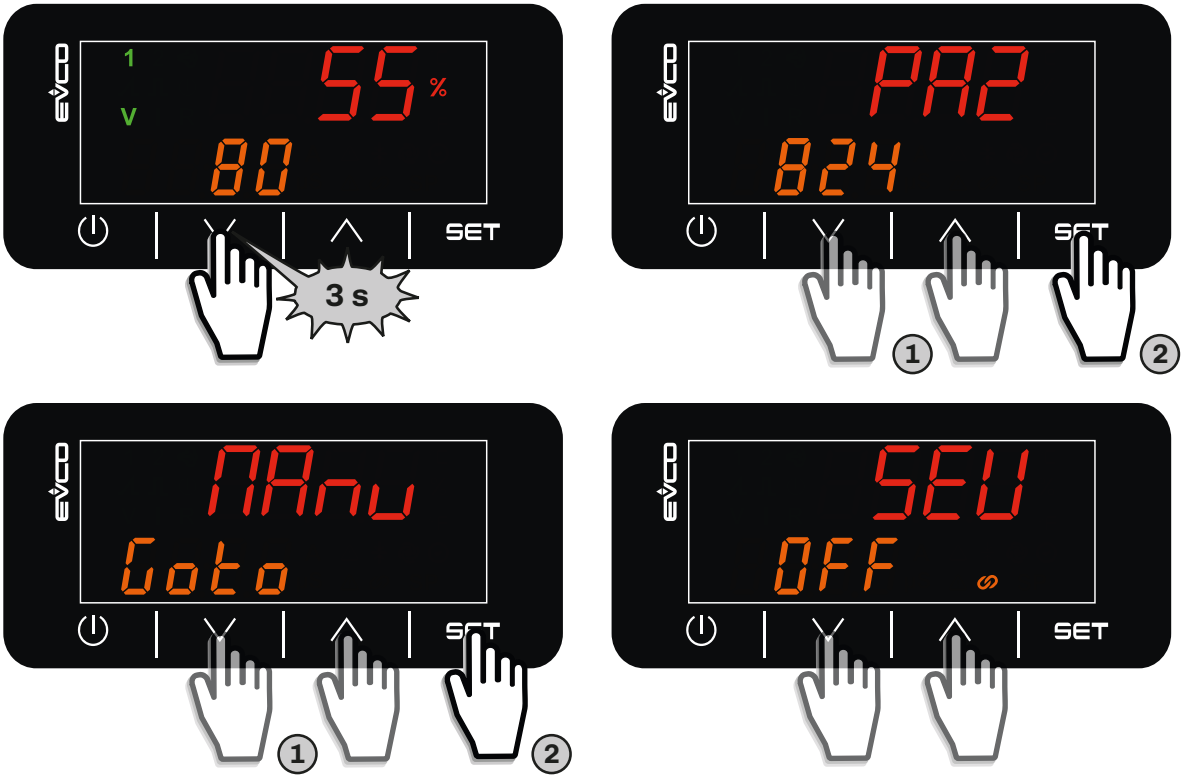


Fig. 48. Output functional test

The table below contains the labels shown on the display and their descriptions:

Top line	Bottom line	Description
SEU	Inlet SV output status	Forces the inlet solenoid valve output on/off. **OFF** = Inlet solenoid valve output forced OFF; **ON** = Inlet solenoid valve output forced ON.
SP	Outlet pump output status	Forces the outlet pump output on/off. **OFF** = Outlet pump output forced OFF; **ON** = Outlet pump output forced ON.
SS	Steam generation contactor status	Forces the steam generation contactor on/off. **OFF** = Steam generator electrode output forced OFF; **ON** = Steam generator electrode output forced ON.
Sd	Dehumidification enable output status	Forces the dehumidifier enable output on/off. **OFF** = Dehumidification enable output forced OFF; **ON** = Dehumidification enable output forced ON.
SF	Fan output status	Forces the fan output on/off. **OFF** = Fan output forced OFF; **ON** = Fan output forced ON.
SAL	General alarm output status	Forces the general alarm output on/off. **OFF** = General alarm output forced OFF; **ON** = General alarm output forced ON.

8. POWER-UP AND START-UP

8.1 First start-up instructions

⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Do not install the equipment while the power supply is connected.
- Cut off the power supply to all equipment, including any connected devices, and remove the power fuses before removing any covers or hatches, or before installing/uninstalling accessories, hardware, cables or wires.
- Always use a properly calibrated Voltmeter to make sure the system is powered off.
- Do not touch the unshielded components or the terminals while they are live.
- Make sure there is an effective earth connection; if there is not, earth the equipment.
- Before applying voltage to the equipment:
  - Make sure all protective elements, such as covers, hatches and grilles, are fitted and/or closed.
  - Check all wiring connections.

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

- Make sure the water mains is correctly connected.
- Make sure there are no traps in the drainage duct.
- Make sure the steam outlet closure clamps are properly tightened.
- Make sure there are no pockets of condensate or throttling in the steam delivery channel.

Make sure the humidifier and all the installed components are properly connected before start-up, in accordance with regulations, criteria and all applicable local, regional and national standards.

At the first start-up, the machine is disabled until the inlet water conductivity has been entered, after which the humidifier OFF screen will open automatically.

To start the humidifier (with humidistat connected or sensor connected if in proportional mode):

- Check the filling and drain network (see sections: ***"5.2 HYDRAULIC INSTALLATION" ON PAGE 21, "5.3 WATER DRAINAGE SYSTEM" ON PAGE 22*** and ***"5.4 STEAM DISTRIBUTION IN THE AHU" ON PAGE 23***);
- Let the water flow through the drain for a few hours before making the final connection;
- Fit the power fuses;
- Connect the humidistat or the probe in accordance with the required operation ***(SEE "6.3 ELECTRICAL CONNECTIONS" ON PAGE 28);***
- Check that the **CV** contact is closed, see ***"6.3 ELECTRICAL CONNECTIONS" ON PAGE 28;***
- Close the electric panel door;
- Activate the isolator installed outside the humidifier and open the water supply source;
- Press the ON/OFF key on the electric panel door to start the humidifier;
- Set the electrical conductivity of the incoming water (if you do not have the electrical conductivity value of the water, it can be obtained from the website of the drinking water supplier);
- Set the humidity setpoint **SP** to 100%;
- The humidifier starts a boiler loading cycle;
- Set the humidity setpoint **SP** to the value required for the application;
- The humidifier drains the water and replenishes it cyclically to perform the dilution procedure in order to keep the humidifier in a good operating condition. The humidifier cyclically carries out a full wash and then restarts with a lower frequency. Operation has been developed to ensure maximum energy efficiency and optimal water use.

8.2 Instructions for seasonal or long-term shut-down

If you need to switch off the humidifier for long periods of time, you must:

- Manually drain the product using the manual drainage launch procedure;
- When draining is complete, deactivate the isolator installed outside the humidifier and open the water supply source;
- Open the manual drain plug to complete draining the manifold and pump.

⚠ WARNING

BIOLOGICAL RISK

- In the event of poor maintenance/cleaning after the humidifier has been shut-down for a long time, microorganisms (including the bacteria that cause Legionellosis) may proliferate and be transferred into the air treatment system.
- The humidifier must be used properly and be maintained and cleaned properly at prescribed intervals, as described in the ***MAINTENANCE*** chapter.

8.3 Starting up after a seasonal or long-term shut-down

- It is advisable to clean the boiler before a seasonal start-up;
- Check the steam inlet and outlet lines (see sections: ***"5.2 HYDRAULIC INSTALLATION" ON PAGE 21, "5.3 WATER DRAINAGE SYSTEM" ON PAGE 22*** and ***"5.4 STEAM DISTRIBUTION IN THE AHU" ON PAGE 23***);
- Let the water flow through the drain for a few hours before making the final connection;
- Check the power fuses;
- Check the humidistat or sensor connections, depending on the required operation ***(SEE "6.3 ELECTRICAL CONNECTIONS" ON PAGE 28);***
- Check that the **CV** contact is closed, see ***"6.3 ELECTRICAL CONNECTIONS" ON PAGE 28;***
- Close the electric panel door;
- Activate the isolator installed outside the humidifier and open the water supply source;
- Press the ON/OFF key on the electric panel door to start the humidifier;
- Set the electrical conductivity of the incoming water (if you do not have the electrical conductivity value of the water, it can be obtained from the website of the drinking water supplier);
- Set the humidity setpoint **SP** to 100%;
- The humidifier starts a boiler loading cycle;
- Set the humidity setpoint **SP** to the value required for the application;
- The humidifier drains the water and replenishes it cyclically to perform the dilution procedure in order to keep the humidifier in a good operating condition. The humidifier cyclically carries out a full wash and then restarts with a lower frequency. Operation has been developed to ensure maximum energy efficiency and optimal water use.

9. OPERATION

9.1 Principle of operation

The **VEH** series is the ELSTEAM immersed electrode humidifier solution dedicated to installations within air handling units (AHUs). **VEH** series humidifiers generate humidity (steam) by means of a current passing between 4 or 7 electrodes immersed in drinking water to bring it to boiling point.
The steam is controlled by adjusting the current strength transferred to the water via the immersed electrodes. When there is a humidity request, the inlet solenoid valve lets water into the hydraulic unit until the required production is reached, at which point the solenoid valve is closed. When the steam production is below the required level, the inlet solenoid valve is activated again until the optimal working condition is reached.

9.2 Humidity regulation

The humidity can be regulated in 6 ways, depending on how the **CFG** parameter is set:

- ON-OFF regulation (**CFG** = 0-1);
- Proportional regulation (**CFG** = PROP);
- Regulation with the humidity sensor (**CFG** = HUM);
- Regulation with the humidity sensor and limit sensor (**CFG** = HUML);
- Regulation with a temperature probe (wellness applications) (**CFG** = 1T);
- Regulation with two temperature probes (wellness applications) (**CFG** = 2T)

9.2.1 ON-OFF regulation | CFG = 0-1

To use the **VEH** with ON-OFF regulation, the following conditions must be met:

- **CFG** = 0-1;
- Enable digital input closed (**CV**);
- Remote ON/OFF digital input closed (**0/1**).

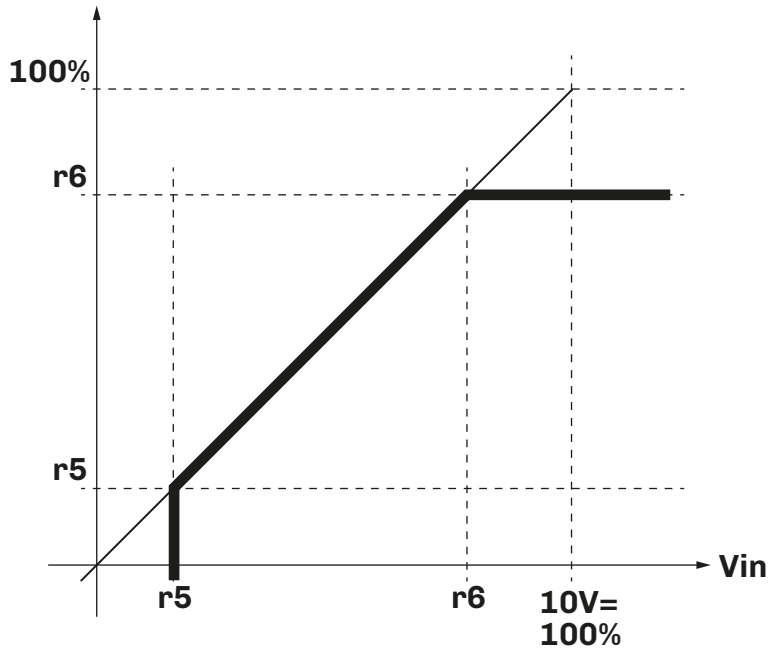
When the **S0** digital input is closed, the **VEH** generates humidity at the maximum value set in parameter **r6**.

9.2.2 Proportional regulation | CFG = PROP

To use the **VEH** with proportional regulation, the following conditions must be met:

- **CFG** = PROP;
- Set the minimum humidity production **r5**;
- Set the maximum humidity production **r6**;
- Enable digital input closed (**CV**);
- Remote ON/OFF digital input closed (**0/1**).

The humidity production varies with the value read at the **S1** analogue input, with the logic expressed in the graph below, without exceeding parameter **r6**:



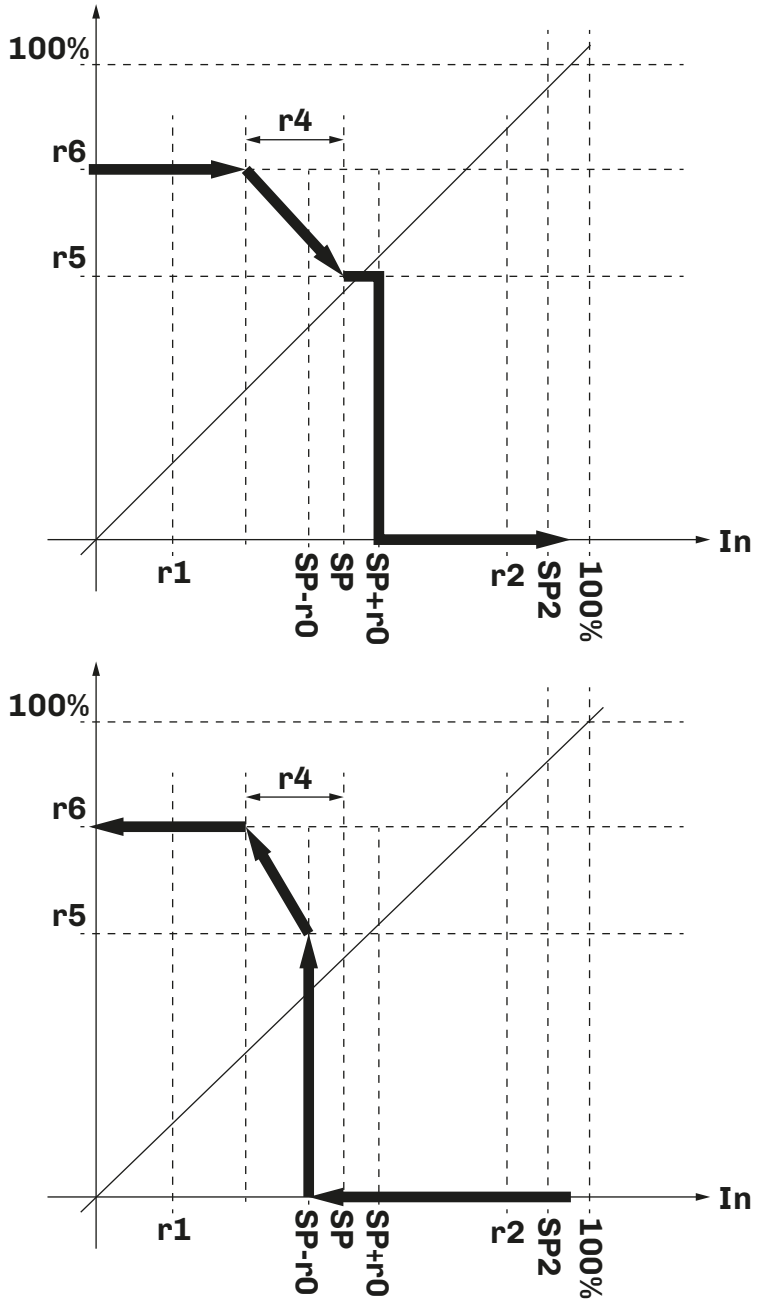
KEY	
Line	**Description**
——	V_{in}
▬	Production

Fig. 49. *How proportional regulation works | **CFG** = PROP*

9.2.3 Regulation with the humidity sensor | CFG = HUM

To use the **VEH** with regulation with a humidity sensor, the following conditions must be met:

- **CFG** = HUM or **CFG** = HUML;
- Set parameter **P2** according to the sensor type to be used;
- Set the minimum humidity production **r5**;
- Set the maximum humidity production **r6**;
- Enable digital input closed (**CV**);
- Remote ON/OFF digital input closed (**0/1**).



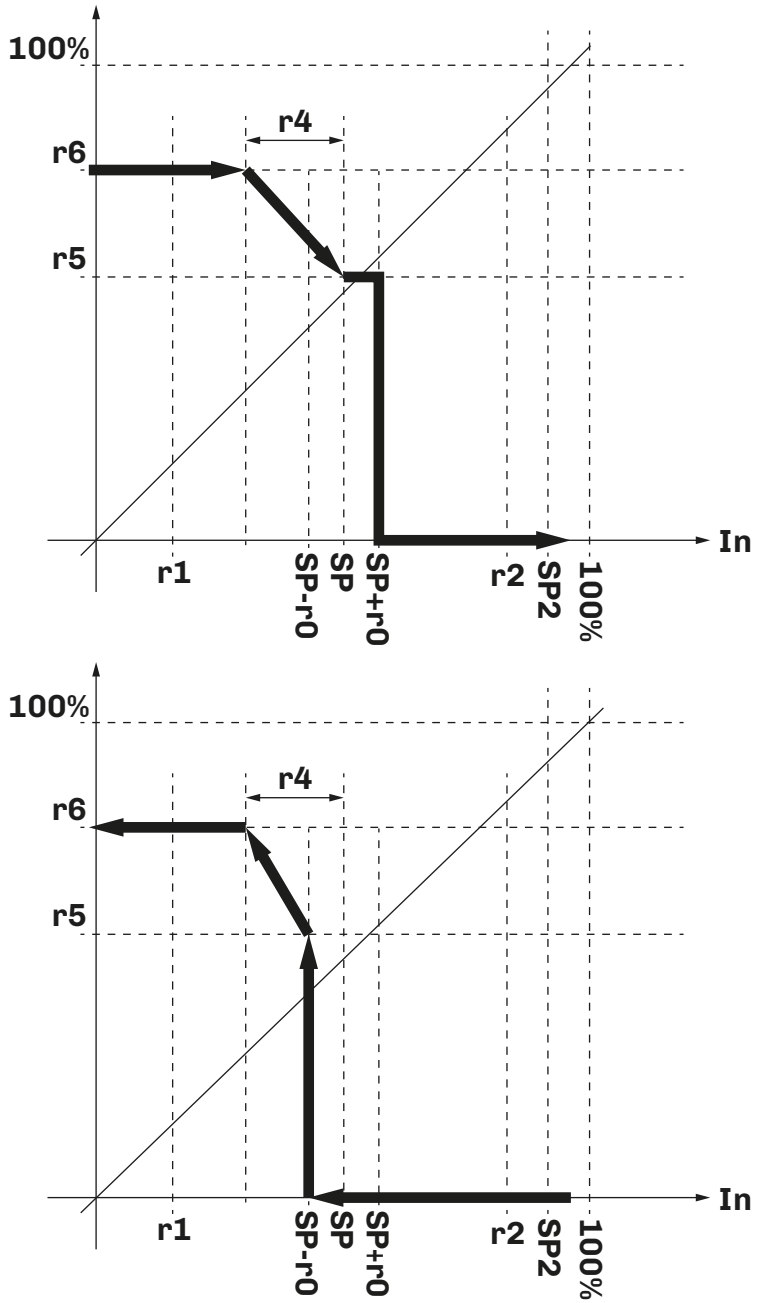
KEY	
Line	**Description**
——	V_{in}
▬	Production

Fig. 50. *How regulation with the humidity sensor works | **CFG** = HUM*

9.2.4 Regulation with the humidity sensor + limit sensor | CFG = HUML

To use the **VEH** with regulation with a humidity sensor and limit sensor, the following conditions must be met:

- **CFG** = HUML;
- Set parameter **P2** according to the sensor type to be used;
- Set parameter **P7** according to the limit sensor type to be used;
- Set the minimum humidity production **r5**;
- Set the maximum humidity production **r6**;
- Enable digital input closed (**CV**);
- Remote ON/OFF digital input closed (**0/1**).



KEY	
Line	**Description**
——	V_{in}
▬	Production

Fig. 51. *How regulation with the humidity sensor + limit sensor works | **CFG** = HUML*

The humidity production behaves in the same way as for regulation with the humidity sensor (**CFG** = HUM), but the second sensor connected to the **S2** analogue input stops steam generation according to the humidity delivery.

The humidity limit activates when the humidity measured by sensor **S2** exceeds **SP2 + r10**.

9.2.5 Regulation with a temperature probe | CFG = 1T

To use the **VEH** with regulation with a temperature sensor, the following conditions must be met:

- **CFG** = 1T;
- Set parameter **P0** according to the sensor type to be used
- Set the minimum humidity production **r5**;
- Set the maximum humidity production **r6**;
- Enable digital input closed (**CV**);
- Remote ON/OFF digital input closed (**0/1**).

Principle of operation

The humidity requirement is managed with a proportional temperature adjustment between SP3 and the proportional band r20, according to the following logic:

- Temperature ≥ **SP3**: 0% humidity required;
- Temperature ≤ **SP3** - **r20**: humidity requirement at **r6**;
- **SP3** < Temperature < **r20**: proportionally linearized humidity required (minimum production **r5**).

9.2.6 Regulation with two temperature probes | CFG = 2T

To use the **VEH** with regulation with two temperature sensors, the following conditions must be met:

- **CFG** = 2T;
- Set parameter **P0** according to the sensor type to be used
- Set the minimum humidity production **r5**;
- Set the maximum humidity production **r6**;
- Set parameter **r23**;
- Set parameter **r24**;
- Enable digital input closed (**CV**);
- Remote ON/OFF digital input closed (**0/1**).

9.3 Water dilution

Water dilution in the hydraulic unit is controlled in two ways, depending on how parameter **c3** is set:

Par.	Description	MU	Range
c3	Type of draining for dilution. **0** = Current-based; **1** = Time-based.	---	0/1

NOTE: The electrodes are off while draining the water. Draining is activated 3 seconds after turning the electrodes off.

9.3.1 Current-based water dilution

Setting **c3** = 0 configures the water dilution based on the measured currents.

The evaporation cycle and water filling times to reach the required production are monitored during operation.

The electrical conductivity of the water tends to rise while producing humidity because it concentrates the substances in the water, and consequently the times mentioned above tend to reduce; during this stage, the **VEH** activates the outlet pump until the internal current drops below the threshold set in parameter **c6**.

NOTE: The electrodes are off during draining to ensure safety.

The configuration parameters for current-based water dilution are:

Par.	Description	MU	Range
c6	Draining value for dilution (if **C3** = 0).	%	20...80

9.3.2 Time-based water dilution

Setting **c3** = 1 configures time-based water dilution to ensure that the water is diluted periodically without waiting for the internal conditions to become critical.

The **VEH** dilutes the water after time **c5** for a duration of **c4**.

The configuration parameters for time-based water dilution are:

Par.	Description	MU	Range
c4	Draining duration for dilution (if **C3** = 1).	s	0...9999
c5	Time between two dilution draining events (if **C3** = 1).	min	30...999

9.4 Hydraulic unit draining

When the electrical conductivity of the water becomes too high, the hydraulic unit must be drained completely to restore optimal operating conditions.

The evaporation cycle and water filling times to reach the required production are monitored during operation.

Once it has been completely drained, it is washed a second time if the **VEH** detects that the unfavourable conditions persist; if the second washing fails to create optimal operating conditions, alarm **AL08** is generated and the humidifier is forced OFF until maintenance is carried out (see ***"12.1 TABLE OF VEH ALARMS" ON PAGE 60***).

9.5 Complete hydraulic unit emptying

The **VEH** hydraulic unit must be emptied completely in the following cases:

- After the inactivity time set in parameter **c0**;
- After the activity time set in parameter **c1**;
- If the timer is not working, when the humidifier is powered up;
- Whenever electrical power is supplied;
- When manual draining is activated from the user menu.

The configuration parameters for the cleaning cycles are:

Par.	Description	MU	Range
c0	Number of consecutive days of inactivity after which the hydraulic unit is emptied. **0** = Function disabled.	days	0...10
c1	Number of consecutive days of activity after which the hydraulic unit is emptied. **0** = Function disabled.	days	0...100

9.6 Level sensor

When the humidifier is running, the water may exceed the level sensor at the top of the hydraulic unit. This is caused by low electrical conductivity of the water in the boiler. The **VEH** activates the outlet pump to drain it partially and resumes the evaporation cycles to achieve optimum electrical conductivity.

9.7 Foam management

Foaming may occur while the water is boiling in the hydraulic unit. Foaming is generally due to surfactants (manufacturing residues in the water filling system, water treatment agents, softeners) or an excessive concentration of dissolved salts in the water.

If **c11** = 1, the **VEH** indicates and manages this condition.

If there is no foam in the boiler, the **VEH** resumes normal operation.

If the level sensor is reached again within time **c12**, there is foam in the boiler. The **VEH** empties the boiler completely. Thereafter, if the following occurs within time **c12**:

- The level sensor is reached again, and the **VEH** performs two complete washing cycles;
- If the level sensor is not reached, the **VEH** resumes normal operation.

If there is foam, the **VEH** displays the code **W05** (see ***"12.1 TABLE OF VEH ALARMS" ON PAGE 60***).

9.8 Operating hours

The **VEH** records the hours of humidifier operation to allow periodic maintenance. The following times are monitored:

- Total hours of machine operating; this cannot be reset and shows the hours of humidifier operation;
- Partial hours of hydraulic unit operation; this can be reset after maintenance on the tank;
- Total hours of hydraulic unit operation; this can be reset after replacing the tank;
- Operating hours of the inlet solenoid valve; this can be reset after replacing the component;
- Operating hours of the inlet pump; this can be reset after replacing the component.

The configuration parameters for the maintenance warning thresholds are:

Par.	Description	MU	Range
M10	Operating hours threshold for unit maintenance warning.	hx10	100....1000
M11	Partial operating hours threshold for the hydraulic unit maintenance warning.	hx10	100....1000
M12	Total operating hours threshold for the hydraulic unit maintenance warning.	hx10	100....1000
M13	Operating hours threshold for valve maintenance warning.	hx10	100....1000
M14	Operating hours threshold for the outlet pump maintenance warning.	hx10	100....1000

9.8.1 Resetting the operating hours

The operating hours can be reset from the maintenance menu by setting the parameters to 0.

9.9 Overproduction

When the humidity production exceeds 30% of the steam demand, draining is performed to return the steam production to the required value.

10. CONFIGURATION PARAMETERS

Description of columns in the Table of Parameters

- **Par.**: List of configurable device parameters;
- **Description**: Indicates parameter operation and any possible selections;
- **MU**: Measurement unit relating to the parameter;
- **Range**: Describes the interval of values that the parameter can assume. This can be correlated with other instrument parameters (indicated with the parameter code).
  ***NOTE**: if the actual value is outside the permitted limits for that parameter (for example, because other parameters defining the aforementioned limits have been altered), the value of the violated limit is displayed instead of the actual value;*
- **Default**: Indicates the pre-set factory configuration;
- **PW**: Indicates the access level for the parameter:
  - **U** = User parameters;
  - **M** = Maintenance parameters.

9.10 Table of adjustment parameters

Par.	Description	MU	Range	Default	PW
	SETPOINT group				
SP1	Humidity setpoint.	%	**r1...r2**	70.0	U
SP2	Humidity limit setpoint.	%	**r11...r12**	85.0	U
SP3	Wellness temperature setpoint.	°C/°F	**r21...r22**	40.0	U
	CONFIGURATION group				
CFG	Operating mode (see ***"9.2 HUMIDITY REGULATION" ON PAGE 43***) **0-1** (0) = ON/OFF from digital input; **PROP** (1) = Proportional input; **HUM** (2) = Humidity sensor; **HUML** (3) = Humidity sensor + limit sensor; **1T** (4) = 1 temperature sensor; **2T** (5) = 2 temperature sensors.	---	0-1 / PROP / HUM / HUML / 1T / 2T	0-1	M
P0	Type of sensor **S1** temperature of pre-heating + anti-freeze. **---** (0) = Disabled; **PTC** (1) = PTC; **NTC** (2) = NTC.	---	--- / PTC / NTC	---	M
P1	Electrical conductivity of the water.	µS/cm	0...1250	0	M
P2	Type of regulator/sensor/probe **S2** (regulation input). **PTC** (0) = PTC probe; **1000** (1) = Pt1000 probe; **NTC** (2) = NTC probe; **0-10** (3) = Proportional input 0...10 V; **0-5** (4) = Proportional input 0...5 V; **0.20** (5) = Input 0...20 mA; **4.20** (6) = Input 4...20 mA; **E520** (7) = EVHTP520 proprietary probe.	---	PTC /1 000 / NTC / 0-10 / 0-5 / 0.20 / 4.20 / E520	0-10	M
P3	Minimum value **S2** (if **CFG** = HUM or **CFG** = HUML).	%rH	0...100	0	M
P4	Maximum value **S2** (if **CFG** = HUM or **CFG** = HUML).	%rH	0...100	100	M
P5	Sensor offset **S2** (if **CFG** = HUM or **CFG** = HUML).	%rH	-10...10	0	M
P6	**S1** sensor offset (temperature).	°C/°F	-10.0...10.0	0.0	M
P7	Type of sensor/probe **S3** (limit or mediating probe with input **P2** if temperature). Similar to **P2**.	---	PTC /1 000 / NTC / 0-10 / 0-5 / 0.20 / 4.20 / E520	0-10	M
P8	Minimum value **S3** (if **CFG** = HUML).	%rH	0...100	0	M
P9	Maximum value **S3** (if **CFG** = HUML).	%rH	0...100	100	M
P10	Sensor offset **S3** humidity (if **CFG** = HUML).	%rH	-10...10	0	M
P11	TA sensor K (1000 = current multiplier of 1.000).	---	0...2000	1000	M
P12	Ventilation presence (enables maintenance management based on utility operating hours). **No** = No ventilation; **Yes** = Ventilation present.	---	No/Yes	Yes	M
P13	Sensor offset **S2** temperature (if **CFG** = 1T or **CFG** = 2T).	°C/°F	-10.0...10.0	0.0	M

Par.	Description	MU	Range	Default	PW
P14	Sensor offset **S3** temperature (if **CFG** = 1T or **CFG** = 2T).	°C/°F	-10.0...10.0	0.0	M
P20	Electrical conductivity of the water at 100°C (212 °F). **0** = 3000 µS/cm; **1** = 4000 µS/cm; **2** = 5000 µS/cm.	---	0...2	1	M
P21	Temperature unit of measure (changing value means that the temperature parameter limits will need to be reset manually). **0** = °C; **1** = °F.	---	0/1	0	M
P22	Steam production unit of measurement. **0** = kg/h; **1** = lb/h.	---	0/1	0	M
	REGULATION group				
r0	Humidity probe setpoint hysteresis.	%	0...20	2	M
r1	Minimum value for setting humidity setpoint.	%	0...**r2**	20	M
r2	Maximum value for setting humidity setpoint.	%	**r1**...100	95	M
r4	Humidity proportional band.	%	0...50	50	M
r5	Minimum production.	%	20...**r6**	20	M
r6	Maximum production.	%	**r5**...100	75	U
r10	Humidity limit probe setpoint hysteresis.	%	0...20	2	M
r11	Minimum value for setting humidity limit setpoint.	%	0...r12	20	M
r12	Maximum limit setpoint value.	%	**r11**...100	95	M
r20	Temperature proportional band.	°C/°F	0.1... 10.0	5.0	M
r21	Minimum value for setting temperature setpoint.	°C/°F	10.0...**r22**	20.0	M
r22	Maximum value for setting temperature setpoint.	°C/°F	**r21**...60.0	50.0	M
r23	Wellness temperature probe 1 weight.	%	0...100	50	M
r24	Wellness temperature probe 2 weight.	%	0...100	50	M
c0	Number of consecutive days of inactivity after which the hydraulic unit is emptied. **0** = Function disabled.	days	0...10	2	M
c1	Number of consecutive days of activity after which the hydraulic unit is emptied. **0** = Function disabled.	days	0...100	14	M
c3	Type of draining for dilution. **0** = Current-based; **1** = Time-based.	---	0/1	0	M
c4	Draining duration for dilution (if **c3** = 1).	s	0...9999	5	M
c5	Time between two dilution draining events (if **c3** = 1).	m	30...999	60	M
c6	Percentage draining for dilution (if **c3** = 0).	%	20...80	30	M
c10	Maximum initial water filling time for water inlet check.	s	50...2000	1200	M
c11	Anti-foam process. **0** = Disabled; **1** = Enabled.	---	0/1	0	M
c14	Time to drain the boiler completely. **(*)** Default according to model, from: **3 kg/h** = 30 s; **5..15 kg/h** = 40 s; **20...100 kg/h** = 180 s.	s	0...240	**(*)**	M
c16	Low conductivity algorithm enable. **0** = Disabled; **1** = Enabled.	---	0/1	0	M
	MAINTENANCE/ALARMS group				
M5	Low humidity alarm threshold. The hysteresis is fixed at 2%. **0** = Disabled.	%	0...100	20	M
M6	High humidity alarm threshold. The hysteresis is fixed at 2%. **0** = Disabled.	%	0...100	95	M
M7	High/low humidity alarm delay. **0** = Disabled.	s	0...999	120	M
M8	Delay in alarm for no production	hours	1...100	48	M
M9	Maximum number of automatic attempts to rearm alarm **AL03** “No water” after which the alarm blocks manual rearming.	num	1...10	3	M
M10	Operating hours threshold for unit maintenance warning.	hx10	100....10000	4000	M
M11	Partial operating hours threshold for the hydraulic unit maintenance warning.	hx10	100....2000	200	M
M12	Total operating hours threshold for the hydraulic unit maintenance warning.	hx10	100....2000	1000	M
M13	Operating hours threshold for valve maintenance warning.	hx10	100....2000	1000	M
M14	Operating hours threshold for pump maintenance warning.	hx10	100....2000	1000	M
M15	Operating hours threshold for fan maintenance warning.	hx10	100....2000	1000	M

Par.	Description	MU	Range	Default	PW
M20	High temperature alarm threshold. The hysteresis is fixed at 0.5 °C; **0** = Excluded.	°C/°F	0.0...80.0	50.0	M
M21	Maximum number of automatic attempts to rearm the high temperature alarm after which the alarm blocks manual rearming (attempts every hour)	num	1...10	3	M
	COMMUNICATION group				
LA1	Modbus communication protocol address.	num	1...247	247	M
Lb1	Modbus transmission speed (baud rate). **0** = 2400; **1** = 4800; **2** = 9600; **3** = 19200; **4** = 38400.	---	0...4	4	E
LP1	Modbus parity bit. **0** = None; **1** = Odd; **2** = Even.	---	0...2	2	E
LS1	Modbus stop bit. **0** = 1 stop bit; **1** = 2 stop bits.	---	0/1	0	E
	PASSWORD group				
PA1	First level password. **0** = No password	---	-99...999	0	U
PA2	Second level password.	---	-99...999	824	M

11. MODBUS RTU FUNCTIONS AND RESOURCES

11.1 Introduction

Modbus RTU (Remote Terminal Unit) protocol is a means of communication which allows data exchange between a computer and programmable logic controllers.

This protocol is based on the exchange of messages between master-slave and client-server devices. Master devices can receive information from slaves and write to their registers, while slave devices cannot initiate any information transfer until they receive a request from the slave device.

Modbus communication is used in industrial automation systems (IAS) and in the construction of building management systems (BMS). Modbus protocol is widely utilised due to the fact it is easy to use, very reliable and has an open source code that can be used royalty-free on any application or device.

Modbus RTU is the most common application and uses CRC error detection and binary encoding.

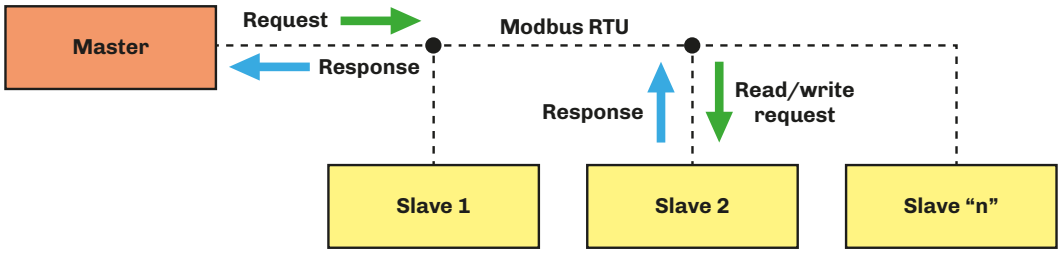


Fig. 52. *Diagram showing message exchange in a Modbus communication*

Modbus protocol establishes a Protocol Data Unit (PDU) independent from the communication layer below it, introducing some additional fields specified on the Application Data Unit (ADU) (***"FIG. 53. FRAMING OF A MESSAGE USING MODBUS PROTOCOL" ON PAGE 52***) to specific buses and networks.

Devices such as PLCs (Programmable Logic Controller), HMIs (Human Machine Interface), control panels, drivers, motion controllers, I/O devices, etc. can use Modbus to begin a remote procedure, and the protocol is often used to connect a supervising computer with a Remote Terminal Unit in a supervision, control and data acquisition (SCADA) system.

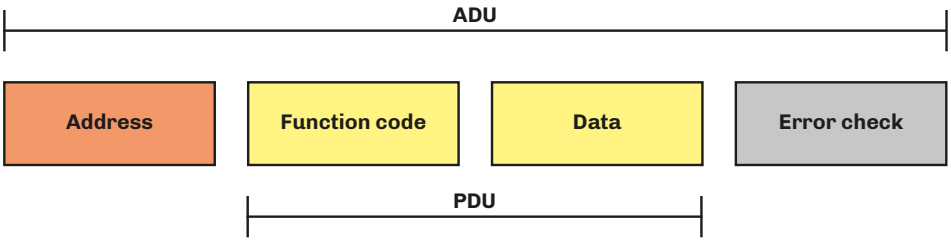


Fig. 53. *Framing of a message using Modbus protocol*

For further information relating to Modbus protocol, visit the official Modbus website: www.modbus.org.

11.2 Modbus message structure

Modbus RTU protocol requires the message to start with a silent time interval of at least 3.5 character times. This feature is often implemented by executing a time interval of multiple of character times at the baud rate used in the network. The characters available for each field are in binary form.

A description of the structure of a Modbus RTU message is provided below.

Start	Address	Function	Data	CRC	Stop
3.5 x character time	8 bit	8 bit	(N x 8 bit)	16 bit	3.5 x character time
Time period in which data must not be exchanged over the communication bus, to allow the connected instruments to recognise the end of one message and the start of the next	Corresponds to the address for the device with which the master has established dialogue; this is a value between 1...247. The address 0 is reserved for the broadcast message sent to all slave devices	Code for the function to execute or which has been executed	Contains the data sent by the master or sent back by the slave as a response to a question	Allows the master and the slave to check whether any errors are present during communication, and if there are, to ignore the message received	Time period in which data must not be exchanged over the communication bus, to allow the connected instruments to recognise the end of one message and the start of the next

11.3 Modbus functions and registers

The Modbus registers for the device are organised around the four types of basic data reference indicated above, and this type of data is further identified by the first number of the address.

11.3.1 Available Modbus commands and data areas

The commands implemented are as follows:

Command	Description
03 (hex 0x03)	Resource reading command
06 (hex 0x06)	Resource writing command

11.4 Address configuration

The RS-485 communication serial port can be used to configure the device, the parameters, the statuses and the Modbus variables and to monitor device operation using Modbus protocol.

The device address in a Modbus message is set by parameter **LA1**.

The address **0** is only used for broadcast messages, recognised by all slaves. Slave devices do not respond to a broadcast message.

Serial line configuration parameters, which can be accessed via the user interface menu, are:

Par.	Description	MU	Range	Default
LA1	Modbus communication protocol address.	---	0...247	247
Lb1	Modbus transmission speed (baud rate). **0** = 2400; **1** = 4800; **2** = 9600; **3** = 19200; **4** = 38400.	---	0...4	4
LP1	Modbus parity bit. **0** = None; **1** = Odd; **2** = Even.	---	0...2	2
LS1	Modbus stop bit. **0** = 1 stop bit; **1** = 2 stop bits.	---	0/1	0

The RS-485 RTU serial line has the following characteristics:

- RTU mode;
- Bit: 8 bit.

11.5 Connections

For the entire system to work properly, including the RS-485 RTU serial line, observe the instructions provided in chapter ***"6. ELECTRICAL CONNECTIONS" ON PAGE 24***.

In particular, take care to make the connections correctly, observing the instructions in section ***"6.3 ELECTRICAL CONNECTIONS" ON PAGE 28.***

11.6 Modbus table content

Table content description

The table below contains the information required to access the resources properly and directly.
There are two tables:

- The Modbus address table, which contains all the configuration parameters for the device and the corresponding Modbus addresses;
- Modbus resource table, which contains all the status (I/O) and alarm resources in the device memory.

Description of columns in the Table of addresses

- **Par.**: List of configurable device parameters;
- **Description**: Indicates parameter operation and any possible selections;
- **MU**: Measurement unit relating to the parameter;
- **Range**: Describes the interval of values that the parameter can assume. This can be correlated with other instrument parameters (indicated with the parameter code).
  NOTE: *if the actual value is outside the permitted limits for that parameter (for example, because other parameters defining the aforementioned limits have been altered), the value of the violated limit is displayed instead of the actual value;*
- **Val. Adr.**: Indicates the address of the Modbus register containing the resource you want to access;
- **R/W:** Indicates the option of reading or writing the resource:
  - **R**: The resource is read-only;
  - **W**: The resource is write-only;
  - **R/W**: The resource can be both read and written.
- **CPL**: When the fields indicates Y, the value read by the register needs to be converted because the value represents a number with a sign. In the other cases the value is always positive or zero.
- **DATA SIZE**: Indicates the size in data bits:
  - **DWORD** = 32 bit
  - **DOUBLE** = 32 bit with sign
  - **SHORT** = 16 bit with sign
  - **WORD** = 16 bit
  - **Byte** = 8 bit
  - The "**n**" bits = 0...15 bit depending on the value of "n"

11.7 Modbus addresses

11.7.1 Modbus address table

Par.	Description	Val. Adr.	R/W	DATA SIZE	CPL	MU	Range
	SETPOINT group						
SP1	Humidity setpoint.	2001	R/W	SHORT	Y	%	**r1...r2**
SP2	Humidity limit setpoint.	2002	R/W	SHORT	Y	%	**r11...r12**
SP3	Temperature probe setpoint.	2086	R/W	SHORT	Y	°C/°F	**r21...r22**
	CONFIGURATION group						
CFG	Control input selection. **0-1** (0) = ON/OFF from digital input; **PROP** (1) = Proportional input; **HUM** (2) = Humidity sensor; **HUML** (3) = Humidity sensor + limit sensor; **1T** (4) = 1 temperature sensor; **2T** (5) = 2 temperature sensors.	2003	R/W	BYTES	---	---	0...5
P0	S1 sensor type (temperature). **---** (0) = Disabled; **PTC** (1) = PTC; **NTC** (2) = NTC.	2076	R/W	3 BIT	---	---	0...2
P1	Electrical conductivity of the water.	2006	R/W	WORD	---	µS/cm	0...1250
P2	**S2** sensor type (humidity 1 / proportional input). **PTC** (0) = PTC probe; **1000** (1) = Pt1000 probe; **NTC** (2) = NTC probe; **0-10** (3) = Proportional input 0...10 V; **0-5** (4) = Proportional input 0...5 V; **0.20** (5) = Input 0...20 mA; **4.20** (6) = Input 4...20 mA; **E520** (7) = EVHTP520 proprietary probe.	2007	R/W	BYTES	---	---	0...7
P3	Minimum value **S2** (if **CFG** = HUM or **CFG** = HUML).	2008	R/W	BYTES	---	%rH	0...100
P4	Maximum value **S2** (if **CFG** = HUM or **CFG** = HUML).	2009	R/W	BYTES	---	%rH	0...100
P5	Sensor offset **S2** (if **CFG** = HUM or **CFG** = HUML).	2010	R/W	BYTES	Y	%rH	-10...10
P6	**S1** sensor offset (temperature).	2011	R/W	SHORT	Y	°C/°F	-10.0...10.0
P7	**S3** sensor type (humidity 2 limit). Similar to **P2**.	2012	R/W	BYTES	---	---	0...7
P8	Minimum value **S3** (if **CFG** = HUML).	2013	R/W	BYTES	---	%rH	0...100
P9	Maximum value **S3** (if **CFG** = HUML).	2014	R/W	BYTES	---	%rH	0...100
P10	Sensor offset **S3** (if **CFG** = HUML).	2015	R/W	SHORT	Y	%rH	-10...10
P12	Ventilation presence (enables maintenance management based on utility operating hours).	2077	R/W	1 BIT	---	---	0/1
P13	Sensor offset **S2** temperature (if **CFG** = 1T or **CFG** = 2T).	2078	R/W	SHORT	Y	°C/°F	-10.0...10.0
P14	Sensor offset **S3** temperature (if **CFG** = 1T or **CFG** = 2T).	2079	R/W	SHORT	Y	°C/°F	-10.0...10.0
P20	Electrical conductivity of the water at 100°C (212°F). **0** = 3000 µS/cm; **1** = 4000 µS/cm; **2** = 5000 µS/cm.	2016	R/W	3 BIT	---	---	0...2
P21	Temperature unit of measure (changing value means that the temperature parameter limits will need to be reset manually). **0** = °C; **1** = °F.	2017	R/W	1 BIT	---	---	0/1
P22	Steam production unit of measurement. **0** = kg/h; **1** = lb/h.	2080	R/W	1 BIT	---	---	0/1
	REGULATION group						
r0	Sensor 1 setpoint hysteresis.	2018	R/W	BYTES	---	%	0...20
r1	Minimum setpoint value.	2019	R/W	BYTES	---	%	0...**r2**
r2	Maximum setpoint value.	2020	R/W	BYTES	---	%	**r1**...100
r4	Proportional band.	2021	R/W	BYTES	---	%	0...50
r5	Minimum production.	1927	R/W	BYTES	---	%	0...**r6**
r6	Maximum production.	1926	R/W	BYTES	---	%	**r5**...100

Par.	Description	Val. Adr.	R/W	DATA SIZE	CPL	MU	Range
r10	Limit sensor setpoint hysteresis.	2024	R/W	BYTES	---	%	0...20
r11	Minimum limit setpoint value.	2025	R/W	BYTES	---	%	0...r12
r12	Maximum limit setpoint value.	2026	R/W	BYTES	---	%	**r11**...100
c0	Number of continuous days of inactivity after which the boiler is emptied. **0** = Function disabled.	2027	R/W	BYTES	---	days	0...10
c1	Number of continuous days of activity after which the boiler is emptied. **0** = Function disabled.	2028	R/W	BYTES	---	days	0...100
c2	Number of cleaning cycles (filling+draining) following emptying due to activity or inactivity.	2029	R/W	BYTES	---	num	0...10
c3	Type of draining for dilution. **0** = Current-based; **1** = Time-based.	2030	R/W	1 BIT	---	---	0/1
c4	Draining duration for dilution (if **C3** = 1).	2031	R/W	WORD	---	s	0...9999
c5	Time between two dilution draining events (if **C3** = 1).	2032	R/W	WORD	---	min	30...999
c6	Draining value for dilution (if **C3** = 0).	2033	R/W	BYTES	---	%	20...80
c10	Maximum initial water filling time for water inlet check, depending on the model.	2036	R/W	WORD	---	s	50...2000
c11	Anti-foam process. **0** = Disabled; **1** = Enabled.	2037	R/W	1 BIT	---	---	0/1
c12	Time to detect foam after lowering the current by 30%.	2038	R/W	WORD	---	s	10...300
c13	Enable water filling with steam generation active.	2039	R/W	1 BIT	---	---	0/1
c14	Time to drain the boiler completely.	2040	R/W	BYTES	---	s	0...240
c15	Hours of dual boiler machine rotation.	2065	R/W	WORD	---	hours	10...500
c16	Low conductivity algorithm enable.	1323	R/W	1 BIT	---	---	0/1
	MAINTENANCE/ALARMS group						
M5	Low humidity alarm threshold. The hysteresis is fixed at 2%. **0** = Disabled.	2041	R/W	BYTES	---	%	0...100
M6	High humidity alarm threshold. The hysteresis is fixed at 2%. **0** = Disabled.	2042	R/W	BYTES	---	%	0...100
M7	High/low humidity alarm delay. **0** = Disabled.	2043	R/W	WORD	---	s	0...999
M8	Delay in alarm for no production.	2064	R/W	BYTES	---	h	1...100
M9	Maximum number of automatic attempts to rearm alarm **AL03** "No water" after which the alarm blocks manual rearming	2067	R/W	BYTES	---	num	1...10
M10	Operating hours threshold for unit maintenance warning.	2044 ... 2045	R/W	DWORD	---	hours x10	100....10000
M11	Operating hours threshold for partial boiler maintenance warning.	2046 ... 2047	R/W	DWORD	---	hours x10	100....2000
M12	Operating hours threshold for full boiler maintenance warning.	2048 ... 2049	R/W	DWORD	---	hours x10	100....2000
M13	Operating hours threshold for valve maintenance warning.	2050 ... 2051	R/W	DWORD	---	hours x10	100....2000
M14	Operating hours threshold for pump maintenance warning.	2052 ... 2053	R/W	DWORD	---	hours x10	100....2000
M15	Operating hours threshold for fan maintenance warning.	2054 ... 2055	R/W	DWORD	---	hours x10	100....2000
M20	High temperature alarm threshold. The hysteresis is fixed at 3 °C (6 °F); **0** = Excluded.	2068	R/W	BYTES	---	°C/°F	0.0...80.0
M21	Maximum number of automatic attempts to rearm the high temperature alarm after which the alarm blocks manual rearming (attempts every hour)	2069	R/W	BYTES	---	num	1...10
	COMMUNICATION group						
LA1	Modbus communication protocol address.	2056	R/W	BYTES	---	num	1...247
Lb1	Modbus transmission speed (baud rate). **0** = 2400; **1** = 4800; **2** = 9600; **3** = 19200; **4** = 38400.	2057	R/W	BYTES	---	---	0...4

Par.	Description	Val. Adr.	R/W	DATA SIZE	CPL	MU	Range
LP1	Modbus parity bit. **0** = None; **1** = Odd; **2** = Even.	2058	R/W	BYTES	---	---	0...2
LS1	Modbus stop bit. **0** = 1 stop bit; **1** = 2 stop bits.	2059	R/W	1 BIT	---	---	0/1
	PASSWORD group						
PA1	First level password. **0** = No password.	2061	R/W	SHORT	Y	---	-99...999
PA2	Second level password.	2062	R/W	SHORT	Y	---	-99...999

11.7.2 Modbus resource table

Code	Description	Val. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
DI1_s0	**S0** digital input status.	257	---	R	1 BIT	---	---	0/1
DI2_cv	**CV** digital input status.	258	---	R	1 BIT	---	---	0/1
DI3_of	**0/1** digital input status.	259	---	R	1 BIT	---	---	0/1
DI4_ls	Level sensor input status.	260	---	R	1 BIT	---	---	0/1
DO1_EV1	Inlet solenoid valve output status.	385	---	R	1 BIT	---	---	0/1
DO2_DP1	Inlet pump output status.	386	---	R	1 BIT	---	---	0/1
DO3_G1	Steam generation output status.	387	---	R	1 BIT	---	---	0/1
DO4_DEH	Dehumidification output status.	388	---	R	1 BIT	---	---	0/1
DO5_FANS	Ventilated distributor output status.	389	---	R	1 BIT	---	---	0/1
DO6_AL	Alarm output status.	390	---	R	1 BIT	---	---	0/1
AI_ temperature	Temperature sensor **S1** value.	516	---	R	SHORT	Y	°C/°F	-3276.8... 3276.7
AI_Humidity	Humidity sensor **S2** value.	517	---	R	SHORT	Y	%rH	-32768... 32767
AI_Humidity_L	Humidity limit sensor **S3** value.	518	---	R	SHORT	Y	%rH	-32768... 32767
AI_Request	Proportional input **S2** value.	519	---	R	SHORT	Y	%	-32768... 32767
AI_Current	Current sensor **CT1** value.	520	---	R	SHORT	Y	A	-327.68... 327.67
PackedAlarm1	Status of warning **W01**.	769	0	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL01**.	769	1	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W02**.	769	2	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL02**.	769	3	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL03**.	769	4	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W04**.	769	5	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W05**.	769	6	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W06**.	769	7	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL07**.	769	8	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W08**.	769	9	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL08**.	769	10	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL09**.	769	11	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL10**.	769	12	R	1 BIT	---	---	0/1
PackedAlarm1	Status of alarm **AL11**.	769	13	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W12**.	769	14	R	1 BIT	---	---	0/1
PackedAlarm1	Status of warning **W13**.	769	15	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL14**.	770	0	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL15**.	770	1	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL16**.	770	2	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL17**.	770	3	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL18**.	770	4	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL19**.	770	5	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL20**.	770	6	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL21**.	770	7	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL22**.	770	8	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL23**.	770	9	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL24**.	770	10	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL25**.	770	11	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL26**.	770	12	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL27**.	770	13	R	1 BIT	---	---	0/1
PackedAlarm2	Status of alarm **AL28**.	770	14	R	1 BIT	---	---	0/1

Code	Description	Val. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
PackedAlarm2	Status of warning **W29**.	770	15	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL29**.	771	0	R	1 BIT	---	---	0/1
PackedAlarm3	Status of warning **W30**.	771	1	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL30**.	771	2	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL31**.	771	3	R	1 BIT	---	---	0/1
PackedAlarm3	Status of warning **W32**.	771	4	R	1 BIT	---	---	0/1
PackedAlarm3	Status of warning **W33**.	771	5	R	1 BIT	---	---	0/1
PackedAlarm3	Status of warning **W34**.	771	6	R	1 BIT	---	---	0/1
PackedAlarm3	Status of warning **W35**.	771	7	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL35**.	771	8	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL36**.	771	9	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL37**.	771	10	R	1 BIT	---	---	0/1
PackedAlarm3	Status of alarm **AL38**.	771	11	R	1 BIT	---	---	0/1
BMS_AL1	**AL01** manual reset.	773	---	R/W	1 BIT	---	---	0/1
BMS_AL3	**AL03** manual reset.	774	---	R/W	1 BIT	---	---	0/1
BMS_W04	**W04** manual reset.	775	---	R/W	1 BIT	---	---	0/1
BMS_AL22	**AL22** manual reset.	776	---	R/W	1 BIT	---	---	0/1
BMS_AL29_B2	**AL29** manual reset.	777	---	R/W	1 BIT	---	---	0/1
BMS_AL31_B2	**AL31** manual reset.	778	---	R/W	1 BIT	---	---	0/1
BMS_W32_B2	**W32** manual reset.	779	---	R/W	1 BIT	---	---	0/1
manWash	Manual draining command (OFF/ON).	1282	---	R/W	1 BIT	---	---	0/1
GeneralAlarm	General alarm status (OFF/ON).	1283	---	R/W	1 BIT	---	---	0/1
unitOn	Unit status (OFF/ON).	1284	---	R/W	1 BIT	---	---	0/1
---	Restore default parameters command	1285	---	R/W	1 BIT	---	---	0/1
HoursService	Hours of humidifier operation (LOW) (*).	1286	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Hours of humidifier operation (HIGH) (*).	1287	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
HoursBoilerP	Partial hours of boiler operation. (LOW) (*).	1288	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Partial hours of boiler operation. (HIGH) (*).	1289	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
HoursBoilerT	Total hours of boiler operation (hours x 10) (LOW) (*).	1290	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Total hours of boiler operation (hours x 10). (HIGH) (*).	1291	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
HoursEV1	Hours of water inlet solenoid valve operation (hours x 10) (LOW) (*).	1292	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Hours of water inlet solenoid valve operation (hours x 10) (HIGH) (*).	1293	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
HoursPump	Hours of outlet pump operation (hours x 10) (LOW) (*).	1294	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Hours of outlet pump operation (hours x 10). (HIGH) (*).	1295	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
HoursFan	Hours of fan operation (hours x 10) (LOW) (*).	1296	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Hours of fan operation (hours x 10). (HIGH) (*).	1297	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
curr100	Nominal current.	1298	---	R/W	WORD	---	A	0.00...655.35
tevap	Evaporation time.	1299	---	R/W	WORD	---	s	0.0 ... 6553.5
actProd	Actual steam production.	1303	---	R/W	SHORT	Y	kg/h	-3276.8 ... 3276.7
limH	Humidity limit sensor status (ON/OFF).	1304	---	R/W	1 BIT	---	---	0/1

Code	Description	Val. Adr.	Filter value	R/W	DATA SIZE	CPL	MU	Range
HoursAct	Hours of continuous activity. (LOW).(*)	1316	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Hours of continuous activity. (HIGH).(*)	1317	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
HoursNotAct	Hours of continuous inactivity. (LOW).(*)	1318	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
	Hours of continuous inactivity. (HIGH).(*)	1319	---	R/W	DWORD	---	h x 10	0.0 ... 429496729.5
MBS_SwEn	On/Off command from BMS.	1922	---	R/W	1 BIT	---	---	0/1

(*) **Calculation of operating hours**
Operating hours = (HIGH register x 65536) + LOW register

12. DIAGNOSTICS

The table below lists alarms with corresponding solutions. Indication takes place via the alarm LED ⚠ and the buzzer. Each alarm is recorded in the alarm log.

12.1 Table of VEH alarms

Code	Description	Cause	Effects	Solution
W01	Warning: +30% overcurrent	• Overcurrent between the electrodes • Electrodes not working or shorted • Current sensor not working • Control board not working • Boiler compromised • High electrical conductivity • Use softened water	• Fixed alarm icon • Showing **W01** • Partial draining • Recording **W01** in the log	• Carry out maintenance • Replace the boiler • Check that the outlet pump is working • Check that the TA is working (if external) • Check the water properties
AL01	Alarm: +50% overcurrent		• Fixed alarm icon • **AL01** displayed • Humidifier OFF • **AL01** recorded in the log	
W02	Warning: no production	• Foam in the boiler • Water inlet flow rate too low • Boiler failing • Water pipes or filter clogged • Backpressure at the steam outlet is greater than rated value • Very low electrical conductivity • No production for a long time	• Fixed alarm icon • Showing **W02** • No effect on regulation • Recording **W02** in the log	• Check the water mains flow rate • Check that the solenoid valve is working • Carry out maintenance on the solenoid valve • Replace the solenoid valve • Check for foam • Check the backpressure in the steam outlet duct
AL02	Alarm: no production		• Fixed alarm icon • Showing **AL02** • Alarm relay ON • Humidifier OFF if **AL02** > 100 h • Recorded **AL02** in the log	
AL03	No water alarm	• Water fill time > **c10** • Inlet filter clogged • Solenoid valve not working • Water pressure too low • Water inlet circuit leaking	• Fixed alarm icon • **AL03** displayed • Humidifier inhibited for 15 minutes • **AL03** recorded in the log	• Check the water mains flow rate • Check that the solenoid valve is working • Carry out maintenance on the solenoid valve • Replace the solenoid valve • Check and clean the internal pipes and inlet/outlet manifold • Cleaning the boiler • Replace the boiler (if there is significant limescale residue)
W04	Warning: insufficient draining	• Insufficient water drained • Water inlet/outlet clogged	• Fixed alarm icon • Showing **W04** • Alarm relay ON • Recording **W04** in the log	• Cleaning the boiler • Replace the boiler (if there is significant limescale residue) • Clean the pump, outlet manifold and outlet circuit • Replace the outlet pump if it is not working
W05	Warning: foam	The water in the boiler reaches the maximum level sensor	• Fixed alarm icon • Showing **W05** • Anti-foam washing activated • Recording **W05** in the log	• Automatic reset • If it persists over time, disconnect the humidifier water connections and let the water drain, then wash and clean the boiler • Check if the filling water is softened
W06	Warning: suspected high electrical conductivity	• High current • Low filling frequency	• Fixed alarm icon • Showing **W06** • Automatic washing activated • Recording **W06** in the log	• Carry out maintenance • Check the inlet water properties
AL07	Alarm: machine service life	Hours of unit operation > **M10**	• Fixed alarm icon • Showing **AL07** • Alarm relay ON • Recording **AL07** in the log	Carry out full maintenance
W08	Warning: boiler maintenance	Hours of boiler operation > **M11**	• Fixed alarm icon • Showing **W08** • Alarm relay ON • Recording **W08** in the log	Clean the boiler

Code	Description	Cause	Effects	Solution
AL08	Alarm: boiler service life	Hours of boiler operation > **M12**	• Fixed alarm icon • Showing **AL08** • Alarm relay ON • Humidifier OFF • Recording **AL08** in the log	Replace the boiler
AL09	Alarm: solenoid valve maintenance	Hours of solenoid valve operation > **M13**	• Fixed alarm icon • **AL09** displayed • No effect on regulation • **AL09** recorded in the log	• Clean the water inlet filter • Check for leaks • Replace the inlet solenoid valve if necessary • Reset the counter
AL10	Alarm: pump maintenance	Hours of pump operation > **M14**	• Fixed alarm icon • **AL10** displayed • No effect on regulation • **AL10** recorded in the log	• Clean the pump and the inlet and outlet manifold • Clean the inlet/outlet circuit • Check for leaks • Replace the outlet pump if necessary • Reset the counter
AL11	Alarm: fan maintenance	Hours of fan operation > **M15**	• Fixed alarm icon • **AL11** displayed • No effect on regulation • **AL11** recorded in the log	• Clean the fans and grilles • Remove residues and dust incrustations • Replace any fans that are not working • Reset the counter
W12	Warning: low humidity	Humidity production < **M5** for a time > **M7**	• Fixed alarm icon • Showing **W12** • Alarm relay ON • Recording **W12** in the log	• If it occurs together with other alarms, check accordingly • If the humidifier is underdimensioned, contact the system designer • Check **R6** and set it > 70%
W13	Warning: high humidity	Humidity production > **M6** for a time > **M7**	• Fixed alarm icon • Showing **W13** • Alarm relay ON • Recording **W13** in the log	• If it occurs together with other alarms, check accordingly • If the humidifier is overdimensioned, contact the system designer • Check **R6** and set it < 70%
AL14	Alarm: temperature sensor **S1**	• Probe not working • Probe not connected properly • Incorrect probe type	• Fixed alarm icon • **AL14** displayed • Humidifier OFF • **AL14** recorded in the log	• Check the sensor type • Check the sensor wiring • Change the sensor type • Check for electrical noise
AL15	Alarm: humidity sensor **S2**	• Sensor not working • Sensor not connected correctly • Control board not working	• Fixed alarm icon • **AL15** displayed • Alarm relay ON • Humidifier OFF • **AL15** recorded in the log	• Check the sensor type (**P2**) • Check the sensor wiring • Change the sensor type • Check for electrical noise
AL16	Alarm: humidity limit sensor **S3**		• Fixed alarm icon • **AL16** displayed • Alarm relay ON • Humidifier OFF • **AL16** recorded in the log	• Check the sensor type (**P7**) • Check the sensor wiring • Change the sensor type • Check for electrical noise
AL17	Alarm: proportional request from regulator		• Fixed alarm icon • **AL17** displayed • Alarm relay ON • Humidifier OFF • **AL17** recorded in the log	• Check the regulator wiring • Check the regulator type
AL18	Alarm: current sensor **CT**		• Fixed alarm icon • **AL18** displayed • Alarm relay ON • Humidifier OFF • **AL18** recorded in the log	• Check for water leaks • Check the electrical phase wiring on the boiler and contactor • Check that the TA is working • If the control board or current sensor are not working, replace the control board

Code	Description	Cause	Effects	Solution
AL19	Alarm: temperature sensor 1	• Probe not working • Probe not connected properly • Incorrect probe type	• Fixed alarm icon • **AL19** displayed • Alarm relay ON • Humidifier OFF • **AL19** recorded in the log	• Check the sensor type • Check the sensor wiring • Change the sensor type • Check for electrical noise
AL20	Alarm: temperature sensor 2		• Fixed alarm icon • **AL20** displayed • Alarm relay ON • Humidifier OFF • **AL20** recorded in the log	
AL22	Alarm: high temperature in wellness room	Wellness room temperature > **M20**	• Fixed alarm icon • **AL22** displayed • Alarm relay ON • Humidifier OFF • **AL22** recorded in the log	• Wait until room temperature < **M20** - 3 °C • Check and eliminate the cause of wellness room temperature > **M20**

13. MAINTENANCE

VEH series humidifiers are defined as "**NOT ACCESSIBLE TO THE PUBLIC**".

⚠ DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

- Any procedure on the humidifier, including maintenance of any type, must only be carried out while the power supply is disconnected.
- The maintenance, repair, installation and use of the equipment must only be entrusted to qualified personnel.

⚠ WARNING

RISK OF BURNS

Before carrying out any work on the system, place the equipment out of service and wait for the machine to cool down (< 50 °C (122 °F)).

13.1 Introduction

VEH series humidifiers are designed for operation with the water specifications indicated in sub-section***"5.2.1 WATER SPECIFICATIONS" ON PAGE 21.***
Using water with different specifications and/or with a hardness level approaching the limit of 50 °f causes maintenance to be required more frequently.

As a guideline, the hydraulic unit requires frequent maintenance and seasonal cleaning in the following conditions:

Water conductivity	Water hardness
200...600 µS/cm	10...30 °f

It is not possible to provide certain instructions to determine the maintenance frequency, as it depends heavily on the morphology of the water used, which can also vary under equal specifications (conductivity and hardness).

If using **VEH series** humidifiers with more critical water conditions, for example:

Water conductivity	Water hardness
700...1250 µS/cm	35...50 °f

maintenance must be carried out more frequently, several time per season (even weekly in extreme cases).

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

Only use the humidifier with the water specifications indicated in this manual.

If frequent maintenance takes place, check the quality of the water supply.

Furthermore, the hydraulic unit should be cleaned promptly when:

- The drain water is very dark (reddish/black) and demonstrates the start of electrode corrosion (*) caused by the highly aggressive nature of concentrated water (replace the electrodes if necessary);
- The humidifier does not work properly, triggering the high current alarm frequently.
  NOTE: a high concentration of salts in the water inside the boiler results in high electrical conductivity, which can cause various high current alarms and lead to frequent drain cycles;
- The hydraulic unit has reached 5 seasons or 24 months of continuous operation with maintenance performed in accordance with best practices;
- There are large amounts of limescale linked to variations in colour and surface on the outer walls of the hydraulic unit, due to overheating caused by limescale bridges between the electrical phases (replace the electrodes if necessary);
  NOTE: Limescale inside the boiler is normal, even in large amounts, as the boiler collects the limescale present in the water; therefore performing maintenance/cleaning on it is essential for correct operation.

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

Only carry out boiler maintenance in accordance with the instructions provided in the Maintenance section of this manual.

(*): The electrodes are made using AISI 316 steel with self-extinguishing engineering plastic parts.

- There are leaks due to breakages, cracks and fissures (**replace the hydraulic unit**).
  NOTE: the water inside the boiler is subjected to electrical voltage and therefore leaks from the boiler are dangerous.

DANGER

RISK OF ELECTRIC SHOCK OR ELECTRIC ARC

- Any procedure on the humidifier, including maintenance of any type, must only be carried out while the power supply is disconnected.
- In the event of water leakage, disconnect the humidifier power supply immediately.

- If any adverse event not described in this documentation arises, carry out maintenance and/or replace the hydraulic unit. Plus, contact ELSTEAM customer service for the relevant guidelines and instructions;

DANGER

RISK OF ELECTRIC SHOCK, EXPLOSION OR ELECTRIC ARC

If an adverse event occurs, disconnect the humidifier power supply immediately.

- After a period of activity and/or due to water specifications, because of the formation of limescale inside the boiler, the electrodes may come closer together and/or closer to the walls of the boiler, forming potential electrical conductors which, in the absence of water, may lead to an increase in temperature (causing the surfaces of the boiler to become black) and cause the boiler wall to melt, leading to the leakage of live water (**replace the hydraulic unit**);

DANGER

RISK OF ELECTRIC SHOCK OR ELECTRIC ARC

- In the event of water leakage, disconnect the humidifier power supply immediately.
- Check and, if necessary, replace the hydraulic unit sealing gaskets.
- If the tank is compromised, replace the entire hydraulic unit.

Checking the status of the humidifier

Perform the following scheduled checks on the humidifier:

When...	What to do...
At first start-up	Make sure there are no leaks after an hour of continuous operation.
When changing parts	Make sure there are no leaks after an hour of continuous operation.
Every 5 days	• Make sure the humidifier works properly (based on the instructions provided in this manual); • Make sure there are no leaks in the hydraulic system; • Make sure there is no unusual operation.
Every 30 days	• Make sure there are no blockages in the water drain; • Make sure the water drains effectively; • Remove any limescale residue from inside the drain.
Every 60 days	• Make sure not too much limescale residue has built up inside the hydraulic unit; • Wash the inside of the boiler with a 20% concentration of citric acid, removing limescale from the electrodes and boiler. • If necessary, replace the electrodes and gaskets.
Every 2 years (*)	Replace the hydraulic unit.
Every 5 years (**)	Replace the hydraulic unit.

(*) **NOTE**: If humidifier used continuously.

(**) **NOTE**: If humidifier used seasonally.

Inadequate use and/or poor maintenance of the humidifier can damage your health.

WARNING

BIOLOGICAL RISK

- In the event of poor maintenance/cleaning after the humidifier has been shut-down for a long time, microorganisms (including the bacteria that cause Legionellosis) may proliferate and be transferred into the air treatment system.
- The humidifier must be used properly and be maintained and cleaned properly at prescribed intervals, as described in the ***MAINTENANCE*** chapter.

Thoroughly remove limescale and biofilm residues from the reservoir and drain (rinse the inside of the reservoir with 20% citric acid and appropriate biocides, and clean the limescale off the surface).

NOTICE

MALFUNCTIONING OF THE EQUIPMENT

Replace the sealing gaskets every time the hydraulic unit is serviced.

13.2 Regular cleaning of the product and its components

- Drain the humidifier, following the instruction provided in section ***"9.8 OPERATING HOURS" ON PAGE 48***;
- Disconnect the machine power supply using the external isolator;
- Open the AHU and approach the hydraulic unit, removing the tank covers from the unit as described in paragraph ***"13.3 CLEANING THE TANK" ON PAGE 65***;
- Unscrew the manifold from the filling/discharge unit;
- Remove any pieces of limescale;
- Disconnect the inlet solenoid valve, remove the filter at the bottom and thoroughly clean it again;
- Reassemble the inlet solenoid valve;
- Re-attach the filling/discharge unit manifold.

13.3 Cleaning the tank

- Drain the humidifier;
- Disconnect the machine power supply using the external isolator;
- Use the 2 screws at the front to disconnect the filling/discharge manifold from the front of the hydraulic unit;
- Loosen the 4 screws on the sides of the top cover and remove the 2 covers;
- Open the top of the tank inside the AHU;
- Gently lift the hydraulic unit until any remaining water has drained out;
- Wash the hydraulic unit tank using a citric acid solution and detach any limescale from the surfaces of the electrodes using a plastic spatula.
- Fully reassemble the hydraulic unit.

13.4 Cleaning the optional STAINLESS STEEL discharge tank (VI accessory)

- Remove the tank connection from the drain;
- Remove the tank from the bottom of the humidifier;
- Clean the tank by removing limescale deposits and rinsing it under running water;
- Re-fit the tank correctly and reconnect the drain.

13.5 Replacing the electrodes

- Drain the humidifier;
- Disconnect the machine power supply using the external isolator;
- Use the 2 screws at the front to disconnect the filling/discharge manifold from the front of the hydraulic unit;
- Loosen the 4 screws on the sides of the top cover and remove the 2 covers;
- Open the top of the tank inside the AHU;
- Unscrew the nuts securing the electrodes, lift them from the part opposite the connections and slide them out of the connection slot;
- Insert the new electrodes, reversing the disassembly instructions;
- Secure the electrodes in their seat, making sure they are well fastened and that the O-RING seals are positioned correctly;
- Close the top of the tank inside the AHU;
- Reconnect the electrical cables using flanged nuts and special Nord Lock washers, making sure connection takes place in accordance with best practices and current regulations.

⚠ ⚠ DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCKS AND OVERHEATING

Tighten the connections in compliance with the technical specifications relating to tightening torques.

Tightening torque between nut and locknut, for the ring terminal: 4 Nm.

13.6 Opening the electric panel

For installers and maintenance personnel **only**.

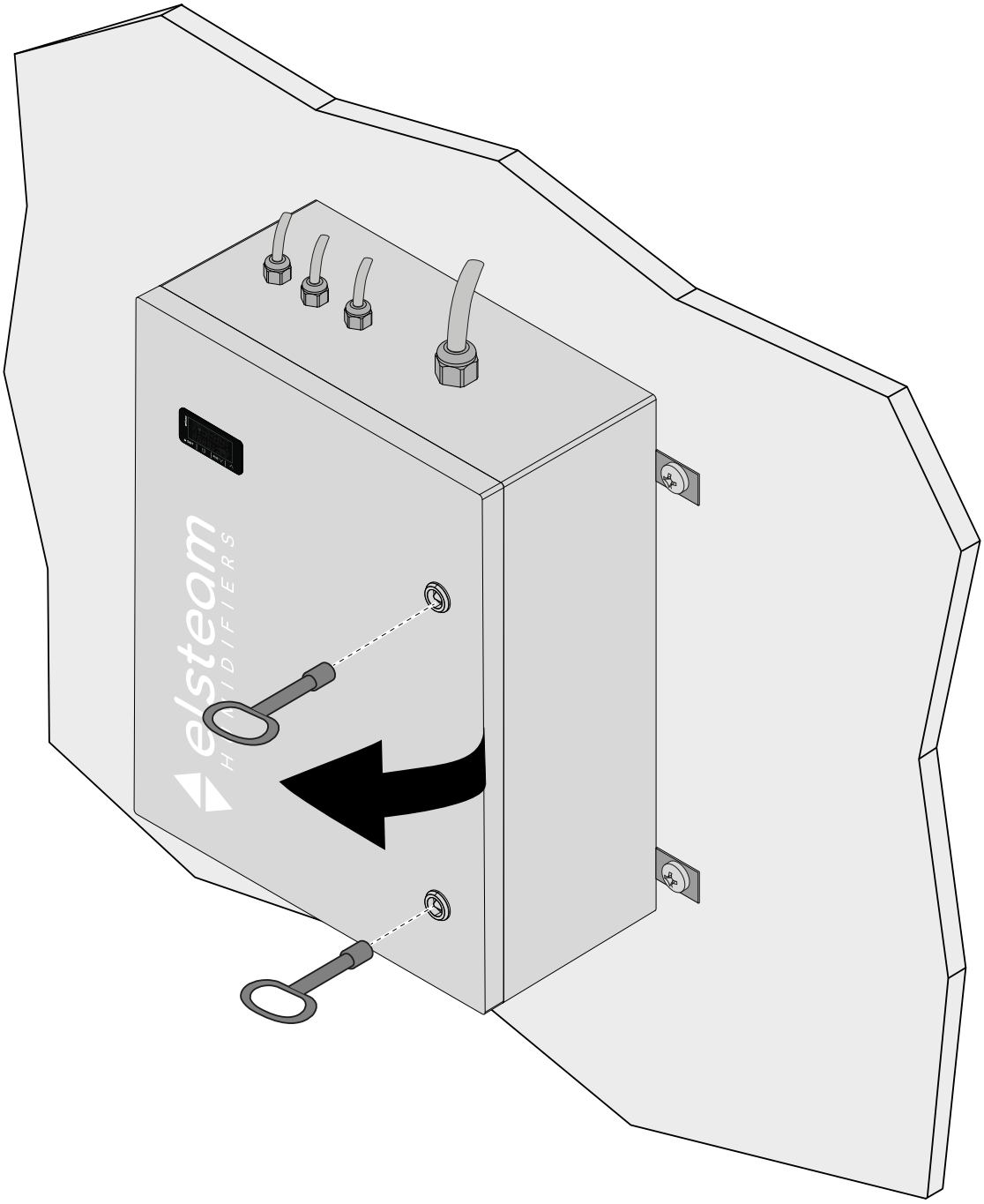


Fig. 54. *Opening the electric panel*

14. SPARE PARTS

14.1 Hydraulic unit

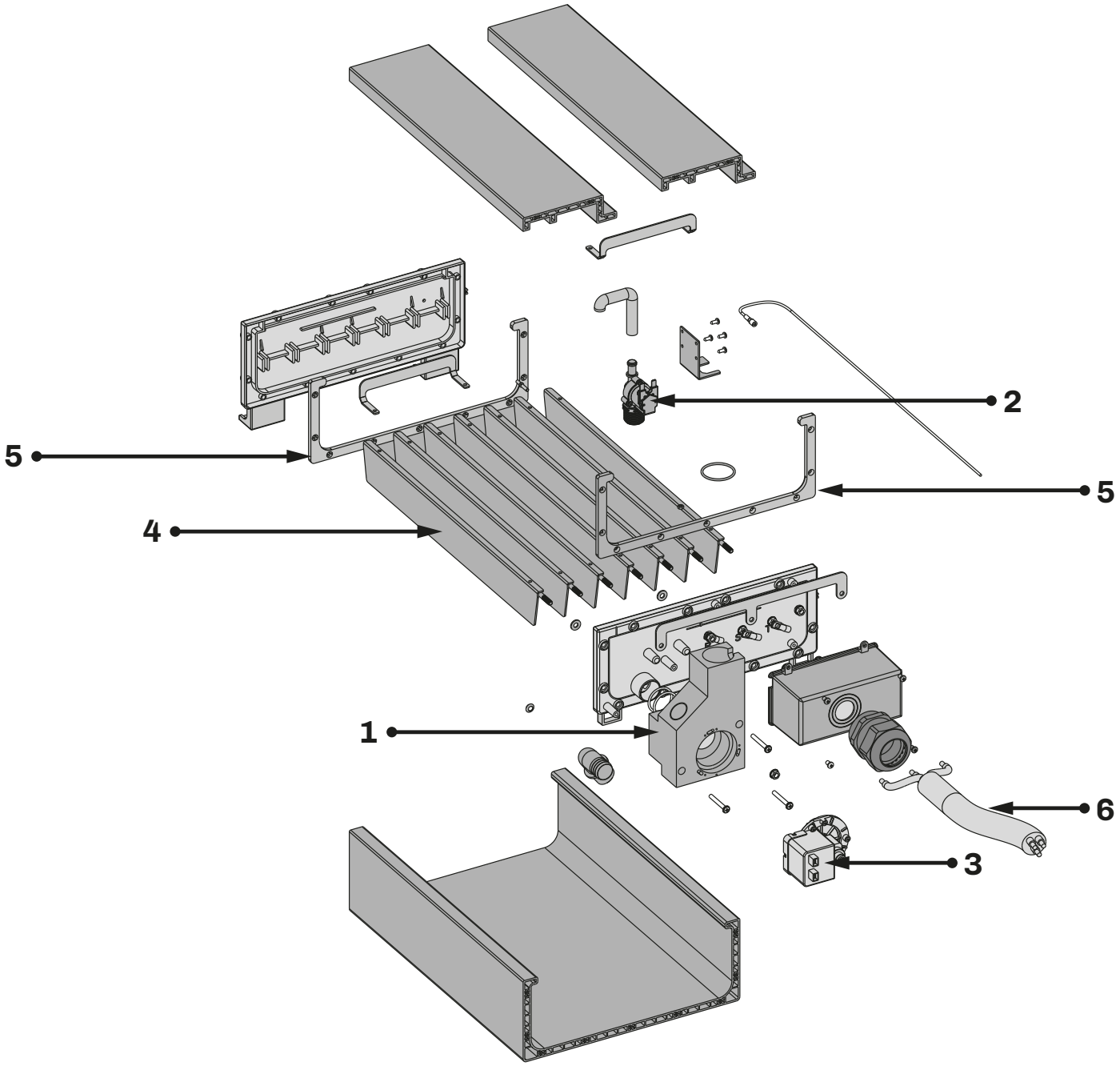


Fig. 55. *Spare parts:* ***VEH series - Hydraulic unit***

Ref.	P/n	Description
1	**EHKD0K01**	**VEH** water filling/discharge manifold unit
2	**EHKT0K02**	**VEH** inlet solenoid valve
3	**EHKT0K04**	**VEH** electric drain pump
4	**EHKD0K02**	Electrode kit for **VEH10XS**/**VEH20XS**
	EHKD0K03	Electrode kit for **VEH20S**/**VEH30S**/**VEH40S**
	EHKD0K04	Electrode kit for **VEH30M**/**VEH60M**
	EHKD0K05	Electrode kit for **VEH40L**/**VEH80L**
	EHKD0K06	Electrode kit for **VEH60XL**/**VEH100XL**
5	**EHKD0K07**	**VEH** hydraulic unit gasket kit
6	**EHKD0K08**	Power cable kit for running from electric panel to hydraulic module for **VEH10-20-30-40**
	EHKD0K09	Power cable kit for running from electric panel to hydraulic module for **VEH60-80-100**

14.2 Electric panel

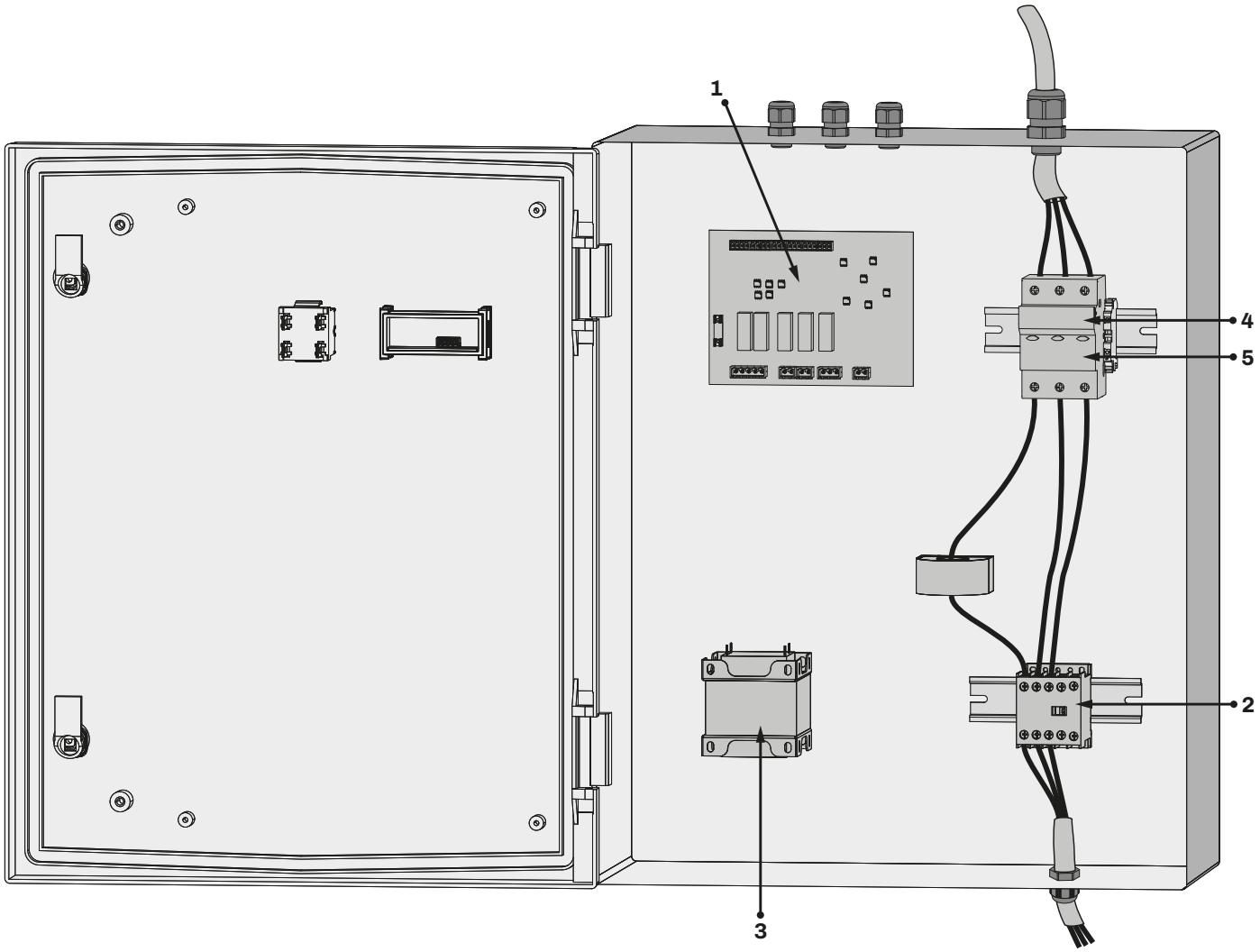


Fig. 56. *Spare parts:* ***VEH series - Electric panel***

Ref.	P/n	Description
1	**VEHK06**	Complete control unit
2	**0209310001**	Remote control switch for **VEH10** models
	0209310002	Remote control switch for **VEH20** models
	0209310003	Remote control switch for **VEH30** models
	0209310005	Remote control switch for **VEH40** models
	0209310004	Remote control switch for **VEH60** models
	0209710007	Remote control switch for **VEH80** models
	0209310006	Remote control switch for **VEH100** models
3	**0101014020**	400 Vac transformer for **VEH** models
4	**0150130001**	Fuse box for **VEH10-20** models
	0150130002	Fuse box for **VEH30-40** models
	0150130003	Fuse box for **VEH60-80-100** models
5	**EHKT0K76**	Fuse kit for **VEH10** gG10x38 16 A
	EHKT0K77	Fuse kit for **VEH20** gG10x38 32 A
	VEHK20	Fuse kit for **VEH30** gG14x51 40 A
	EHKT0K78	Fuse kit for **VEH40** gG14x51 50 A
	VEHK22	Fuse kit for **VEH60** gG22x58 80 A
	EHKT0K79	Fuse kit for **VEH80** gG22x58 100 A
	EHKT0K80	Fuse kit for **VEH100** gG22x58 125 A

15. WIRING DIAGRAMS

15.1 VEH humidifier (4 or 7 electrodes)

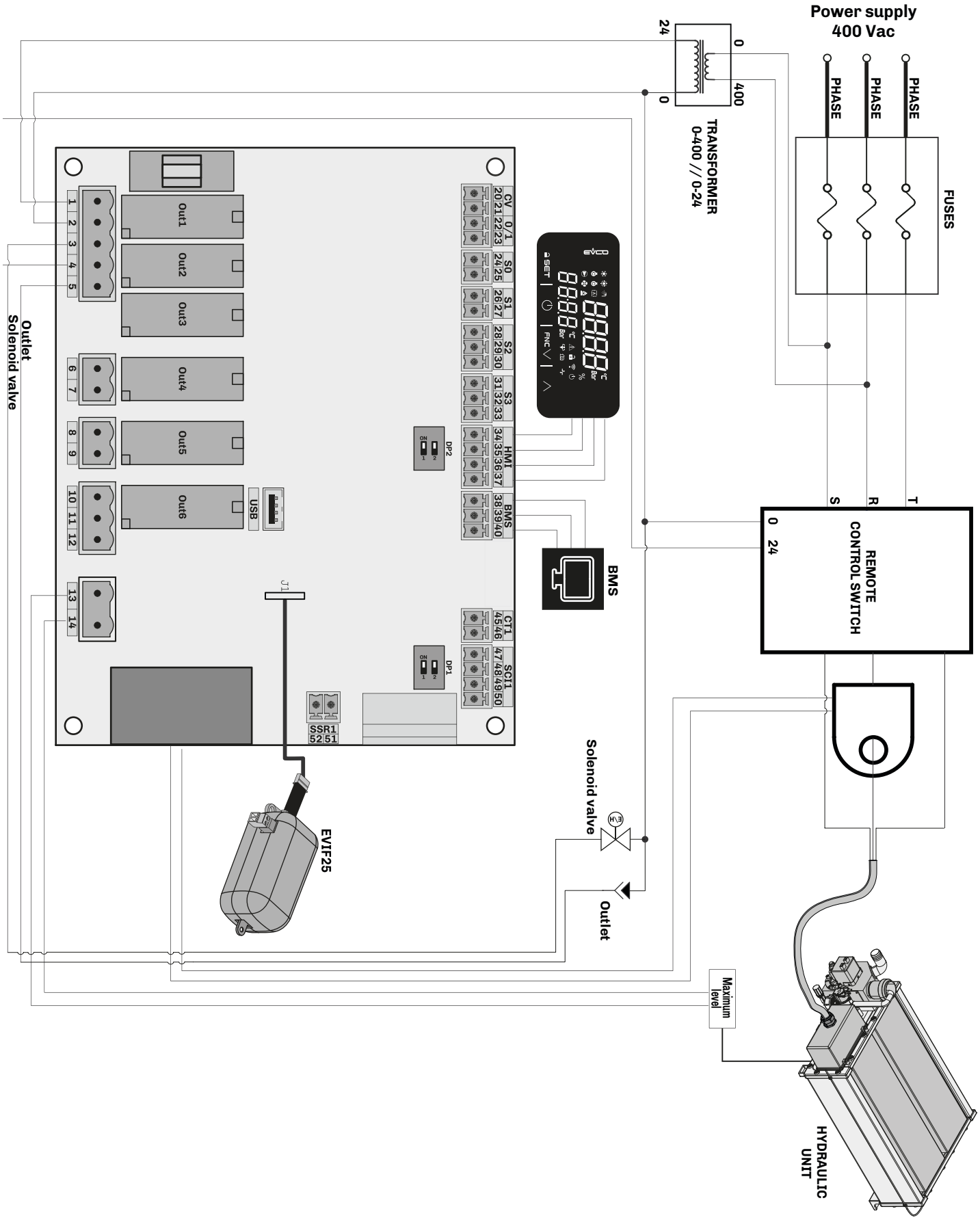


Fig. 57. *Wiring diagram for* ***4- or 7-Electrode*** *models*

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