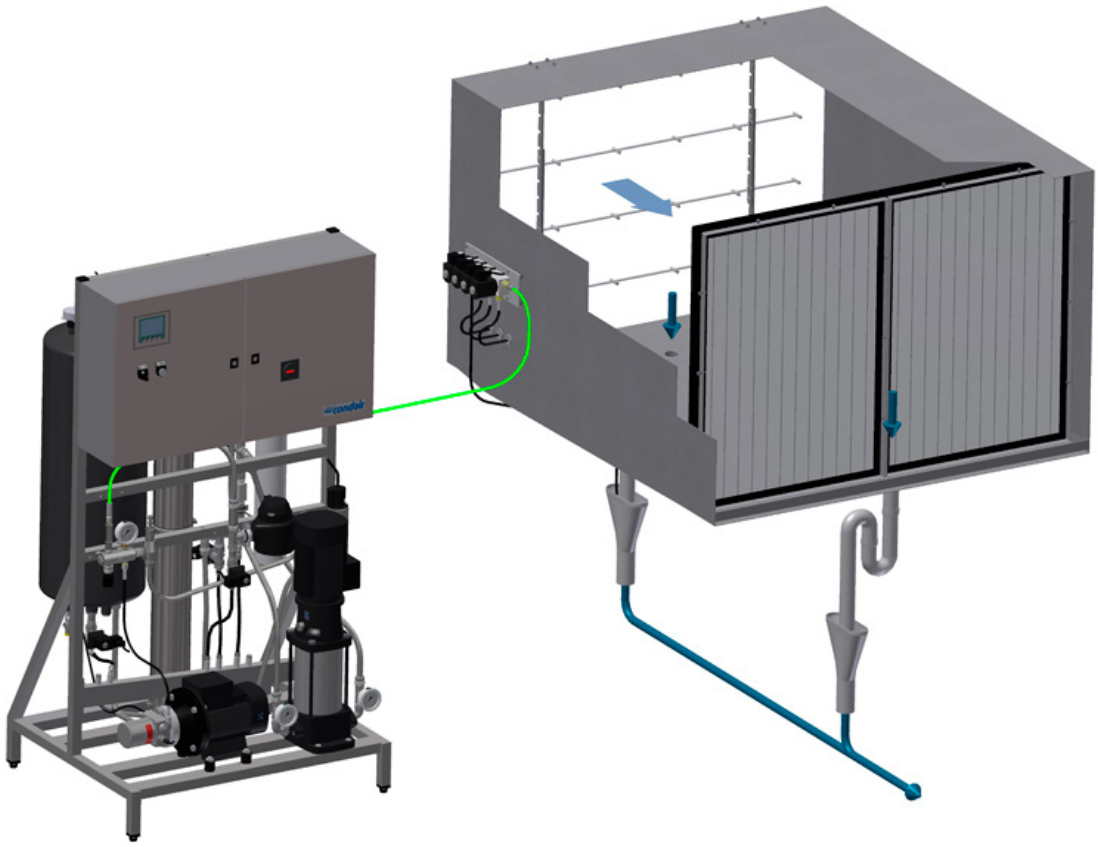
2593990 EN 1806

IMPORTANT! Read and save these instructions. This manual to be left with the equipment.

HP SERIES



INSTALLATION AND OPERATION MANUAL

In-Duct Adiabatic Humidification System
Nortec HP/HP RO
Valid from SN 2016-xxx
US version

Humidification and Evaporative Cooling

nortec

Thank you for choosing Nortec

Installation date (DD/MM/YYYY):
Commissioning date (DD/MM/YYYY):
Site:
Model:
Serial number:

Contact
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2740 Fenton Road, Ottawa, ON, Canada K1T 3T7
Phone. 1.866.NORTEC1, Fax 613.822.7964
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Contents

1 Introduction

1.1 Before you Start!

Thank you for purchasing the **Nortec HP or HP RO in-duct high pressure humidification system** (“Nortec HP" for short).

The Nortec HP adiabatic humidifier incorporates the latest technical advances and meets all recognized safety standards. Never-the-less, improper use of the Nortec HP adiabatic humidifier may result in danger to the user or third parties, and/or damage to property.

To ensure safe, proper and economical operation of the Nortec HP adiabatic humidifier, observe and comply with all information and safety instructions contained in this manual, as well as all relevant documentation of components of the installed humidification system.

If you have additional questions, contact your local Nortec representative. They will be glad to assist you.

1.2 General

Limitations

The subject of this installation and operation manual is the Nortec HP and HP RO in-duct high pressure humidification system and associated equipment whether ancillary or supplementary. The various options and accessories are only described may only be described in-so-far as is necessary for proper operation of the equipment. Additional information on available options and accessories can be obtained in the instructions that are supplied with them.

This manual is restricted to the installation, **commissioning**, **operation**, **maintenance** and **trouble-shooting** of the Nortec HP and is intended for well trained personnel who are suitably qualified for their respective tasks.

Symbols used in this manual

CAUTION!

The word “CAUTION" in conjunction with the general caution symbol is used to provide safety instructions that, if neglected, may cause damage and/or malfunction of the unit or damage to property.

WARNING!

The word “WARNING" in conjunction with the general warning symbol is used to provide safety instructions that, if neglected, may cause injury to personnel. Other specific warning symbols may also be used in place of the general symbol.

DANGER!

The word “DANGER" in conjunction with the general danger symbol is used to provide safety instructions that, if neglected, may cause severe injury to personnel or even death. Other specific danger symbols may also be used in place of the general symbol.

Other Related Publications

This manual is supplemented by other publications such as the HP Controller Manual, which are included in the delivery of the equipment. Where necessary, appropriate cross-references to these publications have been added in this manual.

Storage of Manual

Keep this manual in a place where it is safe and readily accessible. If the equipment is moved to another location, make sure that the manual is passed on to the new user. If the manual is lost or misplaced, contact your Nortec representative for a replacement copy.

Language Versions

This manual is also available in other languages – contact your Nortec representative.

2 For your safety

2.1 Safety

DANGER!

Always isolate all supplies to the system before commencing any maintenance or repair.

General

Every person who is tasked with the design, selection, installation, operation or maintenance of the Nortec HP adiabatic humidifier must read and understand this manual before performing any work. Knowing and understanding the contents of the installation manual and the operation and maintenance manual is a basic requirement for protecting personnel against any kind of danger, preventing faulty operation, and operating the unit safely and correctly.

This manual has been written to ensure the safe use, performance and longevity of the equipment and is intended for use by engineers, contractors, building owners, maintenance personnel and properly trained technical personnel (or anyone who is tasked with working on or with the HP system). Please read this manual thoroughly before specifying, designing, installing or operating a Nortec HP system. Retain for reference.

All labels, signs and marking applied to the Nortec HP adiabatic humidifier must be observed and kept in a readable state.

Personnel Qualifications

All procedures described in this manual must only be performed by personnel who are adequately qualified, well trained and are authorized by the customer. For safety and warranty reasons, any activity beyond the scope of this manual must only be performed by qualified personnel authorized by Nortec. All personnel working with the Nortec HP adiabatic humidifier must be familiar with, and comply with the appropriate regulations on workplace safety and prevention of accidents. Installation, maintenance, repair work or de-commissioning should only be carried out by appropriately qualified and properly trained technical personnel. It is the customer's responsibility to ensure their suitability.

Intended Use

The Nortec HP humidification heads is intended exclusively for adiabatic humidification and/or evaporative cooling using a Nortec HP or HP RO high pressure pump station within specified operating conditions (refer to the Nortec HP RO IOM for details). Any other type of application, without the express written consent of Nortec, is considered to be not conforming to its intended purpose, and may lead to dangerous operation and will void the warranty. In order to operate the equipment in the intended manner all information contained in this manual, in particular the safety instructions, must be observed closely.

Safe Operation

If it is suspected that safe operation has been compromised, the HP System should immediately be shut down and secured against accidental power-up.

Shut down the Nortec HP Humidification System if:

– Components are damaged, worn or very soiled
– Fans have stopped or are noisy
– Joints, pipes, hoses, or connection lines are leaking
– Unusual or very loud noise
– If the Nortec HP does not work correctly.
– After long-time storage under unfavorable condition.

Safety Precautions that Must be Observed

DANGER!
Risk of electric shock!

The Nortec HP humidifier is mains powered. Live parts may be exposed when the access panels are removed. Touching live parts may cause severe Injury or even death.

Prevention: The Nortec HP humidifier must be connected to the mains only after all installation work has been completed, checked for correct workmanship, and the access panels are installed properly and fastened securely.

DANGER!
Risk of injury and equipment damage

Poorly maintained humidification systems may be hazardous.

Prevention: read, understand and follow maintenance guidelines to ensure your system stays safe.

WARNING!
Risk of injury and equipment damage

High pressure! When running the system is pressurized at 1015 psi. Inappropriately fastened hoses may be forced out of the screw connections when pressurized. Never loosen hoses or screw connections in a pressurized system.

Preventing Unsafe Operation

All personnel working with the Nortec HP adiabatic humidifier must immediately report to the customer any alterations to the unit that may affect safety, and **secure the humidifier against accidental power-up**.

Modifications to the Unit Prohibited

Modifications are not permitted on the Nortec HP adiabatic humidifier without the express written consent of Nortec

2.2 Health & Hygiene

DANGER!
Risk of infection or serious illness

The Nortec HP System must be installed, operated and maintained in accordance with this manual. Failure to do so could result in contamination that might cause Legionnaires' disease, which can be fatal.

DANGER!
Risk of water contamination

To prevent water stagnation and microbial contamination, the systems power supply should be left switched on. If the system is switched off for more than 48 hours, the pipework and system must be disinfected as per the instructions, and a full risk assessment must be undertaken to ensure safe operation.

Health Risks

The customer is responsible for ensuring that the installation and operation of the equipment complies with all local regulations (building codes, plumbing regulations, electrical standards) and is in accordance with the local health and safety authorities' technical guidance on the control of bacteria in water systems.

Please observe the local health and safety codes, standards and technical guidance on the control of Legionella in water systems.

The user is responsible for ensuring that the water system complies with local regulations, bye-laws and guidelines (such as the HSE ACoP L8, VDI 6022, ISO 22000, HACCP or equivalent). If inadequately maintained, water systems, of which any humidifier is a part, can support the growth of microorganisms, including the bacterium that causes Legionnaires' disease.

Nortec HP systems, products and components are produced according to the ISO 22000 standards, which means that we have considered all aspects of this equipment to reduce the risk of Legionnaires' disease and other similar conditions. However, the user is responsible for ensuring that the installation, operation and maintenance work on the equipment is performed in a manner ensuring that the system stays clean.

Any risks or hazards relating to the system, including during installation and maintenance, should be identified by a competent health and safety representative who is responsible for introducing effective control measures.

Water monitoring

The quality of water being used in the Nortec HP Humidification System should be checked prior to system commissioning and comply with the guidelines in the high pressure pump manual.

The Nortec HP Humidification System must be monitored for hygiene as part of the maintenance program. Please refer to the maintenance section for further guidance.

Guidelines for a Hygienic System

- Carry out a risk assessment of the water system using a competent person, and implement an appropriate monitoring and control program.
- Conduct preventative maintenance and procedures for checking the UV system, cleaning tanks, changing filters, disinfection, etc.
- The Nortec HP and HP RO systems must be connected to a clean, potable mains water supply.
- Additionally, it is to be noted that if the HP system is chosen (i.e. without RO), then the HP system should be supplied with treated water to avoid dusting in the air stream.
- Enter into a service contract that suits your company.
- Stop the system if polluted drinking water is found in your area.
- Avoid water temperatures between 77 °F and 113 °F (25 °C and 45 °C), which favor the growth of Legionella.
- Do not stop the system unless it is faulty or leaking (avoid water stagnation).
- Refrain from closing nozzles or sections, unless there is leakage or a fault (avoid water stagnation).
- Disinfect the high-pressure system at least once a year and after every maintenance or repair. Always carry out a complete system disinfection if it has been turned off for more than 48 hours.
- Have water samples taken and tested for harmful bacteria at least once a year.
- Conduct follow-up measurements until the system is clean if bacteria have been detected in the system.

Disinfection

Depending on the system hygiene, it is advised that preventative disinfection fluid be added to the HP RO water tank at an appropriate frequency, but at least once a year.

Nortec Humidity recommends using disinfection fluid (i.e. HaloSpray or Sanosil S010 AG 5% - part number: 155404000) to the System via the high pressure pump, desired concentration 0.1%. HaloSpray or Sanosil is safe, non-toxic and eco-friendly which provides a prophylactic, disinfection dose and is effective against all types of microorganisms, including Legionella and E.coli.

Please read the Appendix C section for more information on disinfection and dosing requirements.

If you are in any doubt about the suitability of water quality, please contact your Nortec Humidity distributor who will be happy to support you.

2.3 Disinfection and Dosing

We recommend Sanosil as a disinfection agent in HP Systems. Disinfection should be carried out at least once a year, depending on the inlet water quality. This should be done as part of a regular preventative maintenance by your Nortec Technician please contact Nortec for additional information.

Calculation of mixing ratio between water and disinfectant - example: 5 % Sanosil S010 Ag to 0.1 %

Wanted concentration:		**0.1 %**		
Concentration of chemical		**5 %**		
Mixed solution	**Water**	**Chemical**	**Chemical part**	
Gallon	Gallon	Ounce	Ounce	%
0.27	0.26	0.7	0.3	0.1
0.53	0.52	1.4	0.7	0.1
0.79	0.78	2.0	1.0	0.1
1.06	1.04	2.7	1.4	0.1
1.32	1.29	3.4	1.7	0.1
1.59	1.55	4.1	2.0	0.1
1.85	1.81	4.7	2.4	0.1
2.11	2.07	5.4	2.7	0.1
2.38	2.33	6.1	3.0	0.1
2.64	2.59	6.8	3.4	0.1
2.91	2.85	7.4	3.7	0.1
3.17	3.11	8.1	4.1	0.1
3.43	3.37	8.8	4.4	0.1
3.7	3.6	9.5	4.7	0.1
4.0	3.9	10.1	5.1	0.1
4.2	4.1	10.8	5.4	0.1
4.5	4.4	11.5	5.7	0.1
4.8	4.7	12.2	6.1	0.1
5.0	4.9	12.8	6.4	0.1
5.3	5.2	13.5	6.8	0.1
6.6	6.5	16.9	8.5	0.1
13.2	12.9	33.8	16.9	0.1
15.9	15.5	40.6	20.3	0.1
26.4	25.9	67.6	33.8	0.1
40	39	101.4	50.7	0.1
53	52	135.3	67.6	0.1
79	78	202.9	101.4	0.1
106	104	270.5	135.3	0.1
132	129	338.1	169.1	0.1
159	155	405.8	202.9	0.1
185	181	473.4	236.7	0.1
211	207	541.0	270.5	0.1
238	233	608.7	304.3	0.1
264	259	676.3	338.1	0.1

3 Receiving and Storage

3.1 Inspection

All Nortec products are shipped F.O.B at the factory. All damage, breakage or loss claims are the responsibility of the shipping company.

Upon receipt, remove the transit packaging and inspect the components to ensure that no damage has occurred during transit. Inspect the goods as follows:

- Inspect the shipping boxes for damage. Report any shipping box damages to the shipping company without delay.
- Check the goods against the packing slip to ensure that all items have been delivered. Report any shortages to your Nortec representative within 48 hours of receipt of the goods. Nortec does not assume responsibilities for any shortages beyond this period.
- Unpack the parts/components and check for any damage. If parts/components are damaged, notify the shipping company immediately.
- Verify the model type on the specification label to ensure that it is suitable for your installation.

3.2 Scope of Delivery

The standard delivery includes:

– Pump station complete with pre-filter and control unit
– Nozzle unit(s) including hoses, step/flush valve block and mounting parts
– High-pressure hose 10 feet (3 m) for high-pressure piping between pump station and valve block
– Hose feed through 6 pcs. for double walled AHU or duct
– Special cable to step valves REG1, REG2, REG3 (3 meters)
– Alarm switch (NC)
– Installation and operation manual (the document you are currently reading)
– Installation drawing with mounting dimensions
– Piping diagram

Customized solutions and special orders are available upon request. Please contact Nortec for more information.

3.3 Storage and Transportation

Storage

Store the Nortec HP adiabatic humidifier in its original packaging inside a protected area that meets the following requirements until it is installed. These requirements also apply if the unit needs to be stored for an extended period of time. **If put into storage prior to use, the components must be covered and protected from physical damage, dust, frost and rain. Avoid below freezing temperatures as this can degrade certain wet parts and components, such as RO membranes.**

For storage Nortec recommends:

– Room temperature: 41 to 95°F (5 to 35°C)

– Room humidity: 10 to 75% RH

Transportation

For optimum protection always transport the unit and components in their original packaging, and use appropriate lifting/transporting devices.

Lifting or handling must only be carried out by trained and qualified personnel. Ensure that the lifting operation has been properly planned and risk-assessed, and that all equipment has been checked by a skilled and competent health and safety representative.
The customer is responsible for ensuring that operators are trained in handling heavy goods, and to enforce the relevant lifting regulations. Refer to the weights and measures section for system weight.

Packaging

It is recommended that the components be kept in its transit packaging for as long as possible prior to installation.

Keep the original packaging of the unit/components for later use.

If the packaging needs to be disposed of, observe local regulations on waste disposal. Recycle packaging where possible.

Disposal

You must observe local laws and regulations when disposing of your Nortec HP system at the end of its working life.

4 Site Planning

4.1 Prior to Starting

The basic principles for planning described below are theoretical ones. In practice, the necessary humidification capacity is influenced by parameters that cannot be covered by this documentation. For this reason, the values that were determined in theory have to be complemented by practical values or corrected in many cases. Nortec's technical service team will be pleased to assist you.

Notes on the planning of an in-duct air humidification systems in one or more zones

Proceed as follows when selecting and/or dimensioning the air humidification system:

- Determine the airflow speed of the air handling unit
- Determine the set points (temperature and humidity/relative humidity)
- Determine the number of air handling units or ducts which require humidification equipment
- Calculate the maximum humidification capacity
- Define the device requirements and options/accessories
- Obtain the proper dimensions of the air handling unit or duct
- Define a definite absorption distance dependent on the unit clearances and efficiencies
- Define the components upstream and downstream of where the HP in-duct will be placed
- Determine the placement of pump stations, valve blocks, slave panels and controls

4.2 HP Design Tips

The design of a system is always determined during planning and noted in the system documents. Prior to mounting the HP system, ensure that all hose layouts, distances between pump stations, valve blocks and manifolds have been considered and adhered to, as per the HP Installation section.
The recommended setup of the HP system is mentioned in the following sections. Consult local and national installation regulations. Nortec does not accept responsibility for violations of the installation codes.

The following general positioning notes, however, have to be read and complied with in any case:

- Make sure that the install of the in-duct portion of the system is adequately fastened on which the devices and/or system components will be mounted disposes of a sufficient load-carrying capacity and is suitable for fixing.
- Ensure the air handler provides no less than 100 fpm (0.5 m/s) of airflow duct velocity and no more than 785 fpm (4.0 m/s).
- Ensure that a proper air filter is installed upstream (prior) to the HP humidification/misting system. Air filter should be a minimum of MERV 8 quality specifications or better. MERV13 would be preferred.
- Nortec recommends a minimum of 60 inches or 5 feet (1.5 m) of absorption distance. Differing climate, air handling unit layouts and performances will affect this. As a general rule the more clearly unobstructed absorption the better.
- A minimum distance of 15 inches (0.4 m) between the humidifier unit and a possible heating unit is highly recommended.
- Ensure you have enough absorption distance and clearances in the air handling unit. There should be enough space when opening doors for servicing and access.

- Pay close attention to the airflow of the air handling unit. Do not install humidification heads or nozzles in the immediate vicinity of a discharge, supply, return or exhaust opening.
- Do not point humidification heads or their nozzles at cold parts of a component, e.g. cooling coils, etc. (risk of condensation).
- The evaporation process absorbs heat from the ambient air. For this reason, make sure that the atomized stream is not directed on objects or obstructions that can impede evaporation.
- In order to guarantee optimum humidification, ensure that the atomizers are sensibly distributed in the air handler per the final submittal and principle (Dynamic) drawing AHU manifold grid drawing.
- The system components have to be mounted in such a way to provide enough space for operation and maintenance

Please contact Nortec's Technical Service Team in case you have questions on positioning and clearances.

4.3 Experts on Site

Nortec Humidity has expert technicians employed by Nortec who can provide:

- Pre-site analysis
- Positioning and site assistance or recommendations
- Installation support
- Start-up and commissioning
- Bacteriological troubleshooting on site [1)]
- Cleaning and disinfecting
- Preventive maintenance
- Repair and fault finding
- Training and guidance

[1)] Nortec Humidity uses an industry leading method for measuring bacterial activity in the water; the approved and patented BactiQuant test. This, unique to Nortec, field test takes water samples from critical project locations. Thereafter, the bacteriological quality of the water can be read, on-site, within 30 minutes, and the system can be disinfected if necessary.
Nortec Humidity follows the guidelines in VDI 6022 for colony forming units (CFU) counts in humidifiers. The CFU count in the humidification water must not exceed 150 CFU/ml, corresponding to a maximum BQ value of 40. Please contact your local Nortec Humidity representative for further information about our services.

5 Overview of Nortec HP and HP RO

5.1 General Description

The HP (High Pressure) system is designed to be installed inside an AHU or duct system to humidify air to a desired relative humidity. Proper humidity levels have been shown to be important for health and comfort of occupants. Maintaining proper humidity is also important for many industrial and manufacturing processes.

The HP system uses a series of nozzles to spray atomized water droplets (a very fine mist of water) through an air stream. During this process the air absorbs moisture increasing its relative humidity levels. As the water droplets evaporate, they absorb some energy in the form of heat from the air. This loss of heat causes the air temperature to drop, resulting in a phenomenon known as adiabatic cooling.

The HP adiabatic system has 2 effects:

1. The relative humidity of the air increases (humidification)
2. The temperature of the air falls (adiabatic cooling)

Humidification of the air is the main goal of the HP system. The cooling of the air is secondary and is frequently beneficial since it is 'free' cooling. In cases where air-cooling is un-desired, preheating of the air is required.

In general a HP system has the following advantages over other humidification technologies:

– Low frequency of maintenance, since there are few moving or replaceable parts.
– Replacing components is quick and requires minimal system disassembly.
– A 'free' air-cooling benefit from water extracting latent heat from the air.

5.2 Models Overview

The HP and HP RO series is a high-pressure pump station and, the latter, includes a reverse osmosis system (from now on called RO). The single or combined system is developed by Nortec Humidity Ltd. with focus on reliable and hygienic humidification solutions. The latter system is fitted with an integrated reverse osmosis system and tank for removal (>95%) of salts and minerals in tap water. Additionally, it is to be noted that if the HP system is chosen (i.e. without RO), then the HP system should be supplied with treated water to avoid dusting in the air stream.

The HP comes in six basic models:

– HP 100
– HP 200 (with VFD only)
– HP 300
– HP 500 (optional with or without VFD)
– HP 800 (optional with or without VFD)
– HP 1300 (with VFD only)

The HP RO comes in five basic models:

– HP RO 100
– HP RO 200 (with VFD only)
– HP RO 300
– HP RO 500 (optional with or without VFD)
– HP RO 800 (optional with or without VFD)

The number indicates the maximum continuous water outlet (high-pressure) in liters per hour at 59 °F (15 °C) (tap water temperature).

The main pump on the frame or skid is a high pressure pump - this pump will discharge at 1015 psi. The secondary pump (only on HP RO models), if fitted with an RO system is the RO pump which pumps the raw water through the RO membrane at a pressure of 115 - 175 psi (8 - 12 bar) and into the RO water.

The HP and HP RO pump stations are fitted on easy-to-place frames and all components are assembled, tested and ready for use.

All components exposed to water are made of corrosion-resistant material. All hoses are steel-reinforced and drinking water-approved.

Both the high-pressure and RO pumps are directly mounted on their electric motors. Power is supplied to 3-phase asynchronous motors via a magnet-operated protective motor switch.

The high-pressure pump is protected against dry running by the level sensor in the RO tank that stops the system if water level drops. The high-pressure pump is protected against overheating by a temperature sensor that measures the temperature inside the pump.

A pressure switch just after the inlet filter protects the RO pump from dry running.

The HP RO 100, 200 and 300 comes with a 13.2 gallons (50 l) holding tank for the produced RO water, mounted directly on the pump frame where the RO holding tanks of HP RO 500 and 800/1300 are placed on separate frames (52 gallons (200 l) and 132 gallons (500 l) respectively). On the HP RO 100, 200, 300 and 500 models, the high-pressure pump feeds directly from the holding tanks using gravity. Whereas the HP RO 800 and 1300 has a booster pump for pumping RO water from the RO holding tank to the high-pressure pump.

The control unit consists of a touch display and a PLC mounted in the IP 65-rated electrical cabinet as well as a power board for control of the high-pressure pump and connection terminals for power supply (208...480V/3N~/50-60Hz).

From the touch screen, the operator can easily change humidity set point in each section, adjust alarm limits and view hour counters, logged alarms, trend curves, etc.

The pump station is electrically wired at the factory. At the installation site, main power supply, humidity signal, external safety chain, step valves and additional options must be electrically connected to the control unit.

5.3 Model Designation

The specification label on the side of the Nortec HP adiabatic humidifier shows its model number, year made, serial number, power supply and ratings. The breakdown of the model number is shown in Figure 1.

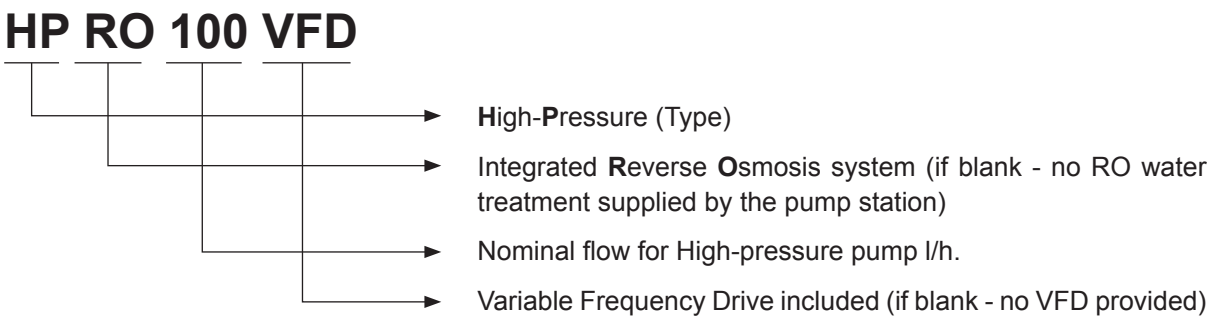


Figure 1: Model number breackdown

Electrical Schematics and Wiring Diagrams

A copy of the electrical schematics and wiring diagrams can be found on the inside panel of the control unit.

5.3.1 Dimensions and weights of pump station

All dimensions in inches (metric at back in Product Specifications)

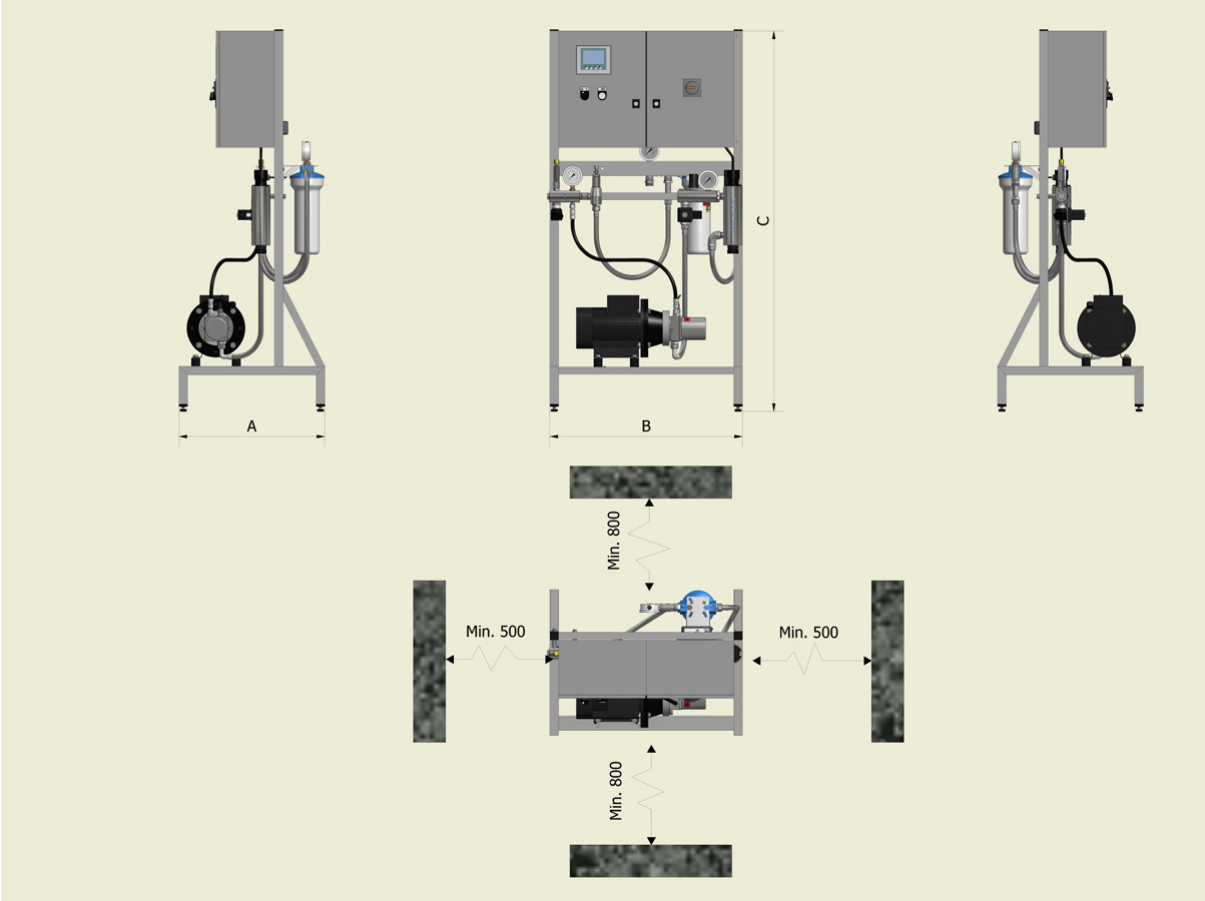


Figure 2: Dimensions pump station (Generic Pump Station shown)

Pump station	Dimension [in]			Weight [lb.]
	A	B	C	
HP 100 and 200 VFD	19.7	26.0	51.2	110 - 143
HP 300, HP 500, HP800	19.7	26.0	51.2	125 - 200
HP 500VFD, 800VFD, and 1300VFD	24.8	26.0	51.2	154, 176, 198

HP RO 100 (200 VFD)	27.6	33.8	63.0	275 - 308
HP RO 300 (500 VFD)	27.6	33.8	63.0	286 - 319
HP RO 500	27.6	33.8	63.0	485
HP RO 800	27.6	33.8	63.0	551
External RO tank for HP RO 500 52 gallons (200 l)	23.6	23.6	39.2	88
External RO tank for HP RO 800 132 gallons (500 l)	23.6	33.8	49.2	132

Valve block 3+1				15
Valve block 4+1				16
Slave station				5

5.4 Nortec HP Pump Station Overview

5.4.1 Brief Description

All components exposed to water are made of corrosion-resistant material. The hoses are drinking water approved high-pressure hoses, stainless steel braided or high-pressure hoses in dimension 1/4" or 3/8". The system is fitted on a frame and all components are assembled, tested and ready to use.

Pump unit: The water-lubricated high-pressure stainless steel pump is directly mounted on the electric motor.
The pump is protected against dry running by a pressure switch that stops the system if the water pressure drops. The high-pressure pump is protected against overheating by a temperature circuit that measures the current temperature in the pump.

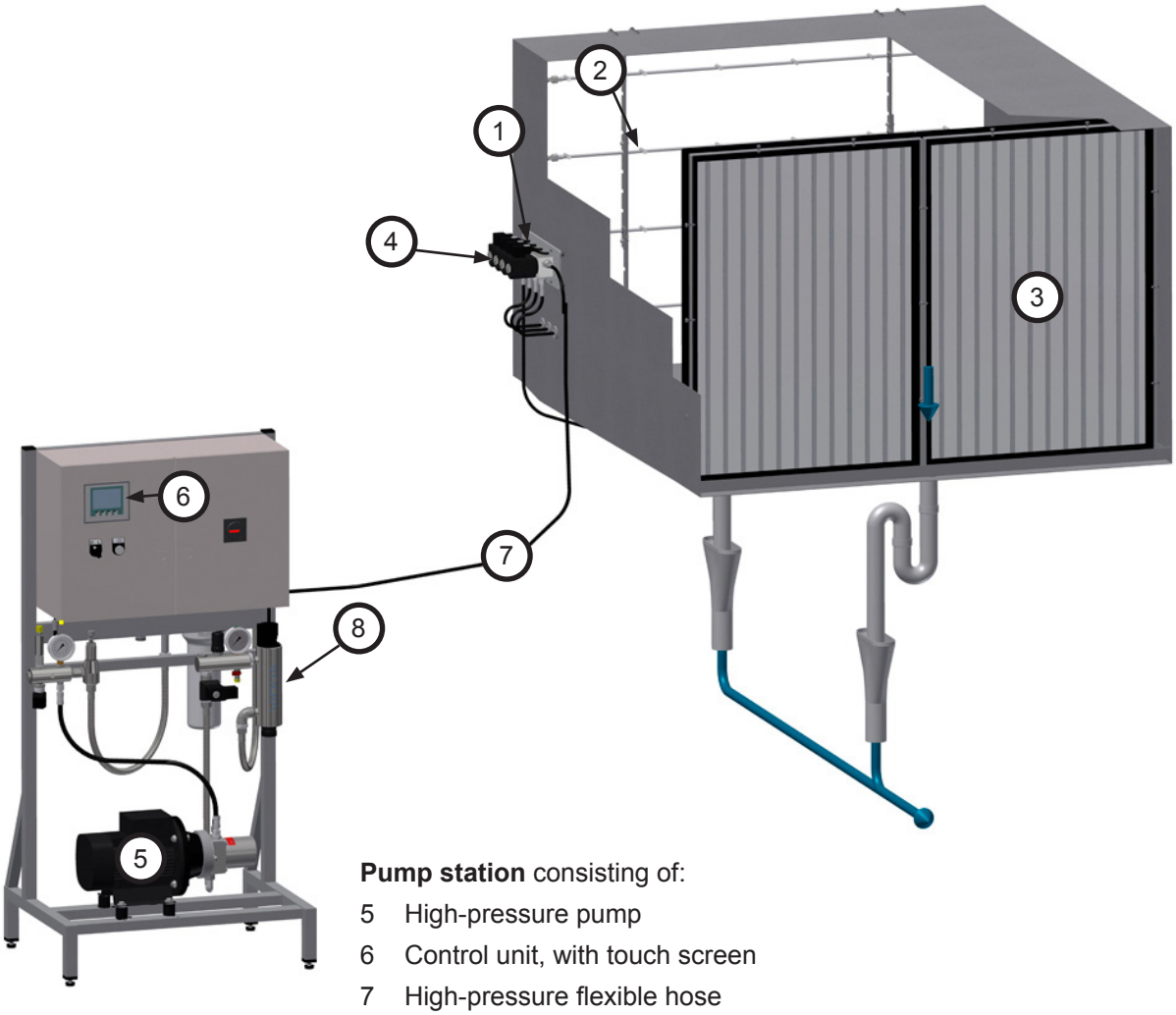
Control unit: the control unit consists of the touch display and PLC. A power board, for control of the high-pressure pump and connection terminals for power supply (108...600V/3N~/50-60Hz). The power board has an alarm switch (NC).

The pump stations can be fitted with various options and extras described in the Notes on planning chapter. The pump station is electrically wired at the factory. At the installation site, main power supply, the humidity signal or humidity sensor, external safety chain, step valves and chosen options must be electrically connected to the control unit.

5.4.2 Stand-alone system Nortec HP (master configuration)

Humidifier unit consisting of:

1 Step valves MV REG1, MV REG2 and MV REG3
2 Nozzle unit
3 Mist eliminator (optional)
4 Flushing valve MV5 high-pressure system



Pump station consisting of:

5 High-pressure pump
6 Control unit, with touch screen
7 High-pressure flexible hose
8 UV-light system (optional)
-- Water meter and conductivity meter (optional, not shown)

Figure 3: Stand-alone system Nortec HP (master configuration)

5.4.3 Compound system Nortec HP (master-slave configuration)

Assuming the system data is within a defined range, the pump station of a stand-alone system may supply pressurized water to up to three further HP systems (slave systems). A so-called master-slave configuration is shown below.

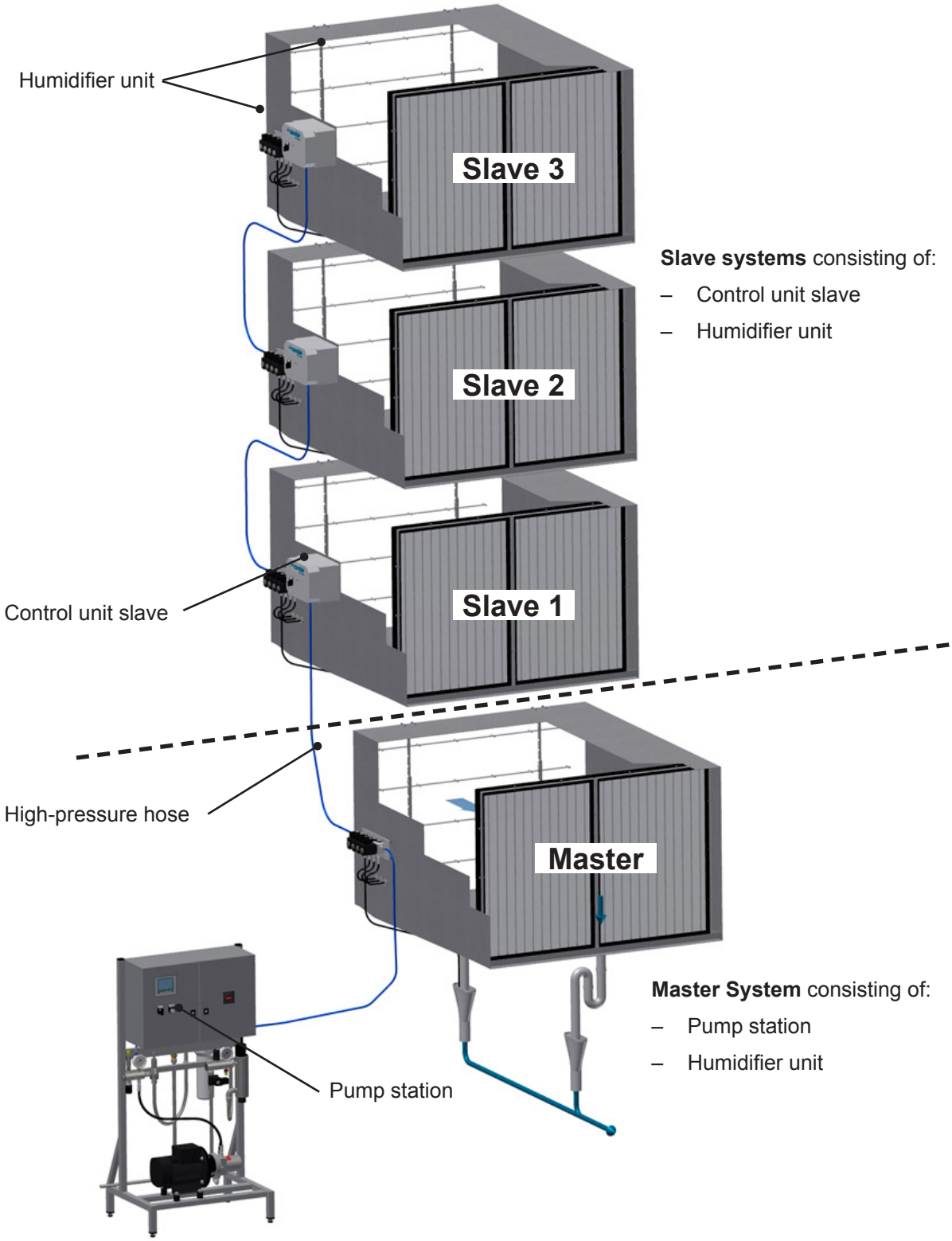


Figure 4: Compound system Nortec HP (master-slave configuration)

5.4.4 Overview pump station Nortec HP 100 - 1300

Figure 5: Overview pump station Nortec HP 100 - 1300

5.4.5 Flow diagram Nortec HP 100 - 1300

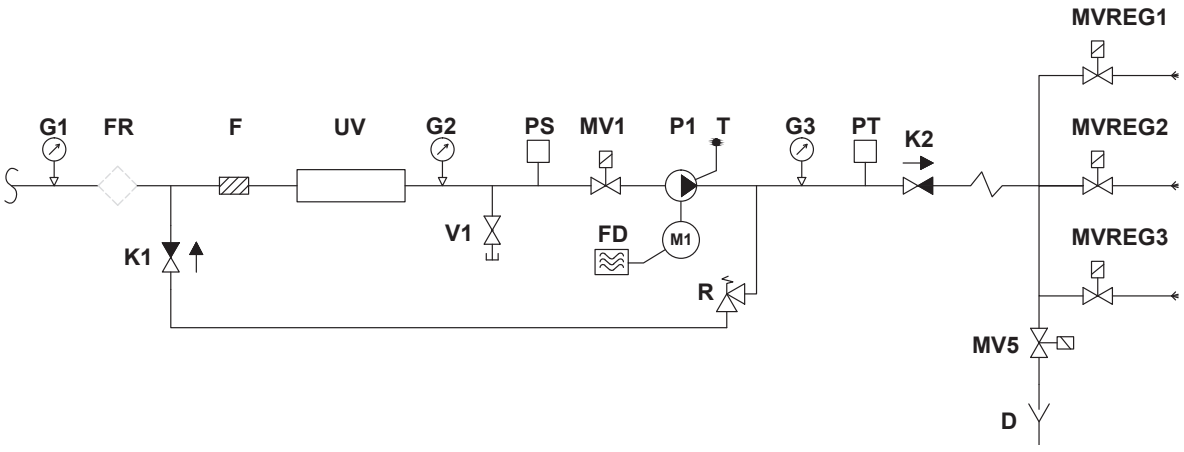


Figure 6: Flow diagram Nortec HP 100 - 1300

5.4.6 Part specification pump station Nortec HP 100 - 1300

D	Drainage system
F	Filter 1µ
FR (optional)	Water meter
G1	Pressure gauge 0-145 psi (0-10 bar)
G2	Pressure gauge 0-145 psi (0-10 bar)
G3	Pressure gauge 0-135 or 0-160 bar
K1	Check valve
K2	Check valve
M1	Motor
MV1	Solenoid valve
MV5	Valve for flushing
MV REG 1	Valve for nozzle strings
MV REG 2	Valve for nozzle strings
MV REG 3	Valve for nozzle strings
P1	High-pressure pump
PS	Pressure switch
PT	Pressure transmitter
R	Pressure reduction
T	Thermostat
UV (optional)	UV system
V1	Test water tap 1/8"

5.5 Nortec HP RO Pump Station Overview

5.5.1 Brief description

Combined high-pressure pump station and reverse osmosis system.
All components exposed to water are made of corrosion resistant material. The hoses are drinking water approved hoses, stainless steel braided or high-pressure hoses in dimension 1/4" or 3/8".The system is fitted on a frame and all components are assembled, tested and ready to use.

Pump unit: The water-lubricated high-pressure stainless steel pump is directly mounted to the electric motor.
In the water inlet a pressure switch protects the RO pump from dry running.
The high-pressure pump is protected against dry running by the level switch in the RO tank that stops the system if water level drops. The high-pressure pump is protected against overheating by a temperature sensor that measures temperature inside the pump.

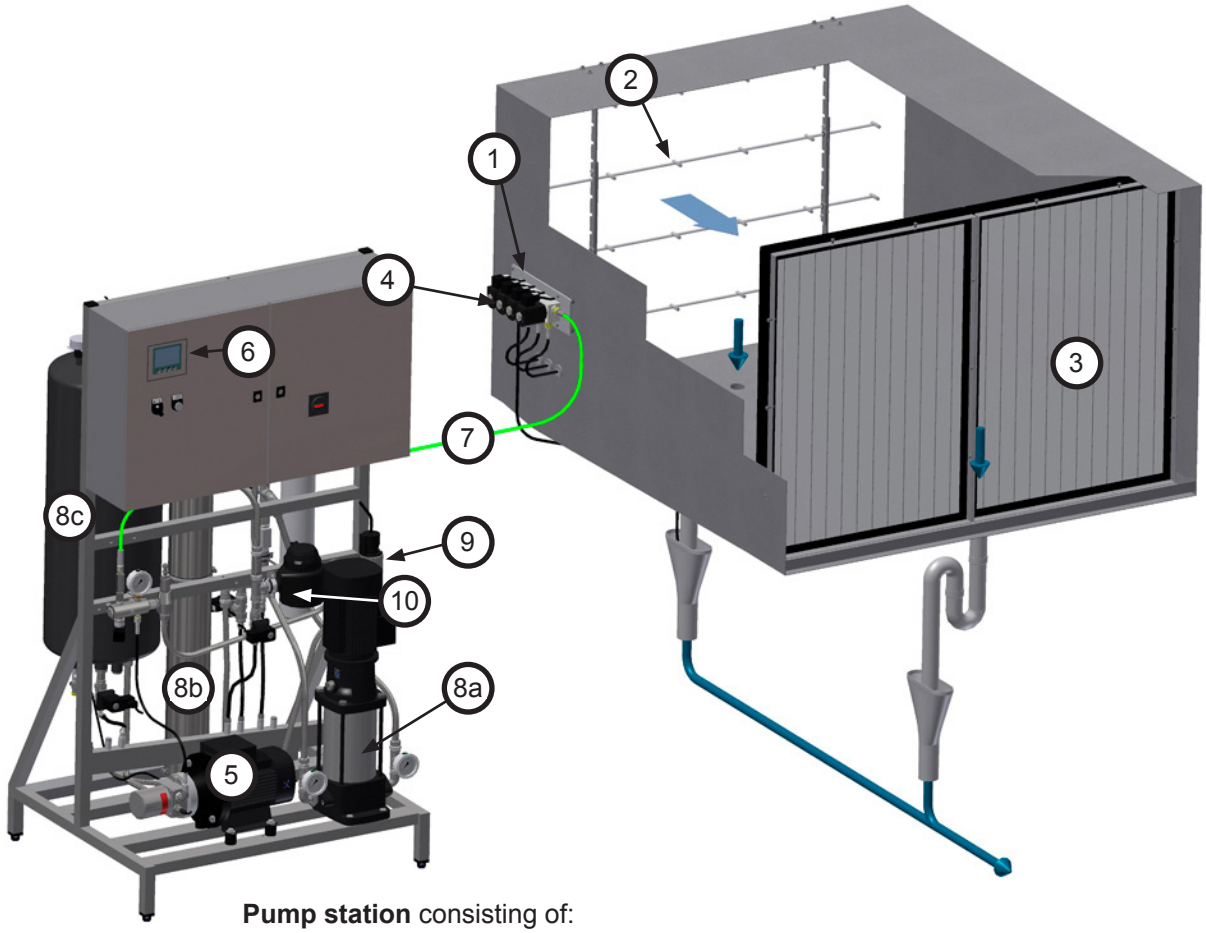
Control unit: The control unit consists of the touch display and PLC. A power board, for control of the high-pressure pump and connection terminals for power supply (208...600V/3N~/50-60Hz). The power board has an alarm switch (NC).

The pump station is electrically wired at the factory. At the installation site, main power supply, the humidity signal or humidity sensor, external safety chain, step valves and chosen options must be electrically connected to the control unit.

5.5.2 Stand-alone system Nortec HP RO 100-800 (master configuration)

Humidifier unit consisting of:

1 Step valves MV REG1, MV REG2 and MV REG3
2 Nozzle unit
3 Mist eliminator (option or product of other manufacturer)
4 Flushing valve MV5 high-pressure system



Pump station consisting of:

5 High-pressure pump
6 Control unit, with touch screen
7 High-pressure flexible hose
8 RO water treatment system (optional)
  a: RO pump
  b: RO membrane
  c: RO water storage tank
9 UV-light system
10 Water meter and conductivity meter (optional)

Figure 7: Stand-alone system Nortec HP RO 100-800 (master configuration)

5.5.3 Compound system Nortec HP RO 100, 200, 300 (master-slave configuration)

It is possible to add up to three slave humidifiers to one master configuration. A so-called master-slave configuration as shown below.

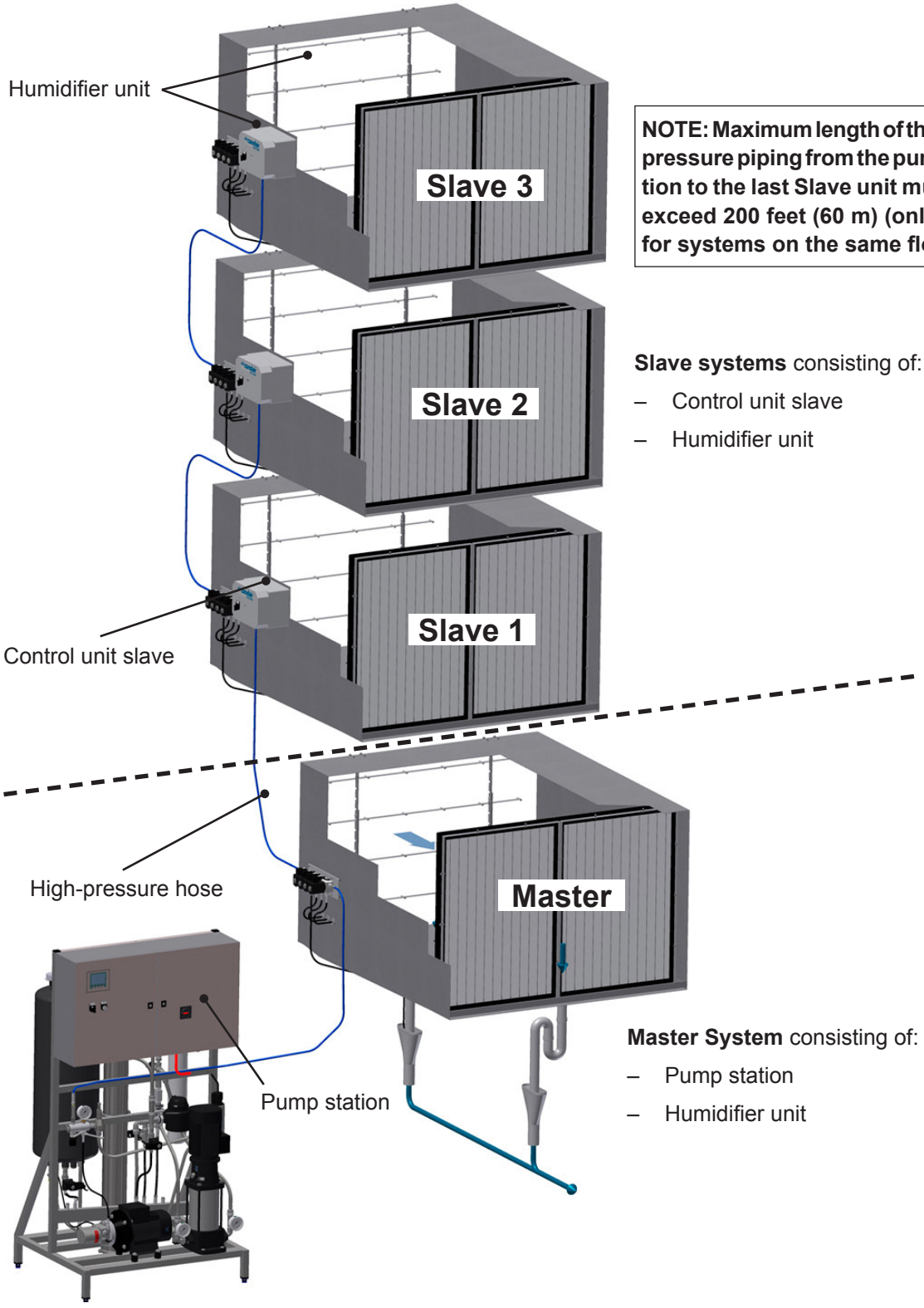


Figure 8: Compound system Nortec HP RO 100, 200, 300 (master-slave configuration)

5.5.4 Overview pump station Nortec HP RO 100, 200, 300

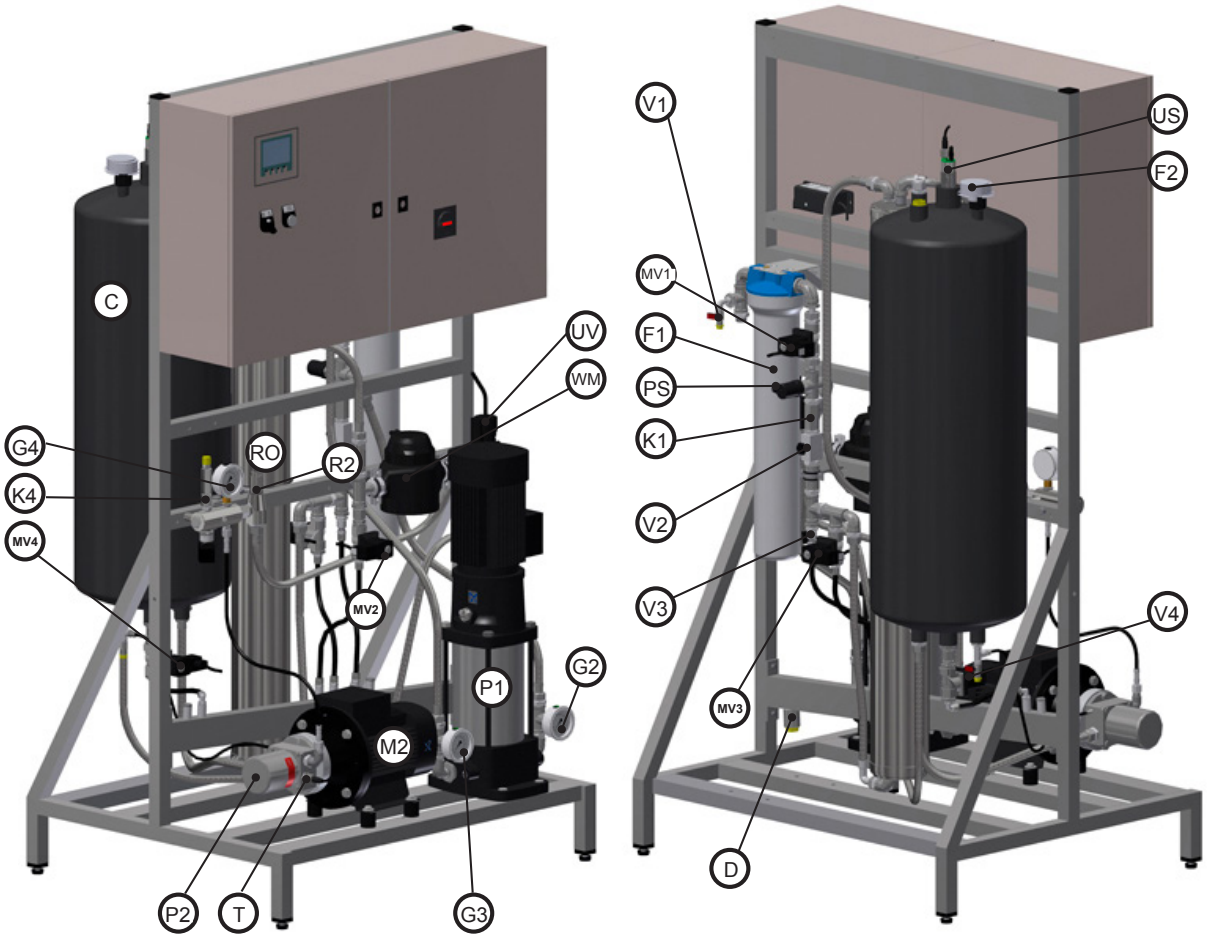


Figure 9: Overview pump station Nortec HP RO 100, 200, 300

5.5.5 Flow diagram Nortec HP RO 100, 200, 300

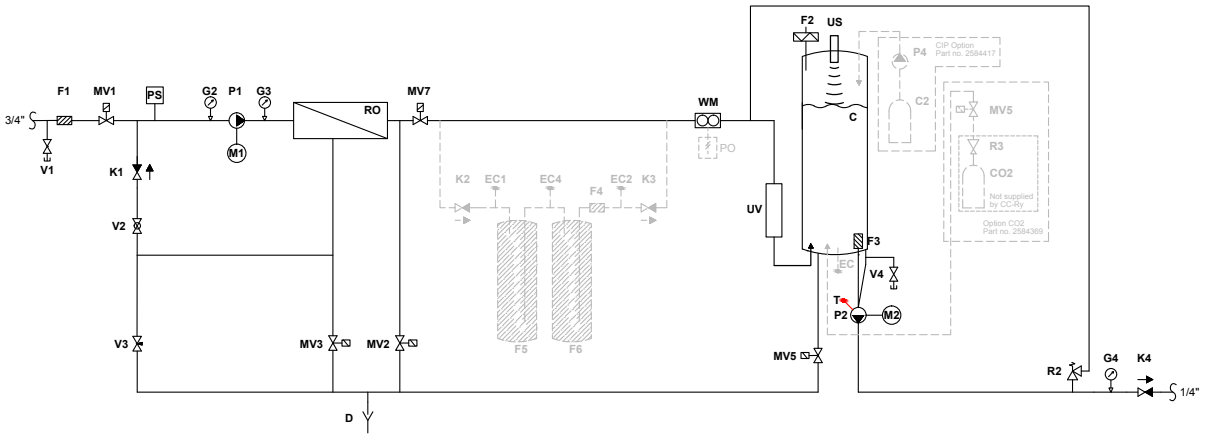


Figure 10: Flow diagram Nortec HP RO 100, 200, 300

5.5.6 Part specification pump station Nortec HP RO 100, 200, 300

C	Permeate container, 14.5 gallons (55 l), black plastic
D	Discharge system
F1	Filter 20", 5 µm
F2	Sterile breathing filter 0,2 µm
F3	Suction filter
G2	Pressure gauge, input pressure RO pump 0-145 psi (0-10 bar)
G3	Pressure gauge, RO pump pressure 0-145 psi (0-10 bar)
G4	Pressure gauge, high-pressure
K1	Check valve 232 psi (16 bar), reverse pressure max. 1.5 psi (0.1 bar)
K4	Check valve
M1	Motor, RO pump HP RO 100: 3x400 VAC, 60Hz, 0.37kW, 1.1A HP RO 300: 3x400 VAC, 60Hz, 0.75kW, 1.9A
M2	Motor, high-pressure pump HP RO 100: 3x400 VAC, 60Hz, 0.5kW, 1.5A HP RO 300: 3x400 VAC, 60Hz, 0.75kW, 1.9A
MV1	ON/OFF valve, 0-145 psi (0-10 bar), 1/2"
MV2	Valve for flushing at start-up, 0-145 psi (0-10 bar), 1/2"
MV3	Valve for membrane flushing, 0-145 psi (0-10 bar), 1/2"
MV5	Drain valve 0-145 psi (0-10 bar) 1/2"
MV7	ON/OFF valve, 0-145 psi (0-10) bar
PS	Pressure switch 0-145 psi (0-10 bar), pre-adjusted to 7.25 psi (0.5 bar)
P1	RO pump
P2	PAH high-pressure pump 1015 psi (70 bar)
RO	RO membrane in stainless steel housing
R2	Pressure regulator, 435-1522 psi (30-105 bar) standard
T	Thermostat
US	Ultra sound level sensor
UV	UV system
V1	Test water tap 1/8"
V2	Ball valve for pressure adjustment 1/2"
V3	Needle valve for concentrate flow
V4	Test water tap 1/8"
WM	Water meter

CO_2 option

CO2	(optional)	CO_2 container
MV5	(optional)	Valve for CO_2
R3	(optional)	CO_2 pressure regulator

CIP option

C2	(optional)	CIP container, 32 fl. oz. (1 L) plastic bottle
P4	(optional)	CIP pump

EC REG 8 option

EC1	(optional)	Conductivity sensor
EC2	(optional)	Conductivity sensor
EC4	(optional)	Conductivity sensor
F4	(optional)	Filter. 5" 5µm
F5	(optional)	Mixbed, ion exchanger bottle (Acquired locally)
F6	(optional)	Mixbed, ion exchanger bottle (Acquired locally)
K2	(optional)	Check valve
K3	(optional)	Check valve

EC option

EC	(optional)	Conductivity sensor

PO option

PO	(optional)	Pulse output for water meter

5.5.7 Pump station Nortec HP RO 500 - Flow diagram

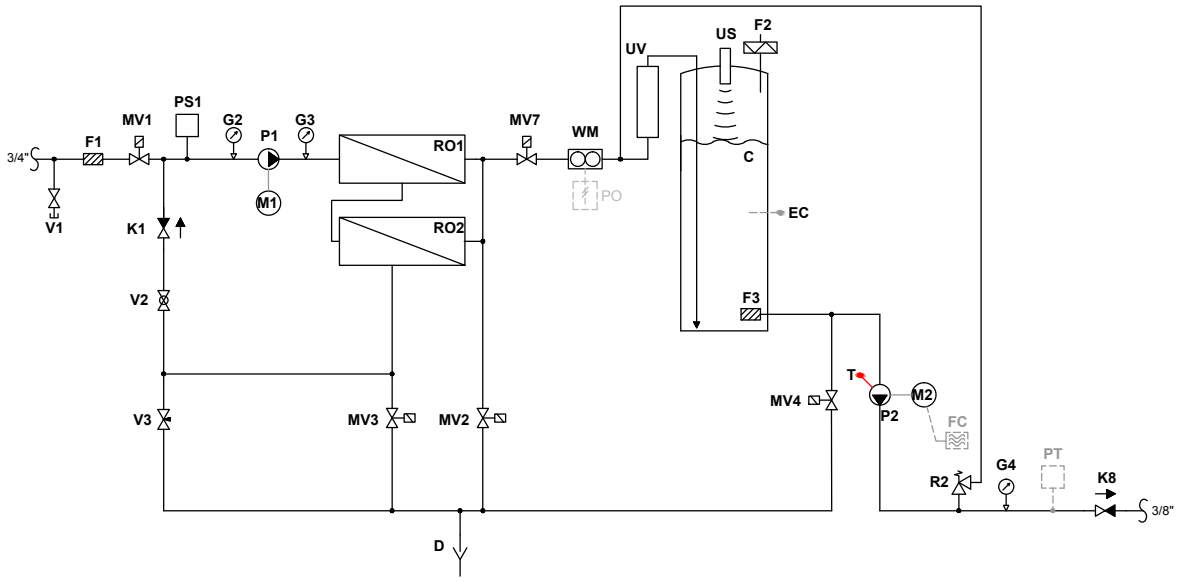


Figure 11: Pump station Nortec HP RO 500 - Flow diagram

5.5.8 Pump station Nortec HP RO 500 - Part specification

C	Permeate container, 14.5 gallons (55 l), black plastic
D	Discharge system
F1	Filter 20", 5 µm
F2	Sterile breathing filter 0,2 µm
F3	Suction filter
G2	Pressure gauge, input pressure RO pump 0-145 psi (0-10 bar)
G3	Pressure gauge, RO pump pressure 0-145 psi (0-10 bar)
G4	Pressure gauge, high-pressure
K1	Check valve 232 psi (16 bar), reverse pressure max. 1.5 psi (0.1 bar)
K8	Check valve
M1/P1	RO pump
M2	Motor, high-pressure pump
MV1	ON/OFF valve, 0-145 psi (0-10 bar), 1/2"
MV2	Valve for flushing at start-up, 0-145 psi (0-10 bar), 1/2"
MV3	Valve for membrane flushing, 0-145 psi (0-10 bar), 1/2"
MV4	ON/OFF 0-145 psi (0-10 bar) 1/2"
MV7	ON/OFF valve, 0-145 psi (0-10) bar
PS1	Pressure switch 0-145 psi (0-10 bar), pre-adjusted to 7.25 psi (0.5 bar)
P1	RO pump
P2	PAHT high-pressure pump 1015 psi (70 bar)
RO1+2	RO membrane in stainless steel housing
R2	Pressure regulator, 435-1522 psi (30-105 bar) standard
T	PT1000 temperature sensor
US	Ultra sound level sensor
UV	UV system
V1	Test water tap 1/8"
V2	Ball valve for pressure adjustment 1/2"
V3	Needle valve for concentrate outlet
WM	Water meter

Options:

EC	(optional)	Conductivity sensor
FC	(optional)	VFD
PO	(optional)	Pulse output for water meter
PT	(optional)	Pressure transmitter for VFD

5.5.9 Pump station Nortec HP RO 800 - Flow diagram

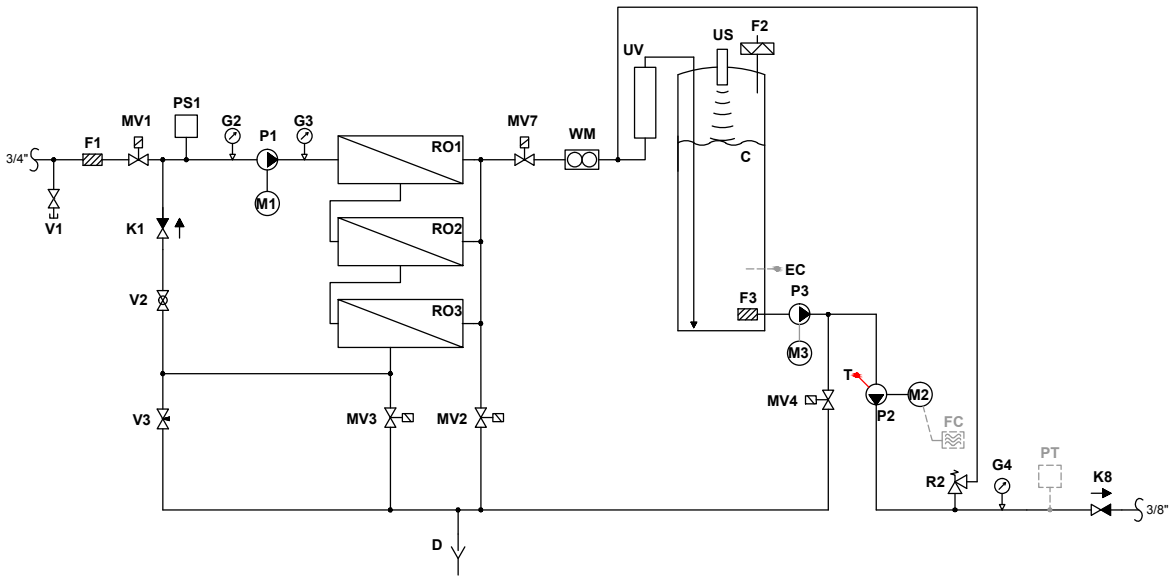


Figure 12: Pump station Nortec HP RO 800 - Flow diagram

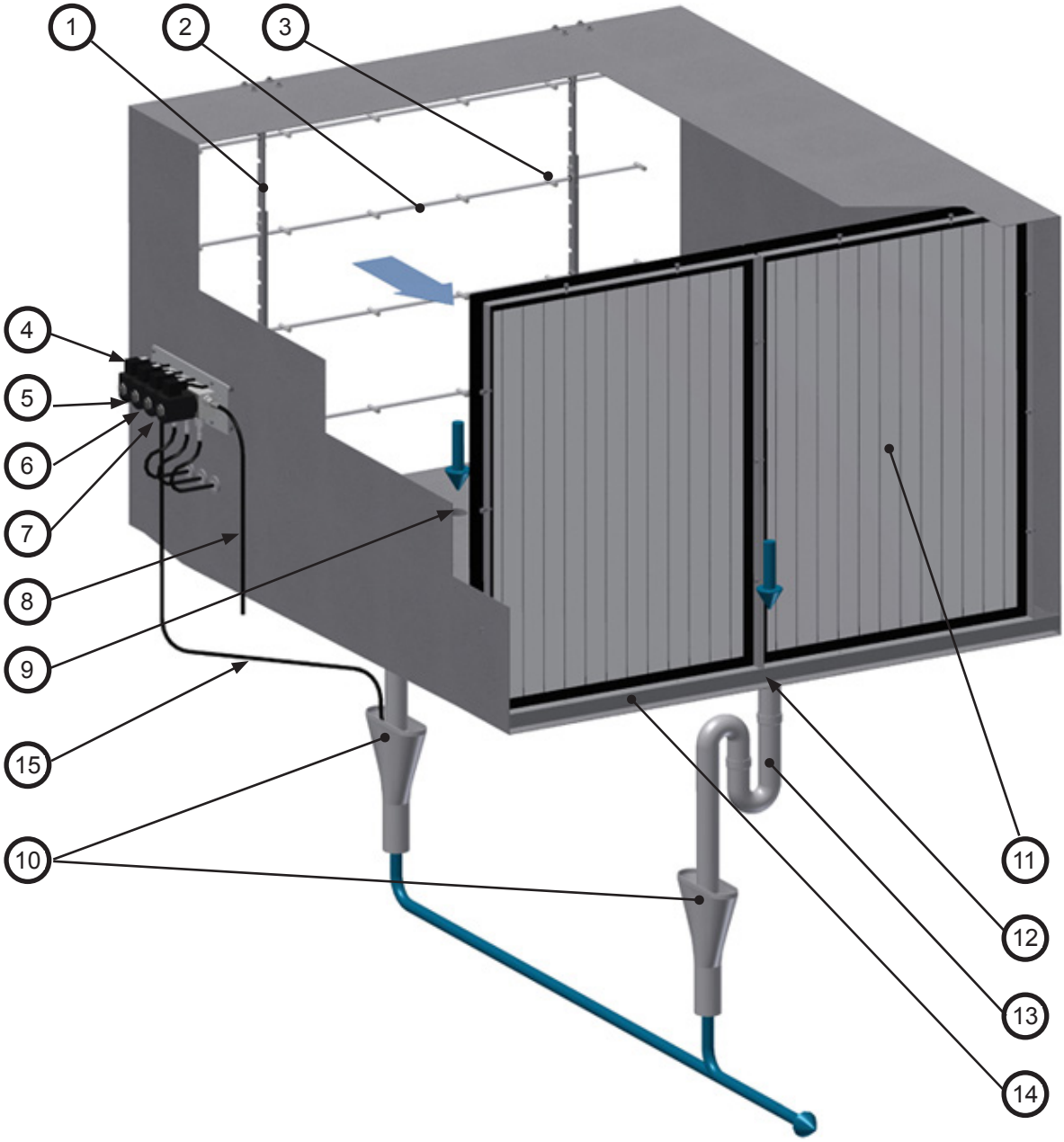
5.5.10 Pump station Nortec HP RO 800 - Part specification

C	Permeate tank, 110 gallons (500 l) external on stand, black plastic
D	Discharge system
F1	Filter 20", 5 µm
F2	Sterile breathing filter 0,2 µm
F3	Suction filter
G2	Pressure gauge, input pressure RO pump 0-145 psi (0-10 bar)
G3	Pressure gauge, RO pump pressure 0-145 psi (0-10 bar)
G4	Pressure gauge, high-pressure
K1	Check valve 232 psi (16 bar), reverse pressure max. 1.5 psi (0.1 bar)
K8	Check valve
M1/P1	RO pump
M2	Motor, high-pressure pump
M3/P3	Booster pump
MV1	ON/OFF valve, 0-145 psi (0-10 bar), 3/4"
MV2	Valve for flushing at start-up, 0-145 psi (0-10 bar), 1/2"
MV3	Valve for membrane flushing, 0-145 psi (0-10 bar), 1/2"
MV4	ON/OFF valve 0-145 psi (0-10 bar) 1/2"
MV7	ON/OFF valve, 0-145 psi (0-10) bar
PS1	Pressure switch 0-145 psi (0-10 bar), pre-adjusted to 7.25 psi (0.5 bar)
P2	PAHT high-pressure pump 1015 psi (70 bar)
RO1-3	RO membrane in stainless steel housing
R2	Pressure regulator, 435-1522 psi (30-105 bar) standard
T	PT1000 temperature sensor
US	Ultra sound level sensor
UV	UV system S5Q-PA/2
V1	Test water tap 1/8"
V2	Ball valve for pressure adjustment 1/2"
V3	Needle valve for concentrate outlet
WM	Water meter

Options:

EC	(optional)	Conductivity sensor
FC	(optional)	VFD
PT	(optional)	Pressure transmitter for VFD

5.6 Humidifier unit



1 Supporting structure nozzle unit
2 Nozzle pipes
3 Spray nozzle
4 Flushing valve MV5 (0.02 inches (0.5 mm) orifice in outlet)
5 Step valve MV REG3 (4/7)
6 Step valve MV REG2 (2/7)
7 Step valve MV REG1 (1/7)
8 High-pressure hose from pump station
9 Water drain after nozzles
10 Open drain funnel (by customers)
11 Mist eliminator (option or product of other manufacturer)
12 Water drain after humidifier unit
13 Siphon (by customers, height adapted to duct pressure)
14 Separation element humidifier unit (min. height: 1.2 inches (3 cm), sealed towards the duct floor and the duct walls)
15 Drain hose from flush valve MV5

Figure 13: Humidifier Unit

5.7 Functional description

5.7.1 General function

Pressurized water is fed to the nozzles, through hoses connected via a valve block to the nozzle pipes. The nozzles atomize the water to a fine mist which is absorbed by the air inside the duct.
The Nortec HP control system consists of a PLC (Programmable Logic Controller) which controls the valves and adjusts humidity in the duct. Adjustment is carried out by means of a special proportional regulator, which activates the necessary number of steps (valves) in relation to the current humidity requirement.
A flushing function is included, which protects against hygiene problems related to standing water. If one of the nozzle pipes has been inactive for half an hour, the control will trigger a rinse pulse lasting two seconds. This ensures that no standing water in pipes or hoses will be older than a few hours.
The control signal comes from an analogue 0-10 volt signal. It is possible to choose between two different modes for this signal:

– Humidity control, where humidity is measured against the relevant input and the control then calculates how many steps to activate in order to achieve the required level of humidity.
– Direct capacity, where the required capacity is transferred directly from a possible CTS/BMS.

Hour counters are incorporated into the control unit. One hour counter that indicates the pump's running time to be used for setting service intervals, one hour counter for the RO pump and one hour counter for each of the steps, which summarizes the period of time where each step is active.

5.7.2 Control

With single air handling unit (i.e. stand-alone) humidification systems (master configuration) the control unit is built into the pump station. The control unit features a separate power supply (208...600V/3N~/50-60Hz), a control/humidity signal input, connectors for the external safety chain and relay connectors for the remote operation and fault indication (optional). In addition, the control unit incorporates the frequency converter for the control of the jetting pump.
With compound systems (more than one air handler), each slave is equipped with a separate control unit (slave panel). Each control unit features a separate power supply (208-240V/1N~/50-60Hz), a control/humidity signal input, connectors for the external safety chain and relay connectors for the remote operation and fault indication (optional). A bus cable connects each slave control unit to the control unit of the master system that controls the high-pressure pump (RJ-45 cable, CAT5, or CAT6 sold separately).

5.7.3 Humidification

The control of the humidification system is established via an external P/PI controller or the PID controller built into the control unit.
As standard, the humidification is effected with 7 step control (or 3 stage valve block). Finer modulation is possible with four valve blocks which give us a 15 step control (optional).

5.7.4 Monitoring of high-pressure pump

The supply pressure and pump temperature are permanently monitored. The HP pump automatically stops if one of these values is outside the admissible range. A respective error message appears in the display.
In addition, the control unit of the pump station and the slave control units can be equipped with a remote operating and fault indication print. The following operating conditions can be transferred by the relays: “Error", “Humidification", “Maintenance" and “Unit on".

5.7.5 Nozzle unit

The nozzle unit consists of several nozzle pipes, which are equipped with the necessary number of nozzles (specific to each system and based on design). The individual nozzle pipes are divided into three different spray circuits (1/7, 2/7 and 4/7). The spray circuits are connected via high-pressure hoses 1/8" or 1/4" and T-pieces to the valve block.

5.7.6 Mist eliminator

Nortec highly recommends the use of a mist eliminator downstream of the high pressure nozzles. The installation of the mist eliminator is generally done in the field or at the air handling manufacturer's factory. Nortec recommends a Factory Trained Technician to insure a complete and proper install.
Nortec provides its own mist eliminator and recommends that the absorption distance for which the system was designed for, from nozzle tips to mist eliminator, be adhered to.
The Nortec Mist Eliminator is a single bank water droplet removal system installed at a predefined distance from the water entry point. The humidified air is to come into contact with the Mist Eliminator and any unabsorbed droplets of water are removed from the air stream. The collected water accumulates on the media then descends downward towards the bottom of the Mist Eliminator. During this process much of the collected water is absorbed into passing air while any remaining water is funneled to one of two drains via a pre-installed drain pan. See Install section on Mist Eliminators.

The Mist Eliminator is available in standard sizes ranging from 4 ft. high x 4 ft. wide to 12 ft. high x 20 ft. wide with 4 feet (1.22 m) increments between. If a duct size does not fall under one of our standard sizes simply order the next larger size then cut to fit.

5.8 Options

Table X shows the list of options for the Nortec HP and HP RO adiabatic humidifier. Contact your Nortec representative for more details.

Table 1: Nortec HP Options

Option	Description
Master/slave configuration	Allows up to 4 individually controlled humidifiers to share a common pump.
UV water treatment Nortec recommends always choosing this option**!**	Factory installed ultraviolet lamp inhibits bacterial growth in the humidification water enhancing hygienic operation and improving operational safety.
Mist eliminator	Easy to install droplet filter contains water to a given evaporation distance and improves water efficiency through post evaporation.
Conductivity sensor	Continuously monitors incoming water quality by measuring conductivity and triggers alarm if water values are out of range. Provides peace of mind and well as enhanced operational safety.
Water meter	Integrated water meter shows consumption. Ideal for building performance monitoring or claiming regional water and sewer tax credits.
High precision system **15 step regulation**	Extra step valve which improves humidity regulation accuracy up to +/-2 RH%
Digital status relay	The pump station is fitted with four digital status relays: Alarm (pump stopped), On/off status, Humidifying and Maintenance
Communication gateway	Communication gateway using the TCP/IP protocol, integrating the Nortec HP/HP RO into a monitoring, automation or BAS system.
Integrated RO system	Provides a high performance reverse osmosis water treatment system integrated directly into the high-pressure pump skid.

5.9 Accessories

Table XX shows the list of accessories for the Nortec HP and HP RO adiabatic humidifier. Contact your Nortec representative for more details.

Table 2: Nortec HP Accessories

Accessory	Description
Water Softener	Self-regenerating ion exchange softener is ideal for systems with integrated RO system. Removes hardness prior to the RO system prolonging membrane life and saving water.
Carbon Filters	Activated carbon pre-filter removes free chlorine from supply water. Recommended for systems with integrated RO system when chlorine concentrations are above 0.05 – 0.1 mg/l.
Additional Hose	Provides additional high-pressure hose for connections between pump and valve blocks. Available in 9.8 feet (3 m), 16 feet (5 m), and 32 feet (10 m) lengths.

6 Installation

6.1 General

Strictly observe and perform all installation tasks including the mounting of the unit and connection of the water and power supplies as described in this manual.

Observe and comply with all local and national codes dealing with water and electrical installations. Nortec does not accept any liability for installation of humidification equipment by unqualified personnel, or the use of equipment/parts that are not authorized by Nortec.

All statements relating to the correct positioning and installation must be followed and complied with.

When installing components of the Nortec HP use the fixing materials supplied with the unit. In case of doubt, please contact your Nortec supplier.

Personnel Qualifications

All installation work must be performed only by persons familiar with the Nortec HP Adiabatic High Pressure Humidifier and sufficiently qualified for such work.

All work concerning the electric installation must be performed only by adequately qualified personnel (electrician or workman with equivalent training).

Safety

For all installation work the ventilation system in which the Nortec HP will be installed is to be rendered inoperative and prevented from further inadvertent operation.

The pump station and possible secondary control units (panels, boxes, controls) may be connected to electric mains only after all installation work has been completed.

Observe the following safety precautions:

WARNING!
Risk of injury and risk of damage to equipment

Do not retighten/unscrew hoses while the system is pressurized!

CAUTION!
Risk of breeding ground for bacteria

Do not use oil, grease, glue, Teflon, silicon, O-ring lubrication, etc. when assembling pipes or hose connections.

All of the above products can act as food for bacteria and therefore may pose a health risks.

Prevention: Wash your hands before or wear clean gloves while assembling parts in direct contact with water. Keep dust covers on pipes and hoses until just before assembly. Only approved lubricant is dish soap

CAUTION!

Do not fasten the pump station or hoses/pipes to vibrating installations.

CAUTION!
Risk of damage to internal components from electrostatic discharge (ESD)

The word “CAUTION" in conjunction with the general caution symbol is used to provide safety instructions that, if neglected, may cause damage and/or malfunction of the unit or damage to property.

WARNING!
Heavy object - risk of injury!

The pump station or pump skid are extremely heavy. Smaller models can weigh 275 lbs. (125 kg) while bigger units can weigh in excess of 550 lbs. (250 kg).

Prevention: Always use appropriate lifting device(s), seek proper assistance, use safety equipment, harness prior to lifting or moving any Nortec ML equipment.

Recommended Tools

– 1.25 in. (32mm) hole saw (hole cutter - to drill the holes for hose bushings in duct)
– Power drill with steel drill bits set
– Screwdriver set (remember small screwdriver for terminals)
– Bubble level
– Tongue-and-groove pliers (i.e. groove-joint pliers, adjustable pliers, slip-joint pliers)
– Wire cutters
– Spanner set
– Sealant gun with water resistant sealant (sealant must be approved by local regulations for materials in air ducts)
– Tape measure
– Marker
– Box cutter

Note! The Nortec HP are delivered with all hoses cut into length and fitted with the hose connectors needed to do the installation. However sometimes it is desirable to shorten the hoses. In this case always use the special hose tool to avoid leaks:

Part No.	Description
160001000	Part no 160001000. Special tools for assembling of 1/8" hose
160005000	Part no 160005000. Special tools for assembling of 1/4" hose
160006000	Part no 160006000. Special tools for assembling of 3/8" hose
160002000	Part no 160002000. Circular cutter for high-pressure hose

6.2 Site Requirements

6.2.1 Important notes on installation and air handling units (AHU ducts)

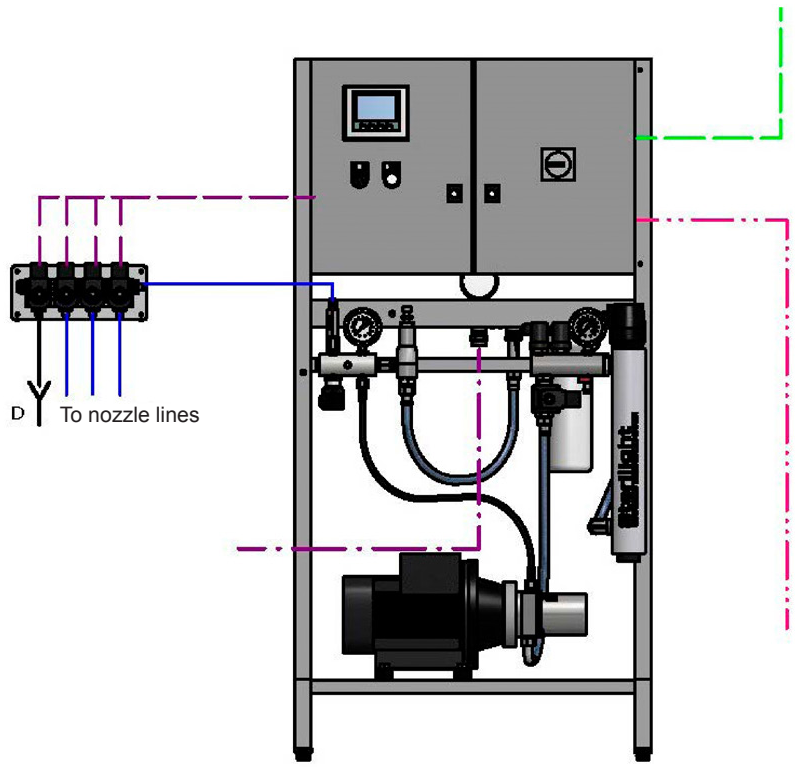
The system-specific dimensions (dynamic drawing) for the positioning of the humidifier unit in the duct are to be found in the installation documents (with submittals), which are provided with your system.

In addition to the installation instructions please observe the following complementary notes on mounting:

- Caution, demineralized water is aggressive! The Nortec HP system uses demineralized water. All components (duct/air handling unit, mounting accessories, drain line, etc.) in the humidifier unit area must be made of stainless steel (DIN 1.4301/AISI 304 or better) or plastic resistant to demineralized water.
- For installation and maintenance of the humidifier unit, the ventilation duct/ air handler must be equipped with a viewing window and a sufficiently large maintenance access door.
- In the humidifier unit area, the ventilation duct/ air handling unit must be waterproof.
- If the ambient air is cold, the ventilation duct must be isolated to prevent the humidified air from condensing at the walls.
- **Important!** At the installation site, an air filter meeting MERV 8 quality specifications or better must be installed before the humidifier unit. MERV13 would be preferred.
- The section of the duct holding the humidifier unit must be equipped with a drain pan having two auxiliary drains, one before and one after the mist eliminator. Ensure the drain pan is double sloped towards the drain. Make sure the water in the drain pan has unhampered access to the drains. Each water drain must be connected to the sewage system separately, via a siphon (P-trap). For hygienic reasons these should be open drains to the sewage line of the site.
  Important: The effective height of the siphon depends on the duct pressure. The proper layout of the draining system is the customer's responsibility.
- The **minimum distance of 15" (0.4 m) between the humidifier unit and a possible heating component (hot water coil, electric coil, etc.)** as well as the **mounting dimensions according** to the system diagram **must be complied with**.
- To prevent water drops from breaking away at the mist eliminators the **air flow to the humidifier unit must be uniform with regard to the entire area**. Air rectifiers or perforated plates must be installed before the humidifier unit, as required.
- The admissible air velocity in the duct before the humidifier unit is 100 fpm (0.5 m/s) to 785 fpm (4.0 m/s)

6.3 Installation Overview

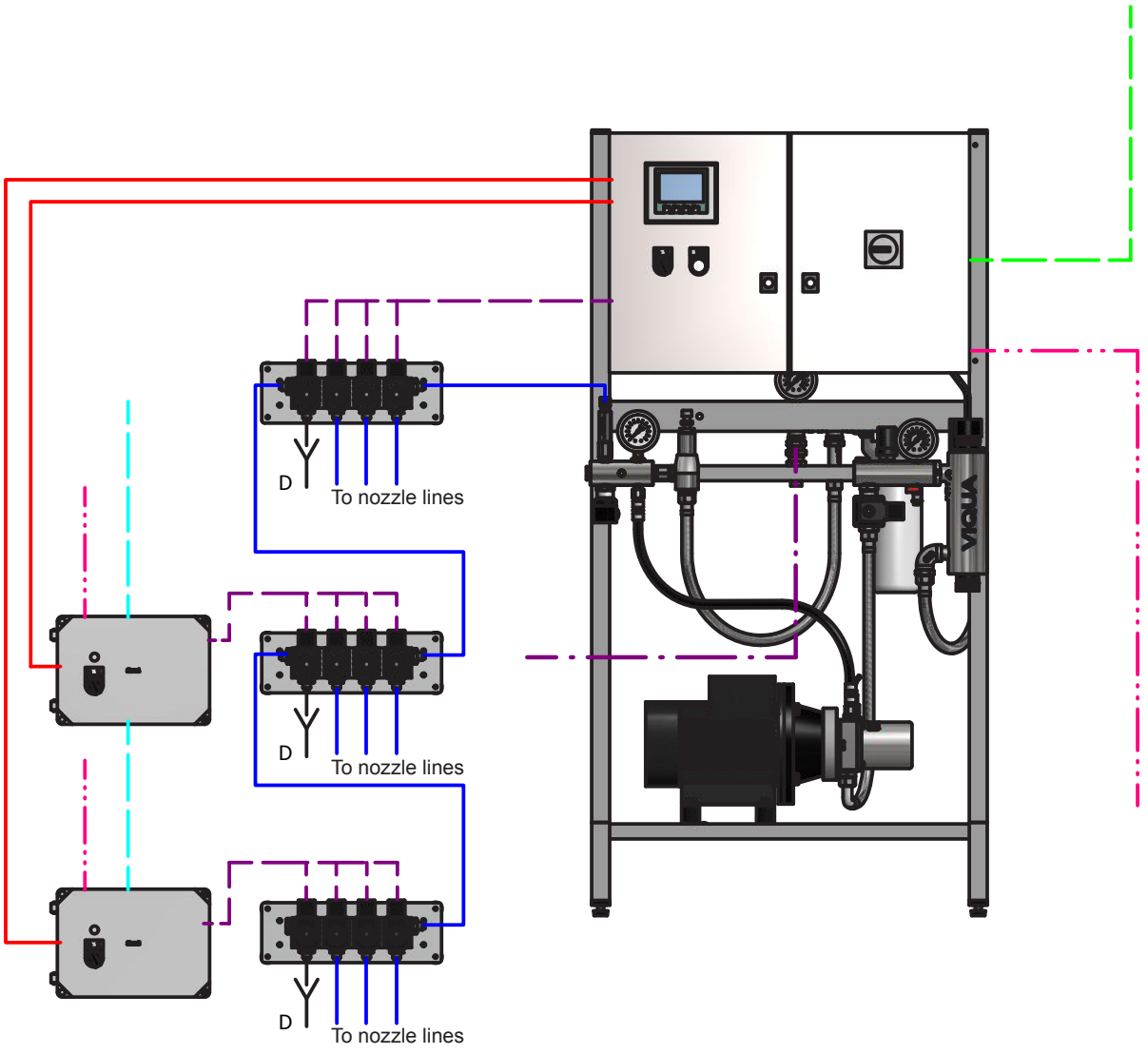
6.3.1 Stand-alone system (master configuration)



On/Off supply solenoids, 24V DC
Power supply to pump station, 208 ... 600 V 50 /60 Hz
Water supply: HP: 14.8 psi ... 58 psi (1 ... 4 bar), HP RO: 36 psi ... 01 psi (2.5 ... 7 bar)
Control humidity signal, 0... 10 V or 4...20 mA control/humidity signal
High-pressure water to valve block and nozzle lines, 870 psi ...1015 psi (60...70 bar)

Figure 14: Stand-alone system (master configuration)

6.3.2 Compound system (master-slave configuration 1 or 2 slaves)



On/Off supply solenoids, 24V DC

Power supply to pump station, 208 ... 600 V 50 /60 Hz

Water supply: HP: 14.8 psi ... 58 psi (1 ... 4 bar), HP RO: 36 psi ... 101 psi (2.5 ... 7 bar)

Control humidity signal, 0... 10V or 4...20 mA control/humidity signal

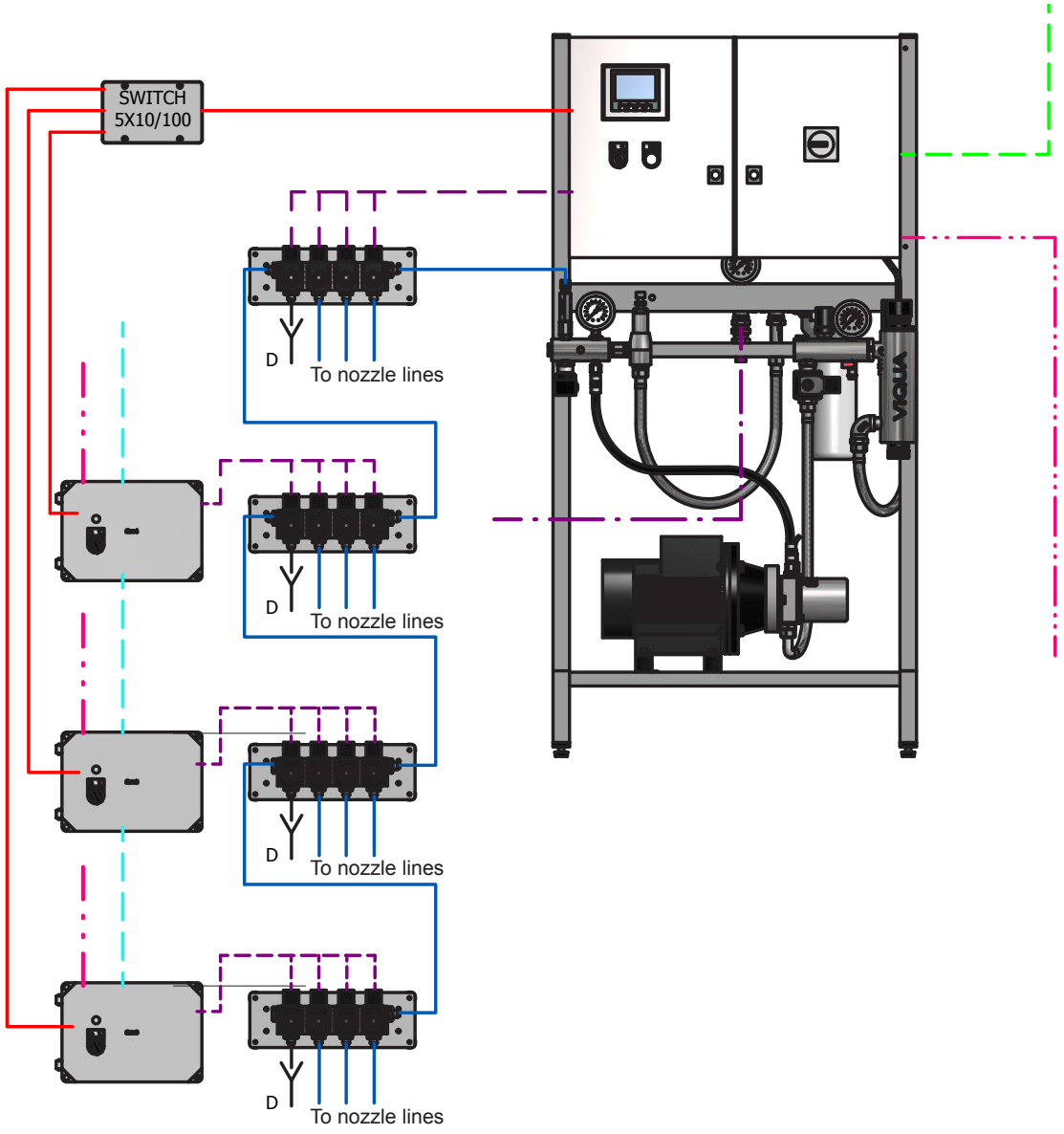
High-pressure water to valve block and nozzle lines, 870 psi … 1015 psi (60 ... 70 bar)

Internal communication, RJ45 cable, -LAN, TCP/IP protocol

Power supply to slave control cabinet, 110-240 V 50/60 Hz

Figure 15: Compound system (master-slave configuration 1 or 2 slaves)

6.3.3 Compound system (master-slave configuration 3 slaves)



On/Off supply solenoids, 220-230 V 50/60 Hz or 24V DC

Power supply to pump station, 208 ... 600 V 50 /60 Hz

Water supply: HP: 14.8 psi ... 58 psi (1 ... 4 bar), HP RO: 36 psi ... 101 psi (2.5 ... 7 bar)

Control humidity signal, 0... 10V or 4...20 mA control/humidity signal

High-pressure water to valve block and nozzle lines, 870 psi ... 1015 psi (60 ... 70 bar)

Internal communication, RJ45 cable, -LAN, TCP/IP protocol

Power supply to slave control cabinet, 110-240 V 50/60 Hz

Figure 16: Compound system (master-slave configuration 3 slaves

Please note: The data switch used when connecting 3 slaves are not supplied by Nortec

6.3.4 Compound system > 211 gph (800 l/h) (master-slave configuration 1-3 slaves)

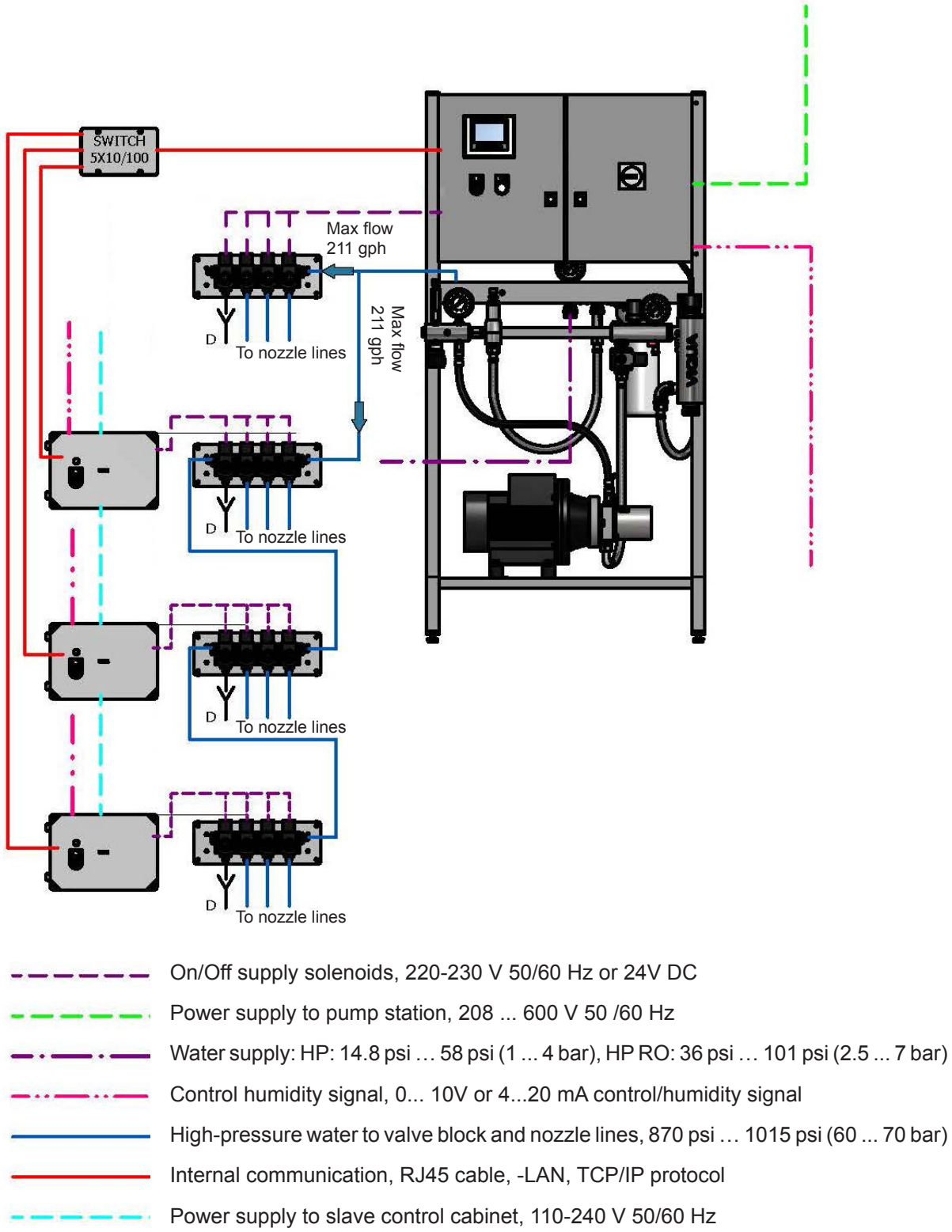


Figure 17: Compound system > 211 gph (800 l/h) (master-slave configuration 1-3 slaves)

Please note: The data switch used when connecting 3 slaves are not supplied by Nortec

6.4 Installing the Nozzle Grid Assembly

Example on principal drawing, provided with each humidifier unit

Each High Pressure In-Duct system designed by Nortec comes with a unique duct specific ‘Principal Drawing’ (a.k.a. ‘Dynamic Drawing’ in Nortec HELP). The Principal Drawing is designed to represent the cross section of the air handling unit or duct. The internal width and height dimensions of the duct are shown, with particular emphasis to the way the nozzle grid (manifold) and tubing (high pressure hoses) are piped back to the valve block. This drawing facilitates the installation and most importantly ensures proper staging based on valve block and nozzles selected.

To ensure your system performs as designed and as intended for a smooth efficient absorption and proper humidification load adhere to the following:

3. It is crucial to note that the number of nozzles and blanks (blind nozzles) to be installed per staging valve is also indicated and must be adhered to, as per the drawing.
4. The principal drawing also denotes the proper tubing and hose connections to connect to each nozzle spray bar, to each staging valve (REG1, REG2, REG3….) and subsequent T-piece (T-valve)

Please note the following important points:

– It is important to note that the nozzles must always be on the top of the nozzle bar.
– Blind or blank nozzles must never be used as the last nozzle.
– Recommended distance of 8 inches (200 mm) between nozzle bars
– Minimum 4 inches (100 mm) between nozzle and duct wall

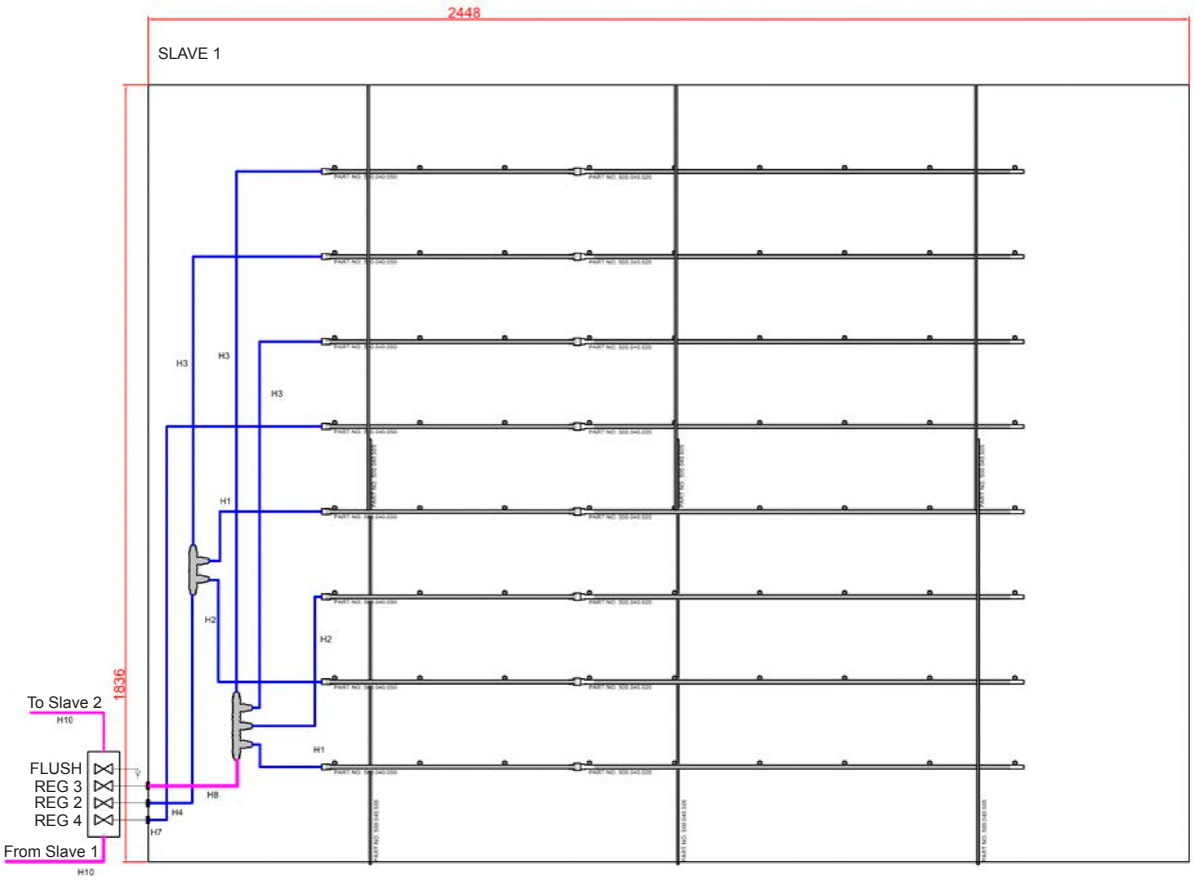


Figure 18: Example on principal drawing, provided with each humidifier unit

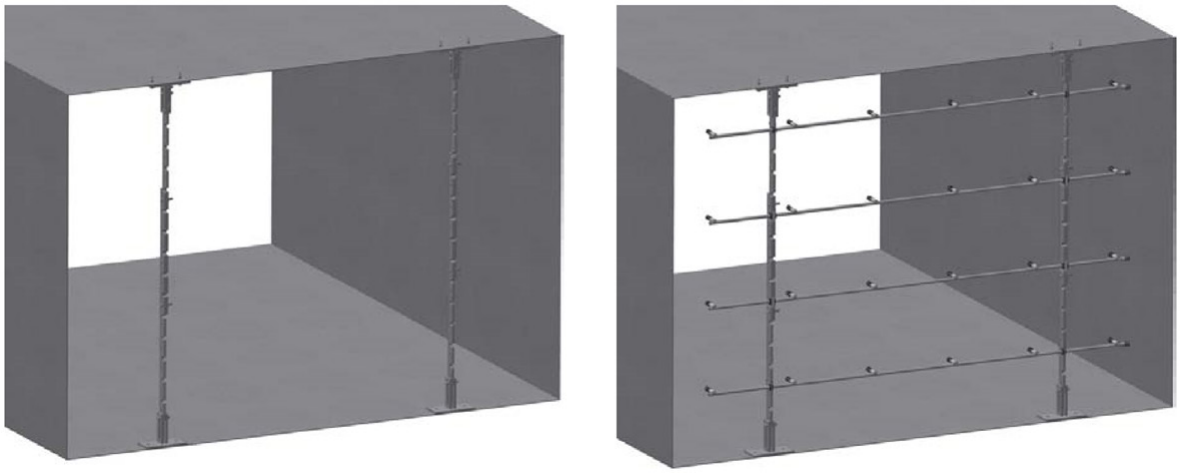


Figure 19: Example of fixture assembly

The following six steps are to install and mount the inner duct work nozzle rid or nozzle manifold and all ancillary equipment in the air handling unit, as well as the valve block:

1. **Installing the vertical mounting fixture (rails)**

   Mark the position of the top brackets at the duct ceiling, approx. 1/5 of the duct width in from each wall. Then, drill the ø0.13 inch (ø3.3 mm) fixing holes (screws) or ø0.24 inch (ø6 mm) (bolts and nuts). **Important!** Make sure that the **fixing holes** in the left and right of the duct ceiling are **exactly aligned**

   Fix the top brackets to the ceiling of the duct with screws or bolts provided.

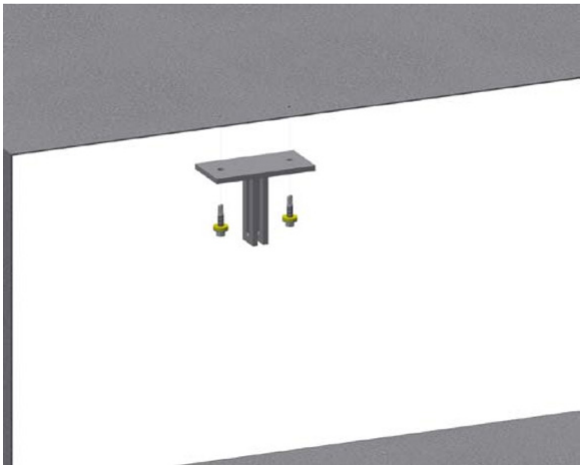


Figure 20: Fixing top brackets

Fix the one piece of pipe fixture to the top brackets using the bolts and nuts provided, tighten loosely.

Figure 21: Fixing pipe fixture

Bolt the bottom bracket to the pipe fixture tighten loosely.

Important! Do not remove the film from the adhesive pad underneath the bottom bracket.

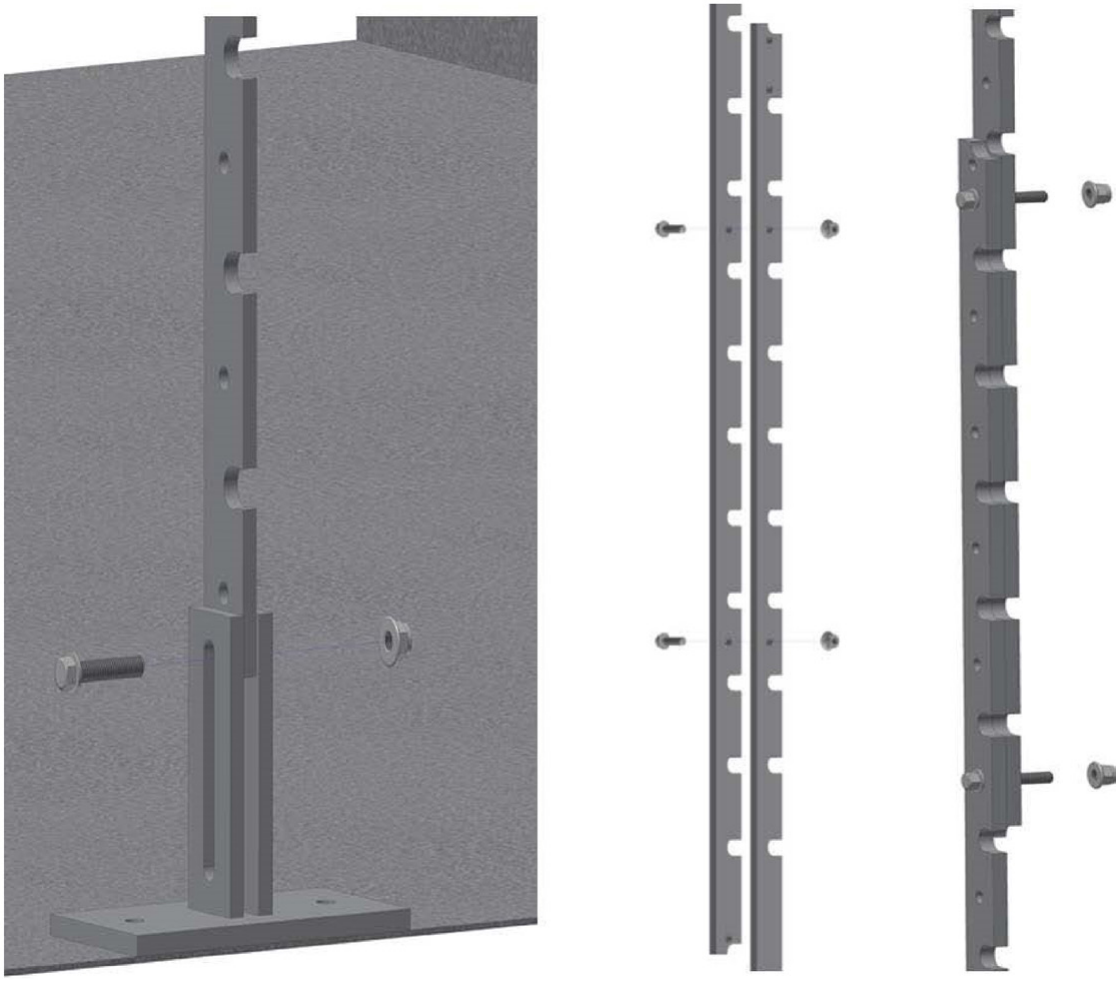


Figure 22: Fixing bottom bracket to pipe fixture

Bolt the two pipe fixtures together, adjust the length such the bottom bracket can slide up and down, tighten the bolts

Use a spirit level to adjust the fixture both sideways and back/forth so that the pipe fixture is exactly vertical in all directions.

Now mark the position of the bottom bracket using a scratch pin or similar, to draw around it. Clean the bottom of the duct thoroughly underneath the bottom bracket, using a degreaser.

Remove the film from the adhesive pad, and press the bottom bracket in place.

Check that the fixture is still vertical in all directions.

Tighten all bolts. The pipe fixture is now in place.

2. Mounting the nozzle pipes

WARNING!

The nozzle pipes must be installed with the nozzles upwards! (as shown on the picture below). Failing to do so can cause hammering and bacteria build-up in the pipes.

Fix the nozzle pipes to the pipe fixture using the clamps and rubber ferrules, provided (position the nozzle pipes according to the installation drawing). Make sure the outlet openings of the nozzles are aligned exactly horizontal in the flow direction.
The clamps and rubber ferrules both come in two different widths, the broad ones are used where the two pipe fixture rods overlap.

First push the rubber ferrule on to the nozzle pipes, the flat side/opening facing away from the nozzles. Proceed by placing the tube and rubber insert in the cut-out. Observe that the nozzles are pointing in the right direction. The nozzle pipes must now be pushed firmly into the cut-out in the pipe fixture.

Mount the clamps firmly around nozzle pipe and fixture. This is done by pushing and turning the clamp into position.

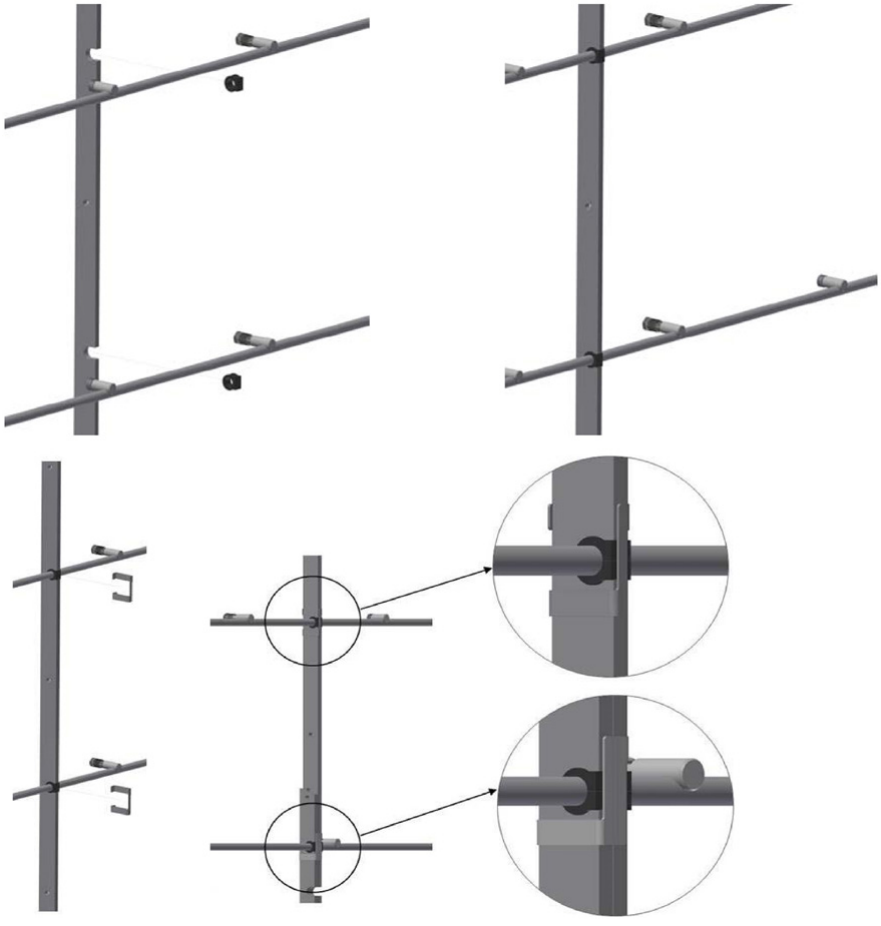


Figure 23: Fixing and securing the nozzle pipes

3. Insertion of nozzles

WARNING!

The last nozzle on a nozzle pipe can never be blank (blind nozzle)! This would result in stagnant water in the pipe, providing a habitat for bacteria.

WARNING!

Never unscrew a nozzle on a pressurized pipe. Disconnect power to the pump station when working on high-pressure system.

CAUTION!

Be careful! The threads on the nozzles break easily, the nozzle seals with an O-ring and hence does not need to be tightened very hard, just a little more than you can do by hand.

It is important to follow the nozzle arrangement guide provided with the system, each step must have the correct number of active and blind nozzles in order for the system to regulate capacity effectively.

- Before inserting the nozzle, check that its threads and O-ring are intact.
- Screw the nozzle in by hand, tighten.
- Use a set of tongue-and-groove pliers (i.e. groove-joint pliers, adjustable pliers, slip-joint pliers) to tighten the nozzle (approx. 1/8 turn).

  Torque value: **1.55 lbf-ft +/- 0.07 lbf-ft (2.1 Nm +/- 0.1 Nm)**
- Always tighten on the tip of the nozzle, to make sure it is also tight.

Figure 24: Inserting the nozzles

4. Connecting nozzle pipes and plugging the ends

CAUTION!

Do not use oil, grease, and glue, Teflon, silicon, O-ring lubrication or the like when assembling nozzle pipes or hose connections.

All of the above products can act as food for bacteria and hence are a potential health risk.

Furthermore, grease or the like can cause the nozzles to block up.

Only approved lubricant: Dish soap

Wash your hands before or wear clean gloves while assembling parts in direct contact with water.

Keep dust covers on pipes and hoses until just before they are assembled.

Tighten the O-ring connection by hand as much as possible, then use a spanner to turn the nut approx. 1/8 until you can feel the O-ring has been compressed.

Figure 25: Connecting nozzle pipes

Figure 26: Plugging pipe ends

5. Mounting the step valve block

Fix the step valve block at the appropriate position to the duct using the screws or the bolts provided. It is recommended to place the valve block 1/3 of the height of the air handling unit - from the bottom of the unit. The valve block should be adjacent to the spray nozzles - and highly recommended that it is mounted outside the airstream.
Then, drill duct passages 3 x ø1.25" (ø32 mm) and close the holes inside and outside with the rubber sleeves provided.

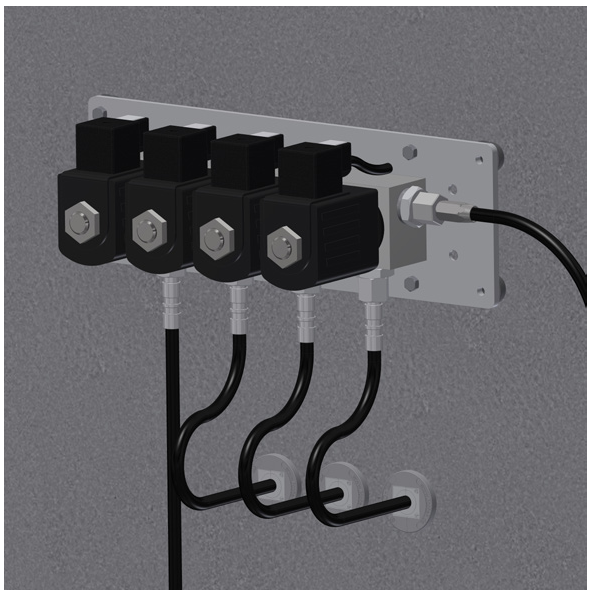


Figure 27: Horizontal mounting of step valve block

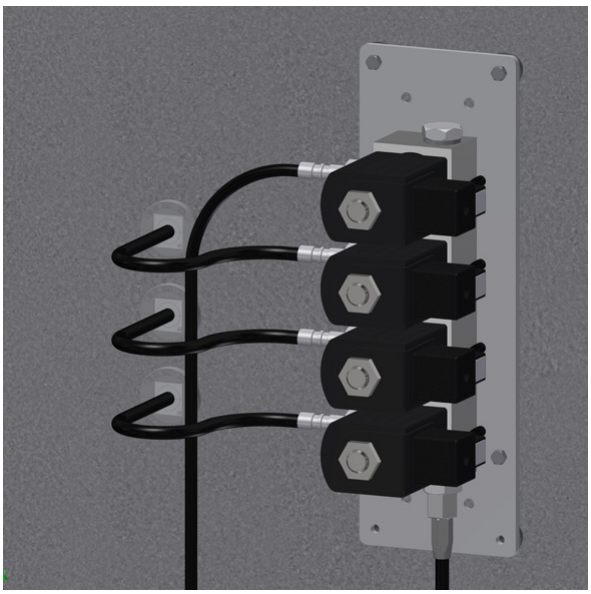


Figure 28: Vertical mounting of step valve block

6. Connecting the high-pressure hoses

WARNING!

Do not retighten/unscrew hoses while the system is pressurized!

CAUTION!

Do not use oil, grease, and glue, Teflon, silicon, O-ring lubrication or the like when assembling nozzle pipes or hose connections.

All of the above products can act as food for bacteria and hence are a potential health risk.

Furthermore, grease or the like can cause the nozzles to block up.

Only approved lubricant: Dish soap

Wash your hands before or wear clean gloves while assembling parts in direct contact with water.

Keep dust covers on pipes and hoses until just before they are assembled.

Connect the high-pressure hoses to the step valve block, and then guide the hoses through the rubber sleeves into the duct.
Important! Start tighten the hose connections by hand, then use an open-end wrench to tighten the screw connections (approximately 1 1/4 turn) using an open-end wrench. Check screw connections for leaks during operation. If the screw connections are leaking, moderately retighten them, however do not overtighten the screw connections.

Torque for cone connection (hose to hose, hose to T-piece and hose to valve block)

- **For 3/8" connections: 52 lbf-ft +/- 1.5 lbf-ft (70 Nm +/- 2 Nm)**
- **For 1/4" connections: 31 lbf-ft +/- 1.5 lbf-ft (42 Nm +/- 2 Nm)**

Connect the high-pressure hoses to the appropriate distribution blocks and nozzle pipes (position of the spray circuits according to the installation drawing).

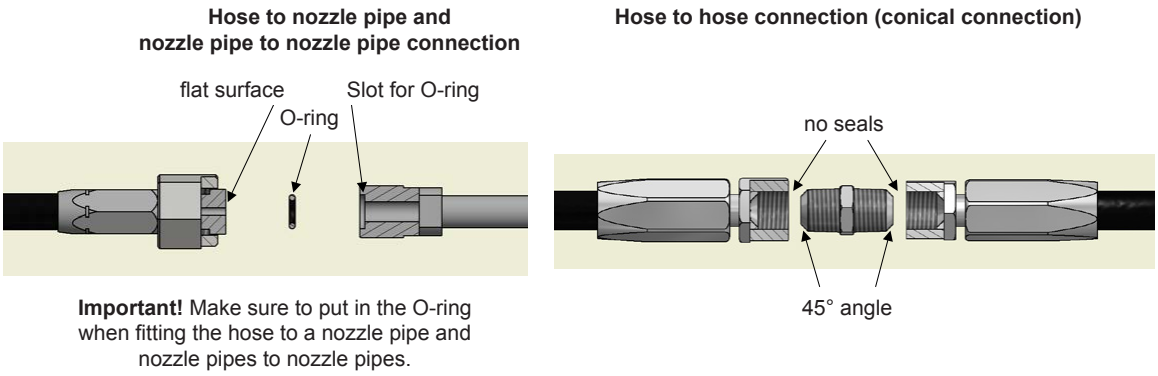


Figure 29: Hose connections

Important! Make sure the hoses are not kinked (if necessary, run hoses in a bow to the connector). Maintain the following minimum bend radius:

- **for hoses DN6 = 100 mm**
- **for hoses DN8 = 130 mm**
- **for hoses DN10 = 180 mm**

6.5 Installing the pump station

6.5.1 Notes on positioning

CAUTION!

Do not connect/fit the pump station on/to vibrating components.

Please observe the following notes on installation:

- Place the pump station in a manner that:
  - The distance to the humidifier unit is as short as possible.
    Note: High-pressure hose (pump to step valve block) is 9.8 ft. (3 m) as standard however 6.5 ft. (2 m), 16.4 ft. (5 m), and 32.8 ft. (10 m) hoses are available in stock and special lengths can be ordered.
  - The HP pump station is freely accessible and there is enough space for convenient operation and maintenance (**min. free space around pump station: laterally 1.6 ft. (0.5 m), front side/ back side 2.6 ft. (0.8 m)**).
- The pump station is designed for operation in protected and dry rooms and thus must not be installed outside.
- Do not install the pump station in exposed locations or locations with heavy dust loads.
- The **pump station** must be installed only in a **location with a water drain in the floor**. If this is not possible, it is mandatory that **water sensors** be provided to safely interrupt the water supply in event of leakage. Furthermore, choose a suitable location that prevents damage to material assets in event of leakage.
- The pump station is designed for installation on a load-bearing floor.
- Ensure pump station is located in a location where there is no freezing temperatures.

6.5.2 Pump station installation

CAUTION!

The room where the pump station is placed must have a drain in the floor near the system to prevent flooding in case of a leak.

Once placed, level the pump station using the adjustable supports (see figure below).

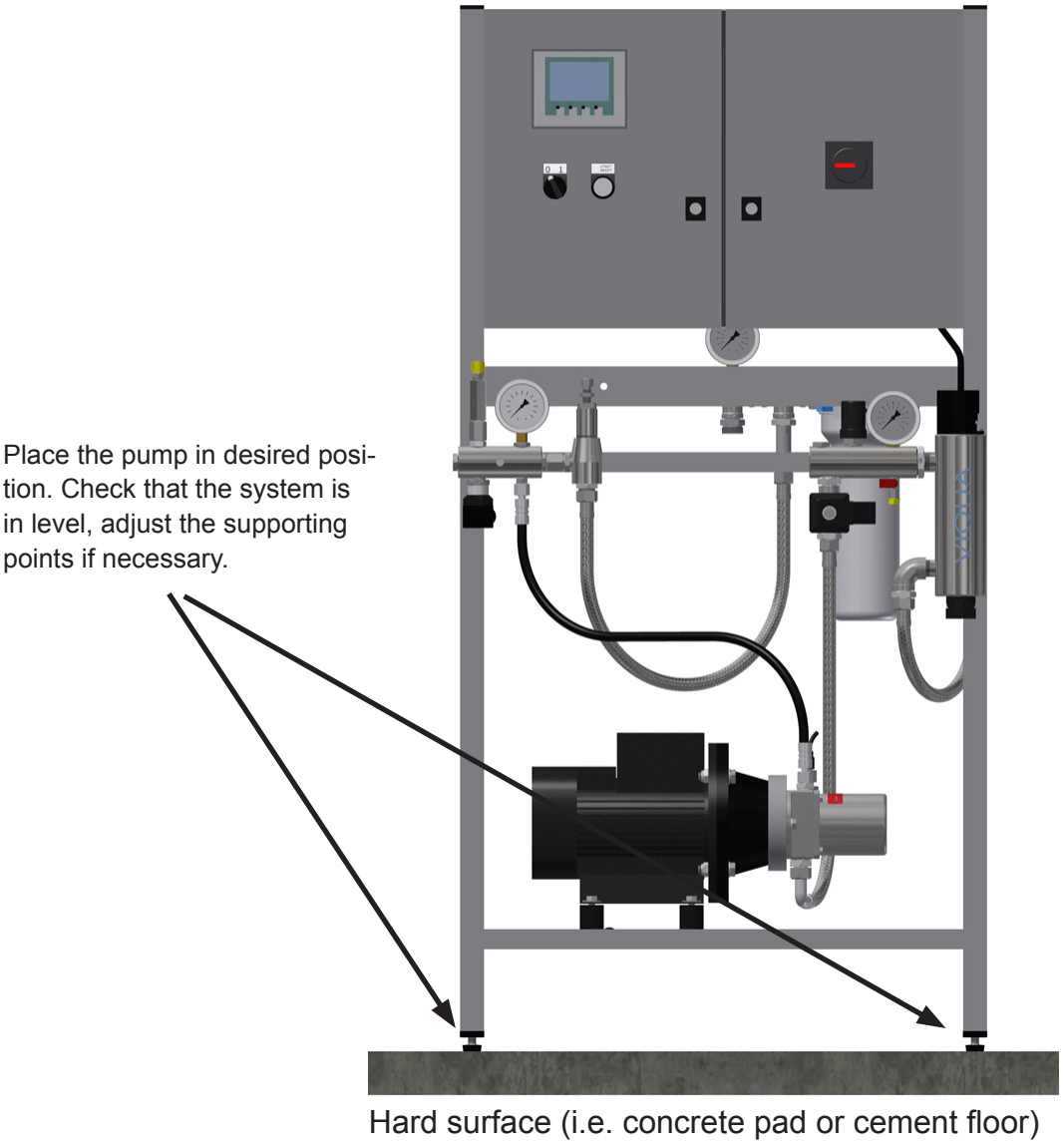


Figure 30: Leveling pump station

6.5.3 Water installation, Nortec HP

WARNING!

Before connecting the water supply, the piping must be flushed for at least 10 minutes, to make sure the first incoming water is as clean as possible.

CAUTION!

The high-pressure hose between the high-pressure pump and high-pressure manifold must not be installed before bleeding of the high-pressure pump has been done (see *chapter 7.6.2*)

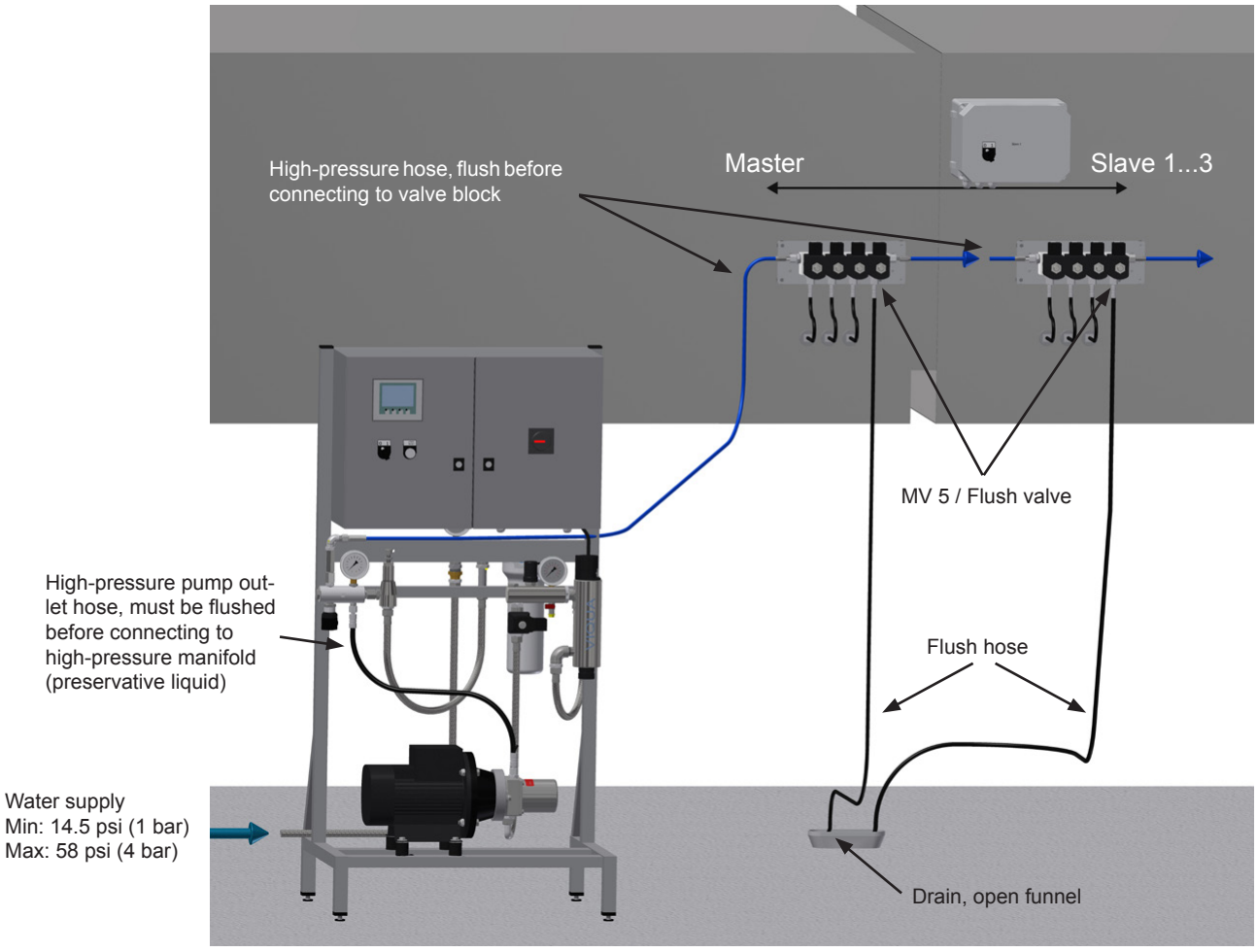


Figure 31: Water installation, Nortec HP

Connecting the water supply

- Connect water supply hose to the water inlet using the gasket provided.

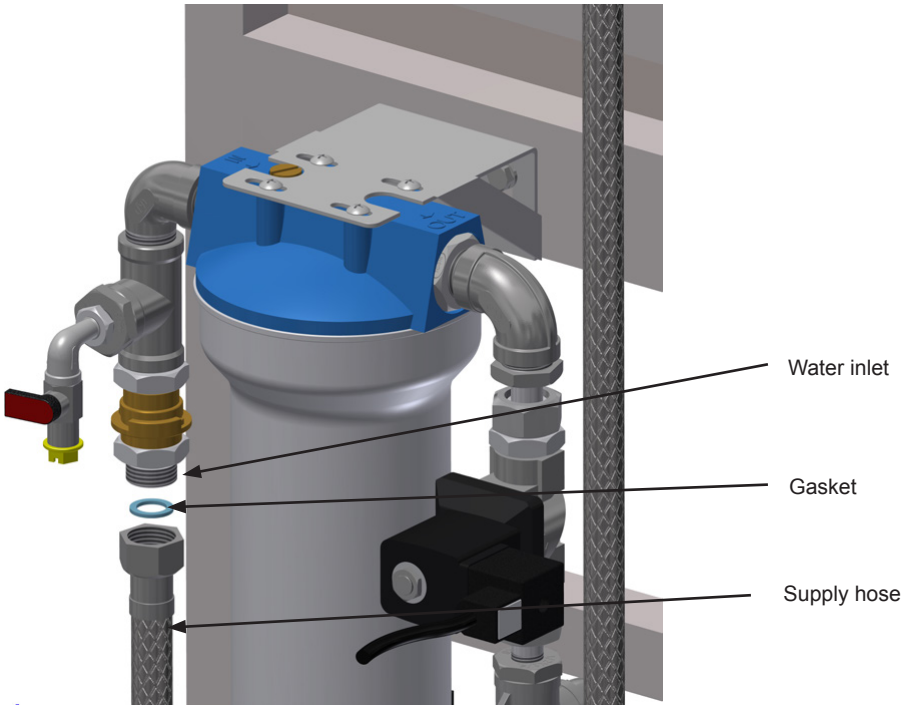


Figure 32: Water supply installation, Nortec HP

Connecting the high-pressure hoses

- Connect high-pressure hoses to the pump station; do not connect it to the valve block yet, as it needs to be flushed.
  - Use only the high-pressure hoses provided to connect the pump station, high-pressure manifold and the step valve block.
  - Install the high-pressure hoses in a way so they do not touch each other or other system components. Where it is not possible to prevent the high-pressure hoses touching each other or other system components, use anti-chafe spiral hose or similar to protect the hoses.

Connecting the drain line to the working pressure flushing valve MV5

Each valve block has a high-pressure flush valve MV5. In the outlet of the valve there is a 1/64 inch nozzle, allowing the system to flush without losing operating pressure in the entire system.

- Connect drain hose to the flushing valve connector using the drain hose supplied.
- Run the drain hose down to an open funnel with a constant downward slope.
- Fix drain hose in its position, so it cannot move during operation.

6.5.4 Water installation, Nortec HP RO (with RO)

WARNING!

Before connecting water supply, the piping must be flushed for at least 10 minutes, to make sure the first incoming water is as clean as possible.

CAUTION!

The high-pressure hose between high-pressure pump and high-pressure manifold must not be installed before bleeding of high-pressure pump has been done (see *chapter 7.6.2*).

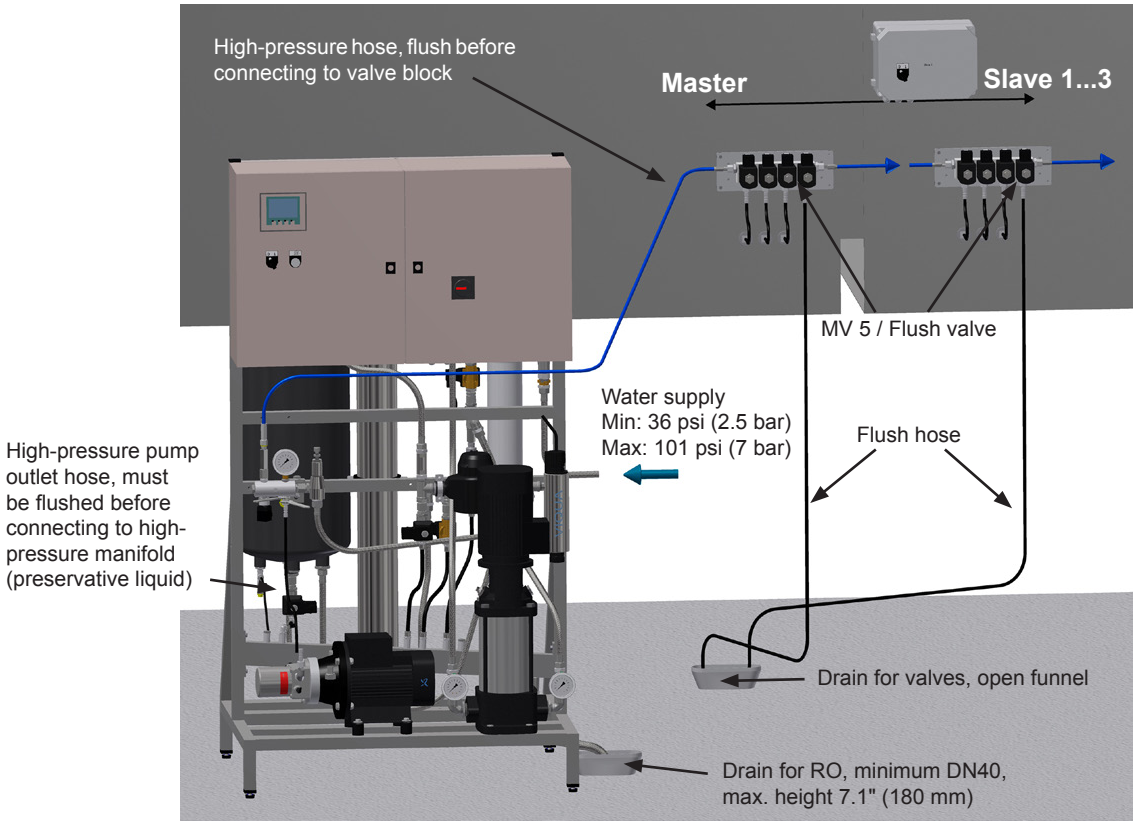


Figure 33: Water installation, Nortec HP RO

Connect RO drain

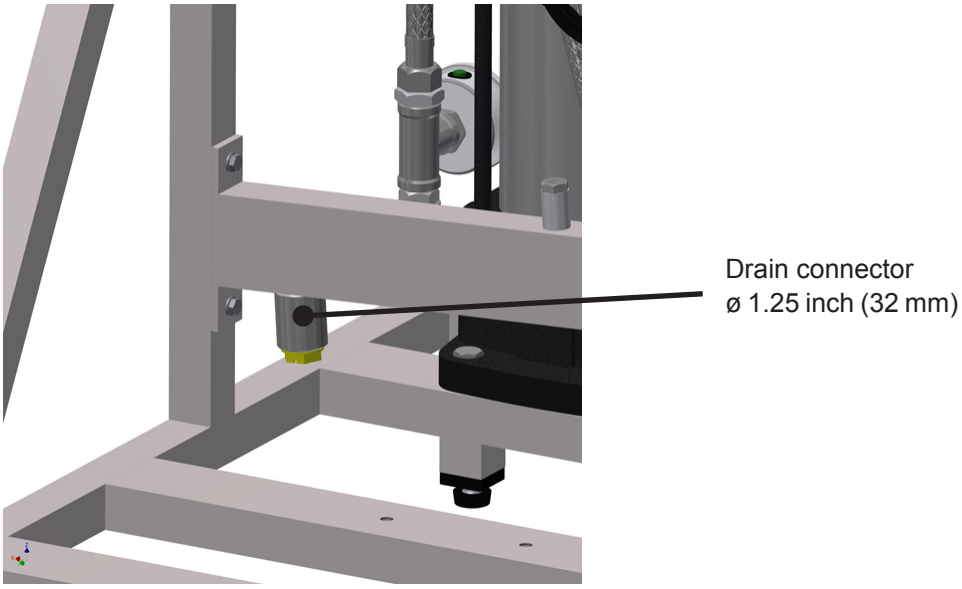


Figure 34: RO Drain connector

- Remove protecting plug from drain connector.
- Connect drain hose to water outlet connector ø1.25 inch (ø32 mm) and lead the drain hose down to an open funnel with a constant down-slope.
  - Min. diameter of the drain hose: ø 1.6 inch (ø40 mm)
  - Max. drain height: 7.1 inch (180 mm).
- Fix drain hose in its position, so it cannot move during operation.

Connecting the water supply

Water supply: 36 - 101 psi (2.5–7 bar), water volume > nozzle capacity x 2. Requirements for water quality can be found in Product Data.

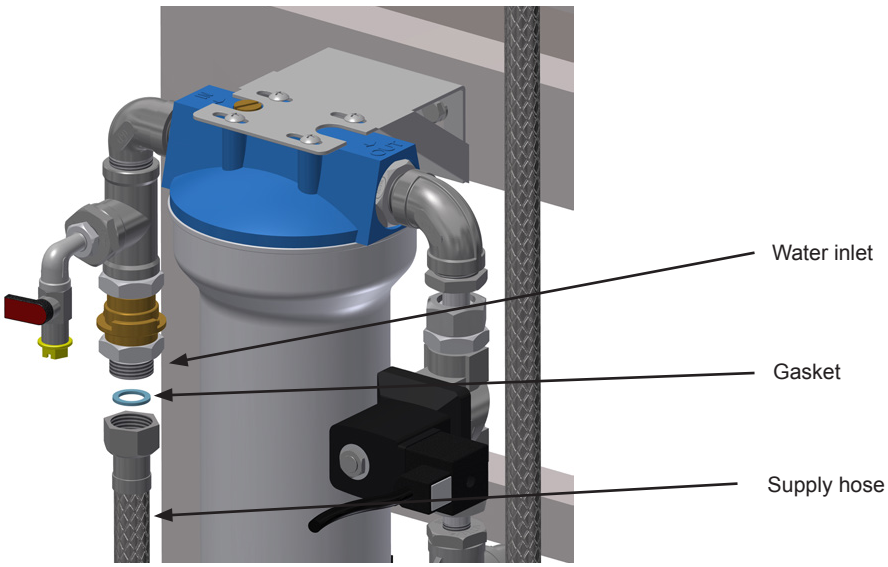


Figure 35: Connecting water supply

- Connect water supply hose to the water inlet using the gasket provided.

Connecting the high-pressure hoses

- Connect high-pressure hoses to the pump station; do not connect it to the valve block yet, as it needs to be flushed.
  - Use only the high-pressure hoses provided to connect the pump station, high-pressure manifold and the step valve block.
  - Install the high-pressure hoses in a way so they do not touch each other or other system components. Where it is not possible to prevent the high-pressure hoses touching each other or other system components, use anti-chafe spiral hose or similar to protect the hoses.

Connecting the drain line to the working pressure flushing valve MV5

Each valve block has a high-pressure flush valve MV5, in the outlet of the valve it has a 1/64 inch nozzle allowing the system to flush without losing operating pressure in the entire system.

- Connect drain hose to the flushing valve connector using the drain hose supplied.
- Run the drain hose down to an open funnel with a constant downward slope.
- Fix drain hose in its position, so it cannot move during operation.

6.6 Electrical installation

DANGER!

Danger of electric shock!

High voltages, Danger of electric shock! Electrical installation should only be carried out by a certified electrician. Touching live parts may cause severe injury or even death.

CAUTION!

The electronic components inside the control unit are very sensitive to electrostatic discharge. When carrying out work on the open unit, appropriate measures must be taken to protect these components against damage caused by electrostatic discharge (ESD protection).

Notes on electrical installation

- The wiring diagram can be found inside the control unit of the electrical cabinet / main box.
- Installation must be carried out according to local laws and regulations
- The electrical installation (power supply, humidity control) must be carried out according to the wiring diagram supplied with the unit and the applicable local regulations. All information given in the wiring diagrams must be followed and observed.
- All cables must be run into the control unit via the cable openings and the use of cable glands.
- Make sure the cables do not rub against vibrating parts.
- The supply voltage must comply with the voltage in the wiring diagram.
- Study the system setup part to get an overview.
- The pump station comes with a 9.8 ft. (3 m) rubber coated power cable.
- Power consumption and size of pre-fuse can be found in chapter: product data.

Note: The Nortec HP is equipped with a 3-phase monitoring relay for detection of incorrect phase sequence, total and partial phase loss. Instructions are found on a sticker inside electrical cabinet.

6.6.1 Connections and components inside the Electrical cabinet and PLC – box

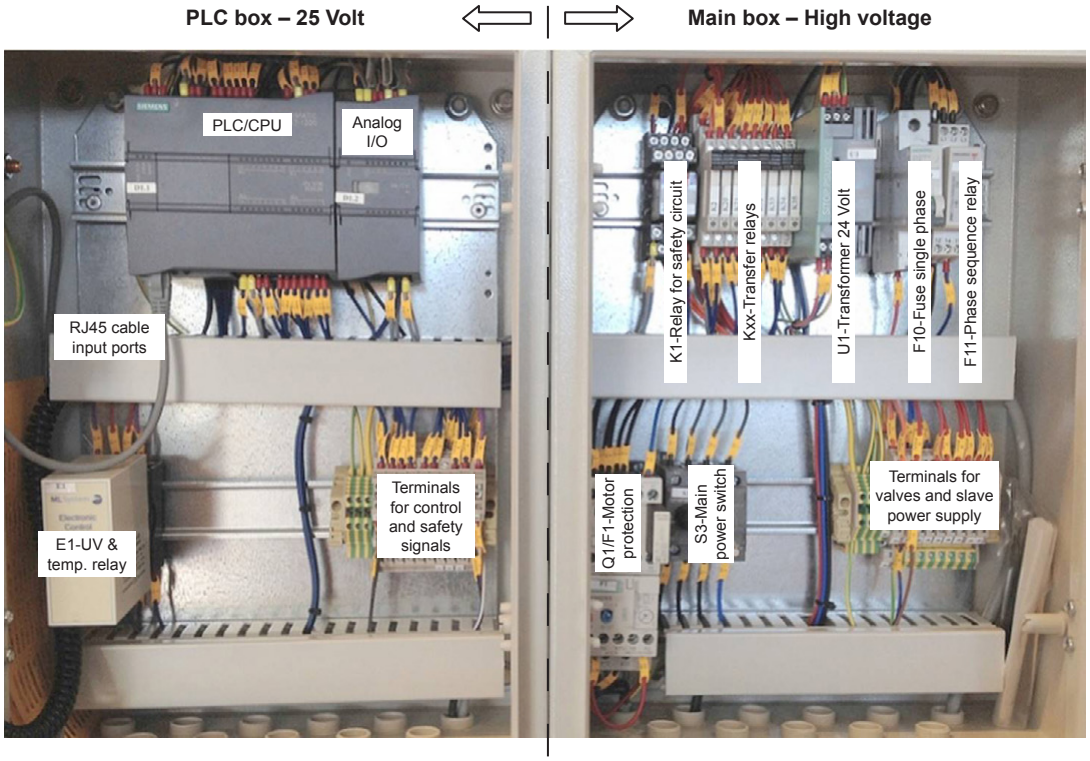


Figure 36: Connections and components Electrical cabinet

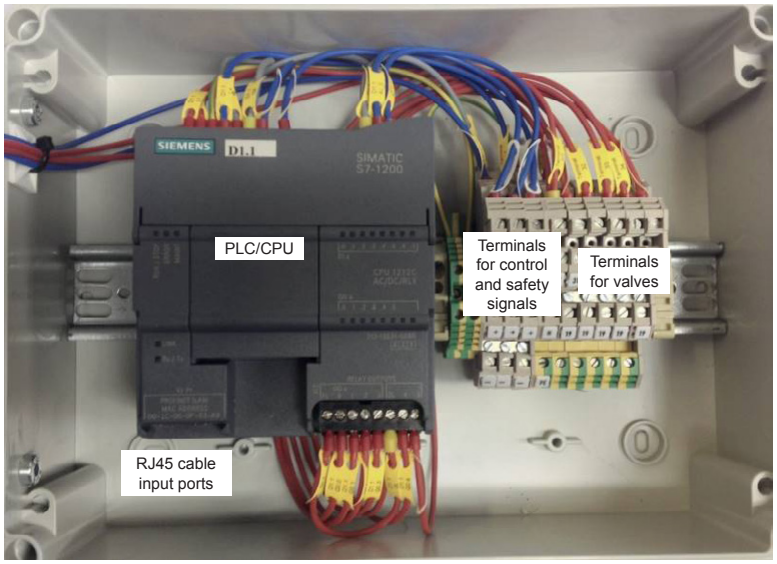


Figure 37: Inside the slave box

6.6.2 How to connect to power supply

- Make sure that electrical supply corresponds to the specifications on the humidification system rating plate.
- Unlock the enclosure door with the intended key.
- Insert the power supply cable through a suitable free cable gland and lead the cable to the field terminal block, as shown on the picture of the enclosure below.
- Follow the appropriate electrical wiring diagram for the actual humidification system and connect the power supply leads to the field terminal block accordingly.

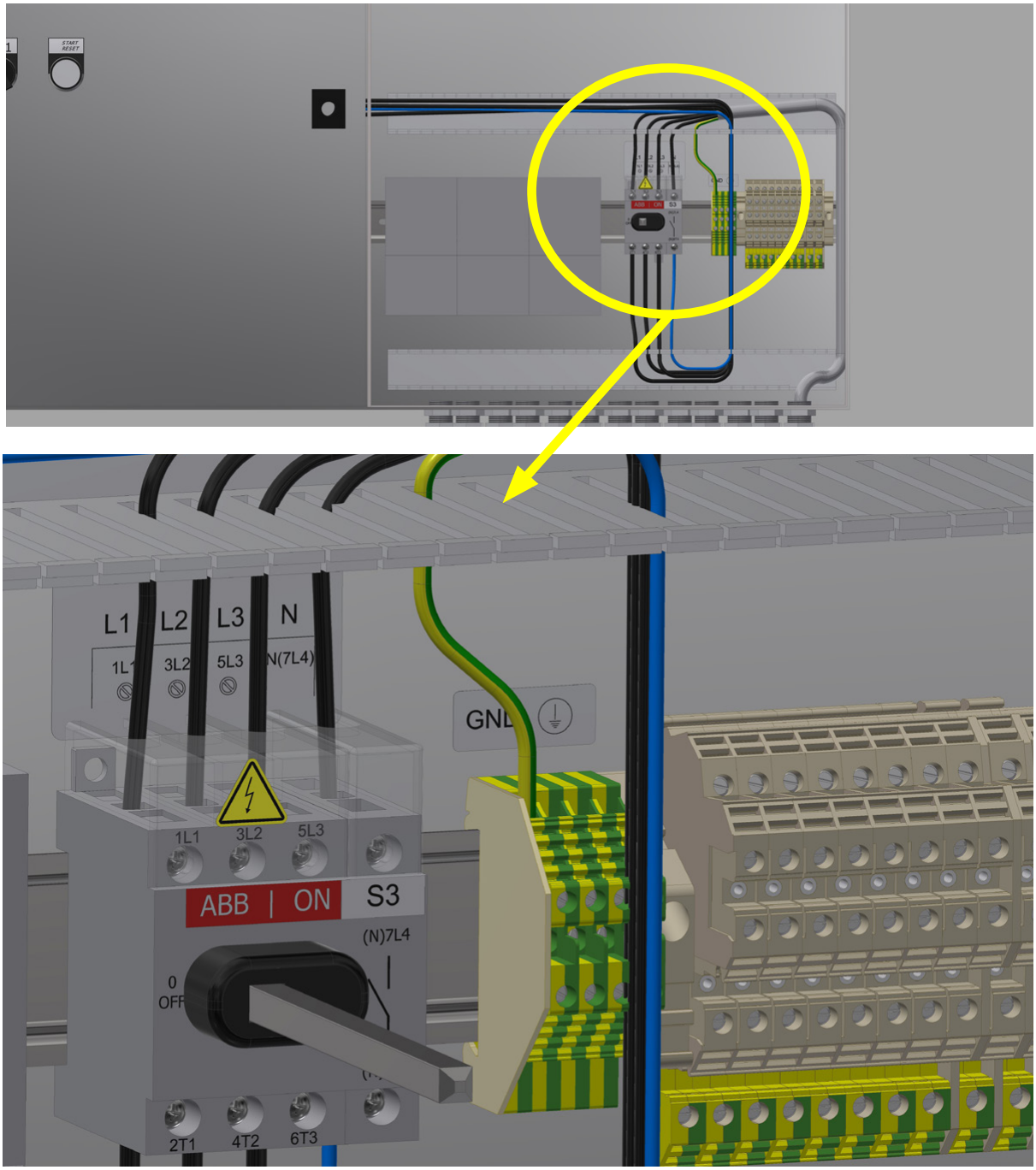


Figure 38: Connecting the power supply

6.6.3 Electrical connection diagram, HP and HP VFD

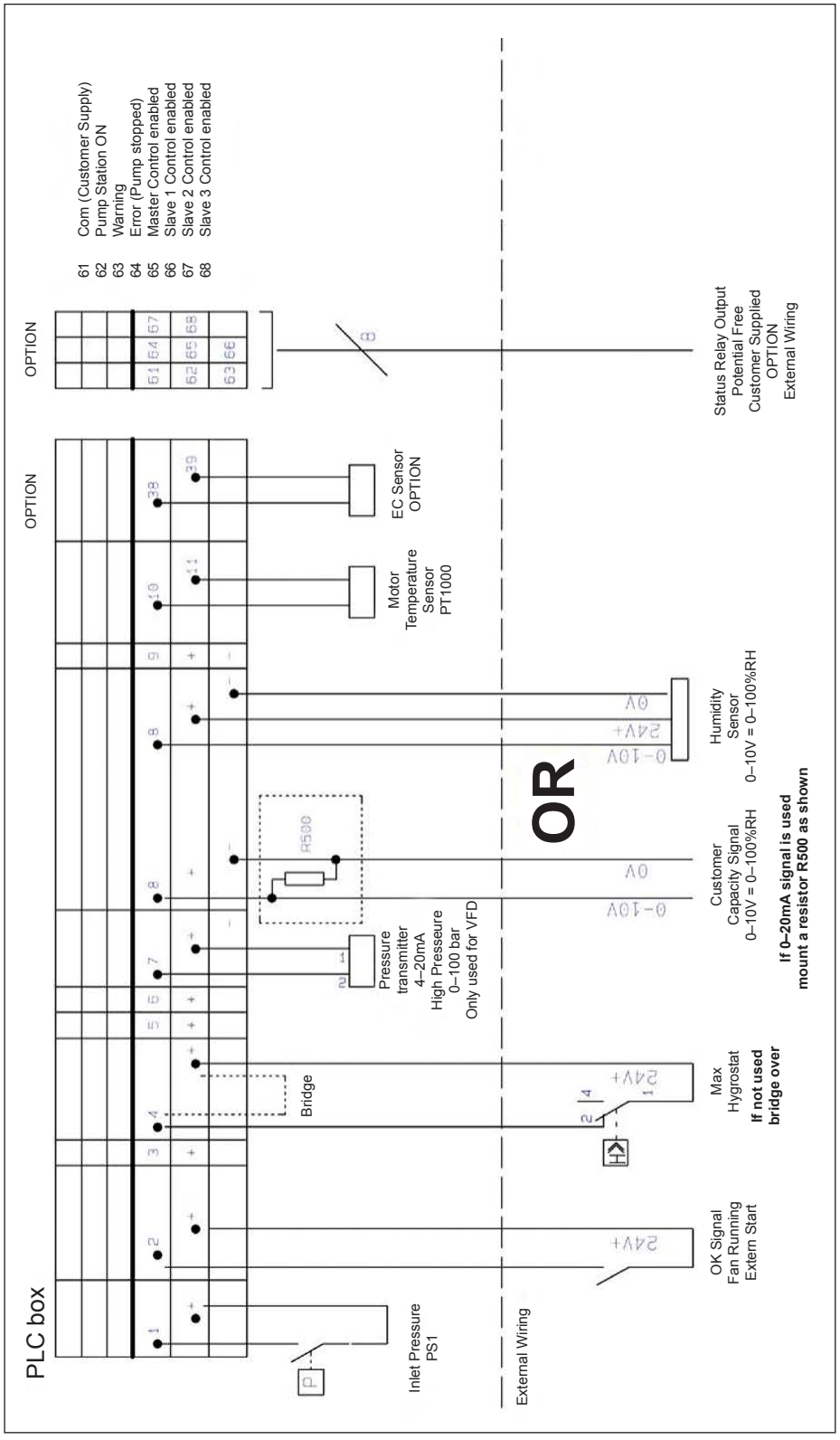


Figure 39: Electrical diagram HP and HP VFD - 1

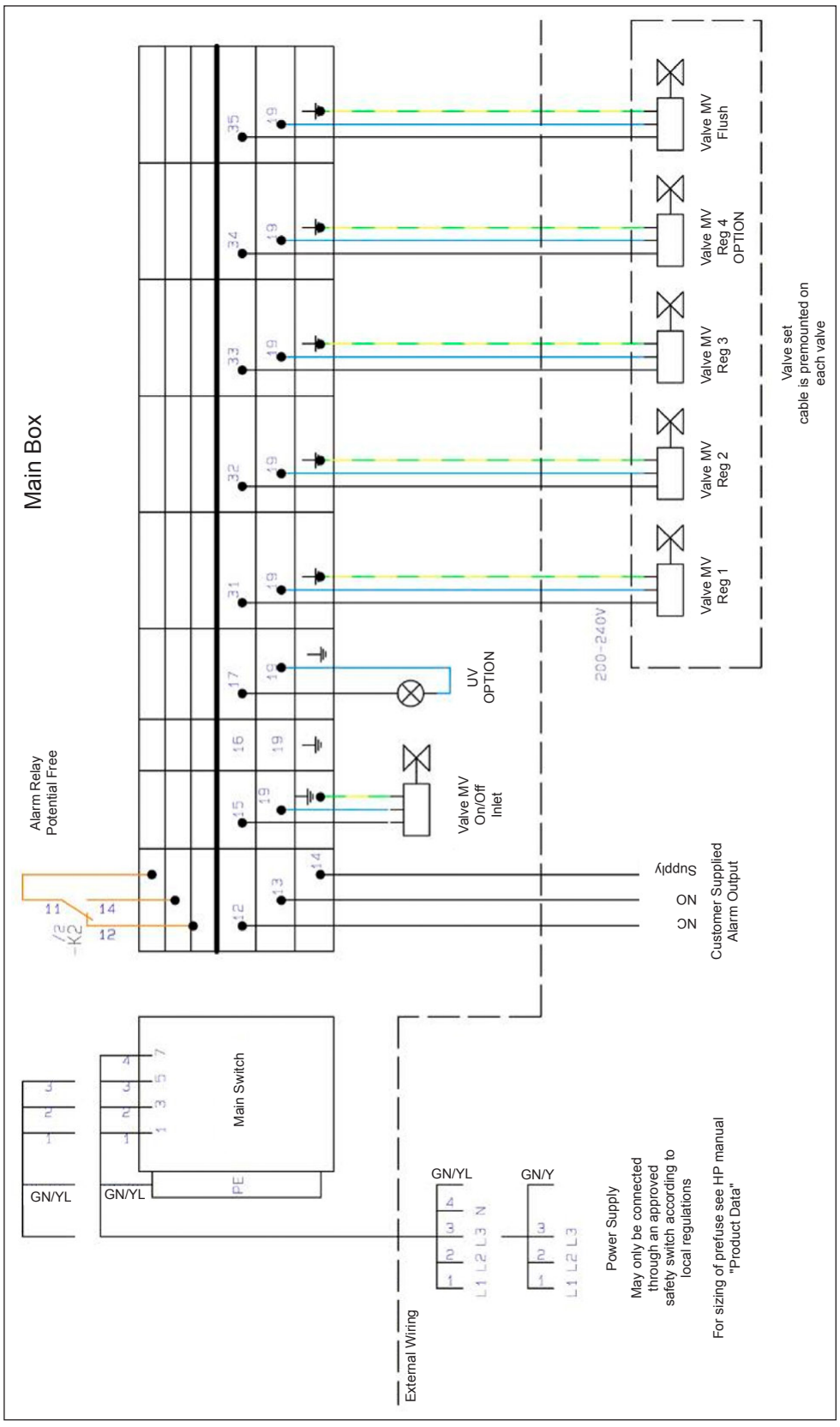


Figure 40: Electrical diagram HP and HP VFD - 2

6.6.4 Electrical connection diagram, HP RO and HP RO VFD

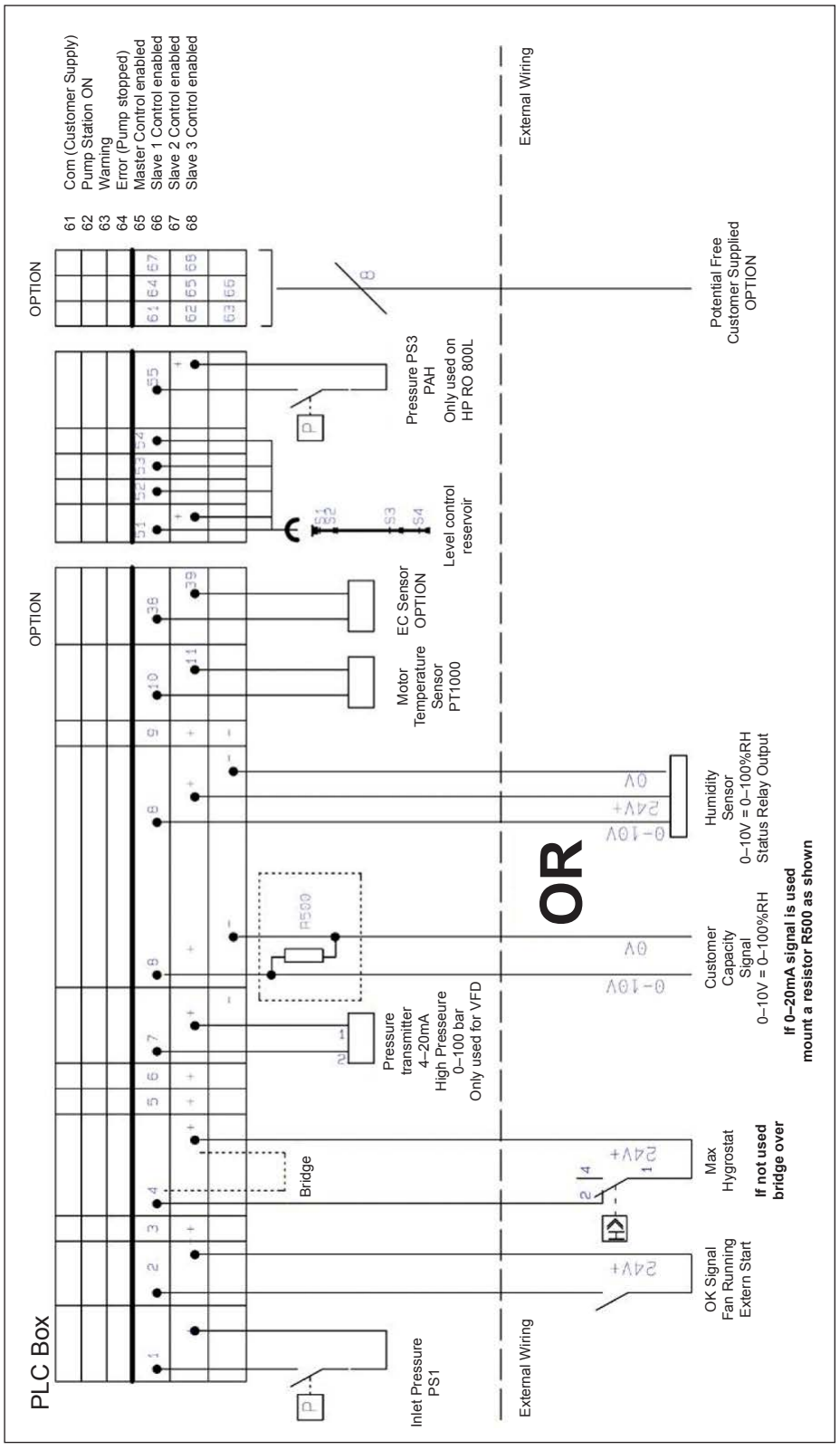


Figure 41: Electrical diagram HP RO and HP RO VFD - 1

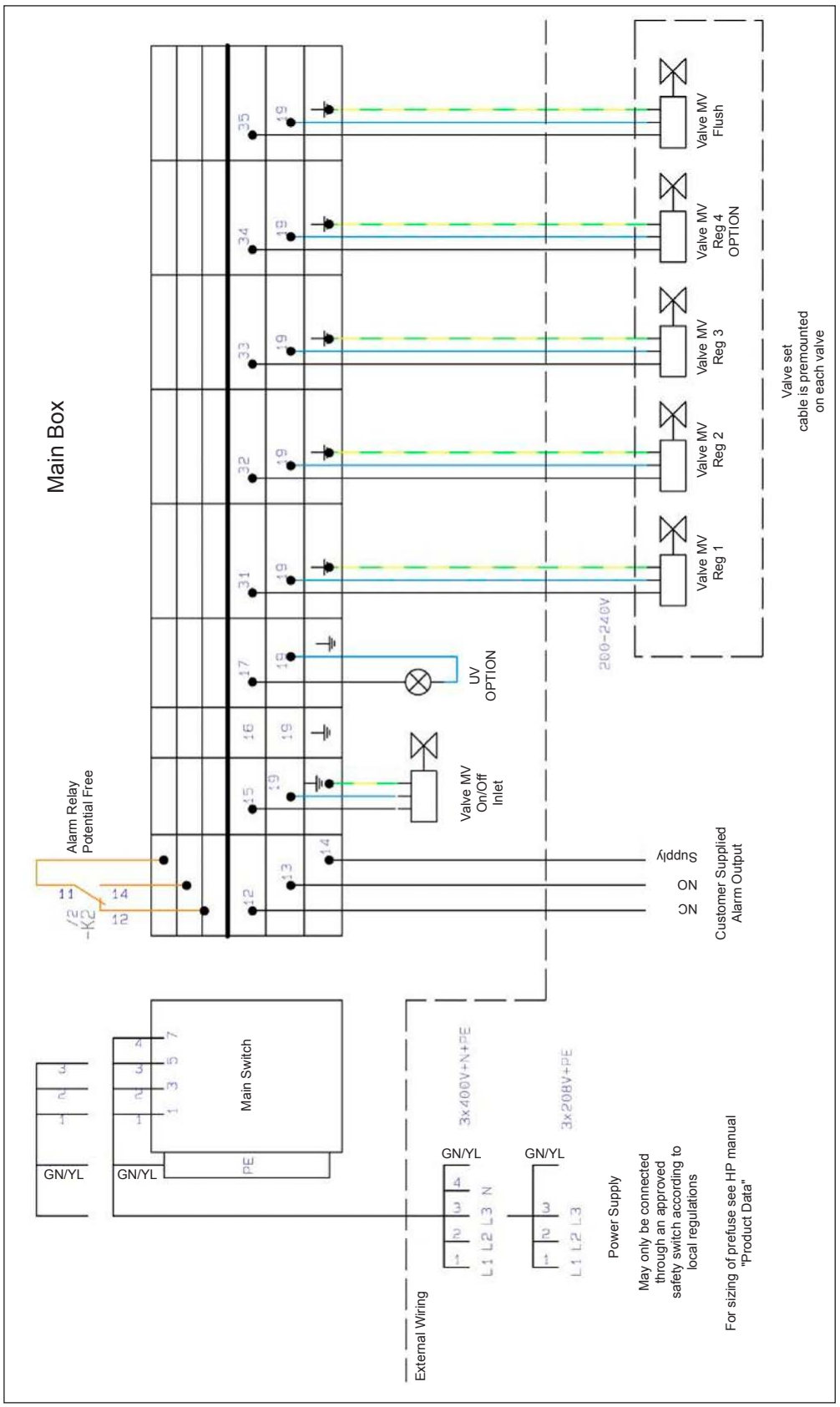


Figure 42: Electrical diagram HP RO and HP RO VFD - 2

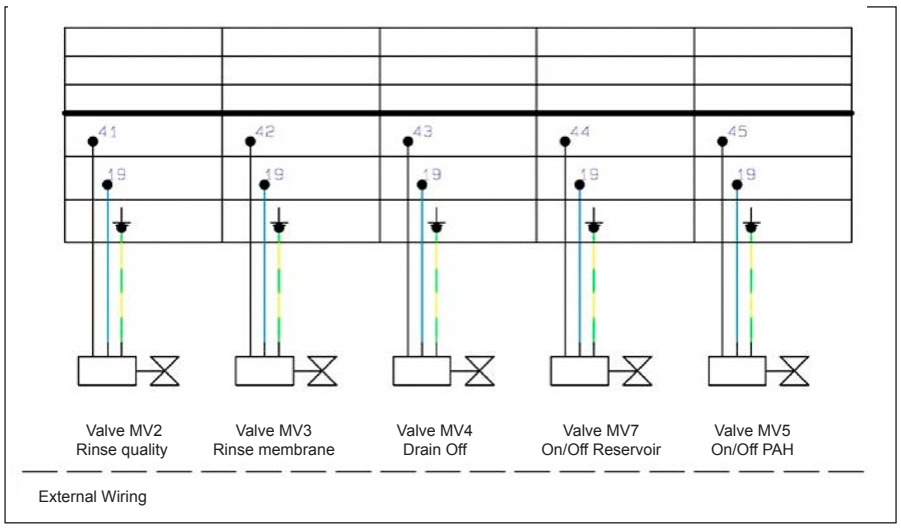


Figure 43: Electrical diagram HP RO and HP RO VFD - 3

6.6.5 Electrical connection diagram, Slave

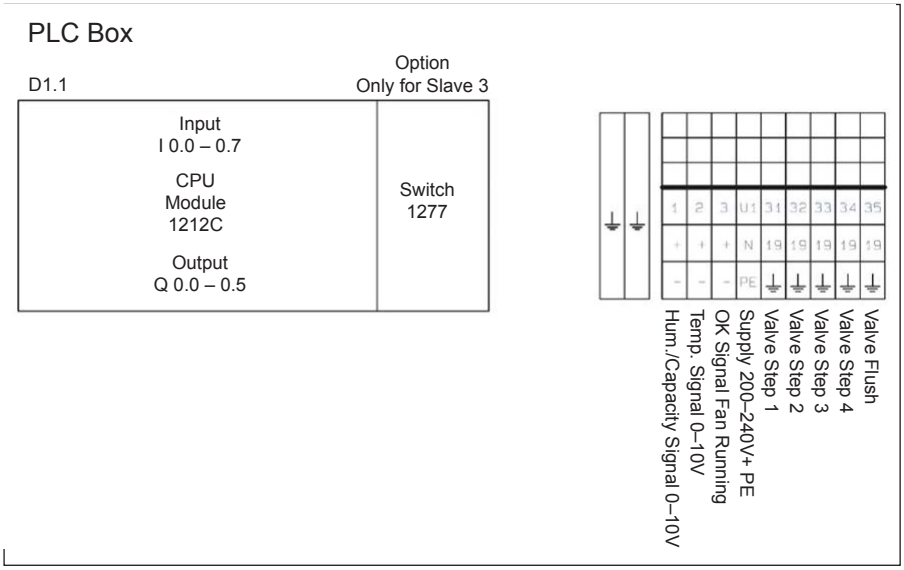


Figure 44: Slave unit wiring

6.6.6 mA Control signal connection

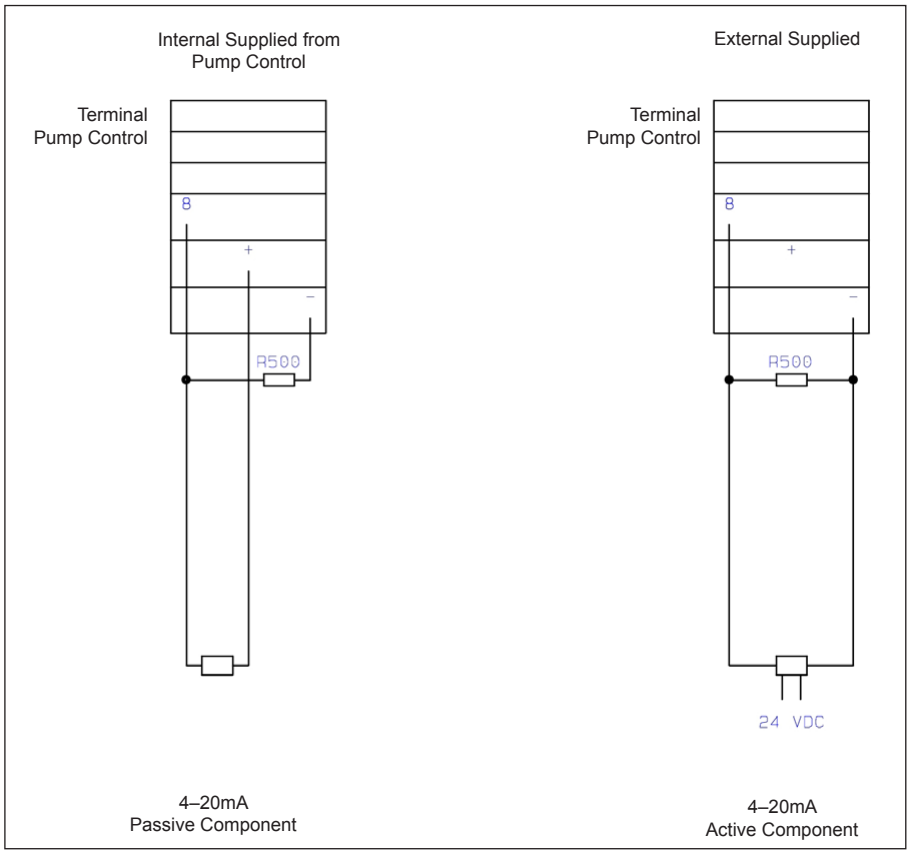


Figure 45: mA Control signal connection

6.7 Mist Eliminator Installation

6.7.1 General

The Nortec Mist Eliminator is a single bank water droplet removal system installed at a predefined distance from the water entry point. The highly humidified air is to come into contact with the Mist Eliminator and any un-absorbed droplets of water are removed from the air stream. The collected water accumulates on the media then descends downward towards the bottom of the Mist Eliminator. During this process much of the collected water is absorbed into passing air while any remaining water is funneled to one of two drains via a pre-installed drain pan. See Figure 19: Mist Eliminator Overview.

The Mist Eliminator is available in standard sizes ranging from 4ft high x 4ft wide to 12ft high x 20ft wide with 4ft increments between. If a duct size does not fall under one of our standard sizes simply order the next larger size then cut to fit.

The drain pan is to be installed at the bottom of the plenum to remove the water collected by the Mist Eliminator. The height of the drain pan should be not be any less than 3 inches (7.5cm) and should extend past the filter bank 8 inches (20.3cm). A drain with trap before and after the Mist Eliminator is required, shown in *Figure 47 – Drainage and Drains*. For this the duct"s static pressure must be known. The drain traps must be 2 inches larger than the duct"s static pressure. Ensure that the drain trap is filled with water prior commissioning a high-pressure system.

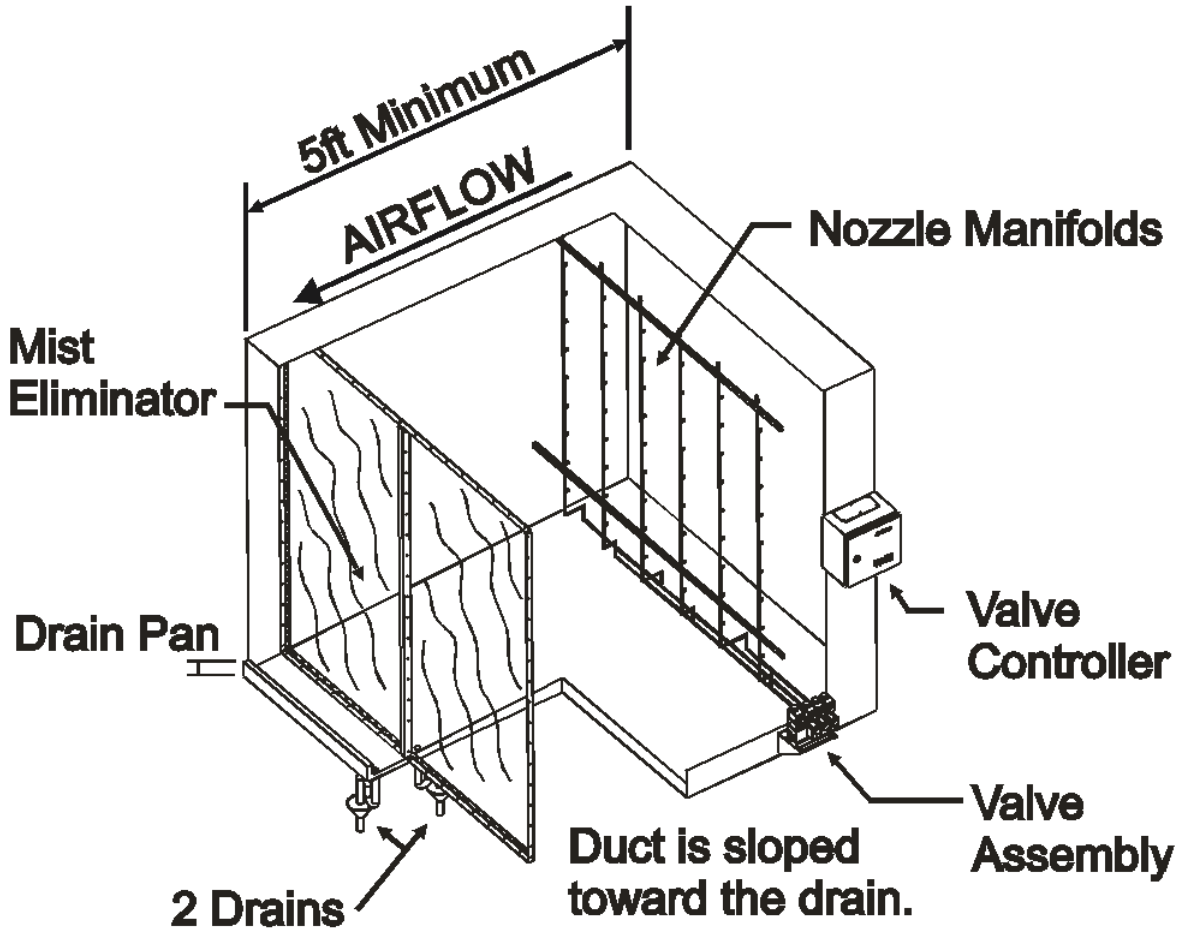


Figure 46: Mist Eliminator Overview

6.7.2 Installation of Mounting Angles

Measure the duct height and width.

Height = _____

Width = _____

The mounting angles are to completely surround the duct. Mark the duct floor with a line a minimum of 8” from the end of the drain pan and perpendicular to the ducts airflow. Now continue the line up vertically up the walls and finally across the ducts ceiling.

Each angle measures 95.5 inches. Enough length of angle is supplied to cover the perimeter of the duct but they must be cut to fit. Over-lapping joints slightly is recommended for the floor angles only as they should be sealed along the entire length of angle with appropriate caulking to prevent free air flow through the drain pan. Angles may have to be cut in half to make-up two 4ft lengths. When securing the mounting angles to the duct place the side with circular holes against the duct and the bent edge along the marked line.

Orient the mounting angle as shown in Detail A in *Figure 48 – Mounting Angles*. Using field supplied self taping screws attach the mounting angle to the duct via the round mounting holes. A screw every 18 inches is recommended.

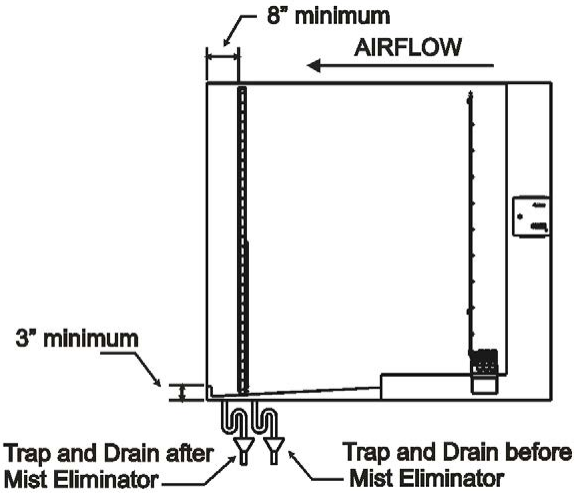


Figure 47: Drainage and Drains

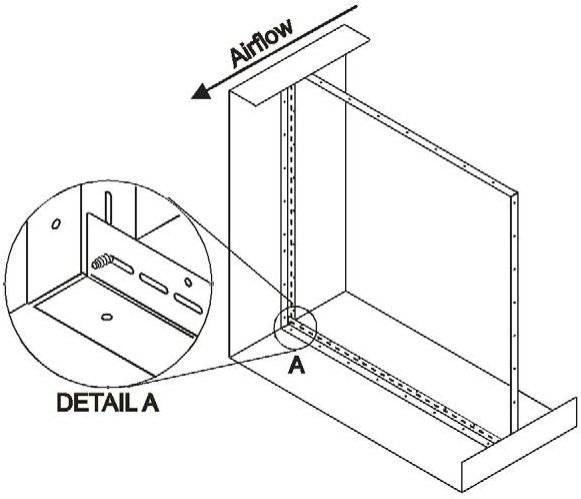


Figure 48: Mounting Angles

6.7.3 Installation of Mounting Channels

Before installing the mounting channel or channels the starting mounting point needs to be determinedusing the duct width. If the duct width is 4ft or less then there is no need for a mounting channel, continue to the next step.

Table 3: Table 1. Mounting Channel Locations

Duct Width	Mounting Position	Number of Channels
4ft - 8ft	Middle	1
8ft - 12ft	Offset 2ft from middle	2
12ft - 16ft	Middle	3
16ft - 20ft	Offset 2ft from middle	4

Once the mounting location is determined the mounting channel(s) are ready to be cut to fit, keeping in mind that drain pans are not level and lengths may vary. From the starting point, each additional mounting channel is placed at 4ft centers. In the figure below a typical 4ft x 8ft installation is shown with the mounting angle surrounding the perimeter and a mounting channel installed vertically at the center point of the duct.

In *Figure 50 – Large Duct Mounting Channel Locations*, a 6ft high x 10ft wide mist eliminator frame is shown. Notice how the mounting channel placement is offset from the center.

Installations between 8ft x 12ft to 16ft x 20ft may involve the removal of excess material. Excess material is removed equally from both sides of the frame not from the middle.

To secure the mounting channel in place use the factory supplied ½ inch self-threading screws. Use the center row of slotted holes to attach the mounting channel to the mounting angle. Place one screw at the top and one at the bottom making sure that the mounting channel is level or square to the ceiling, this will help for mounting the wire mesh. See Figure 24: Mounting Channel Installation.

If the duct height greater than 8 feet a channel extension is needed in order to link 2 mounting channels together. The extension slides inside the mounting channel. Use 4 ½ inch factory supplied screws for each mounting channel as shown in *Figure 52 – Mounting Channel Extension Kit*.

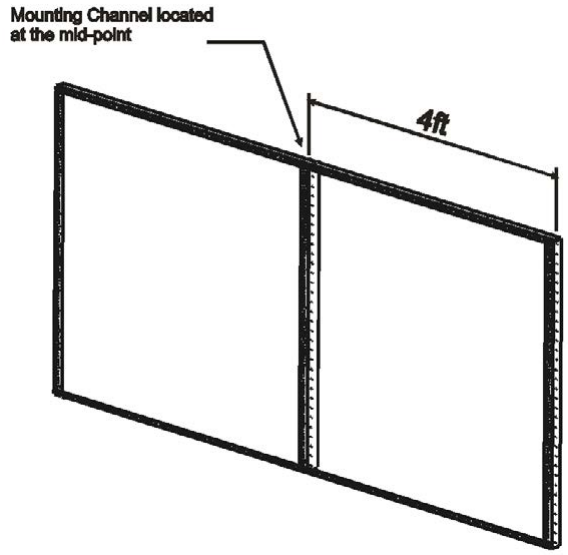


Figure 49: Mounting Channel Location

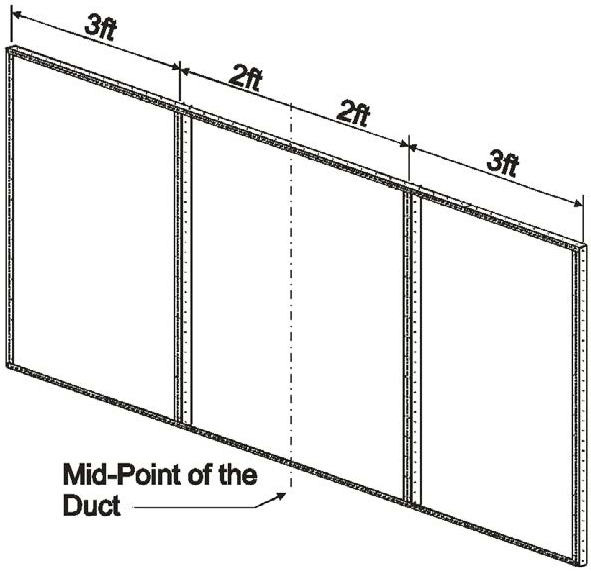


Figure 50: Large Duct Mounting Channel Locations

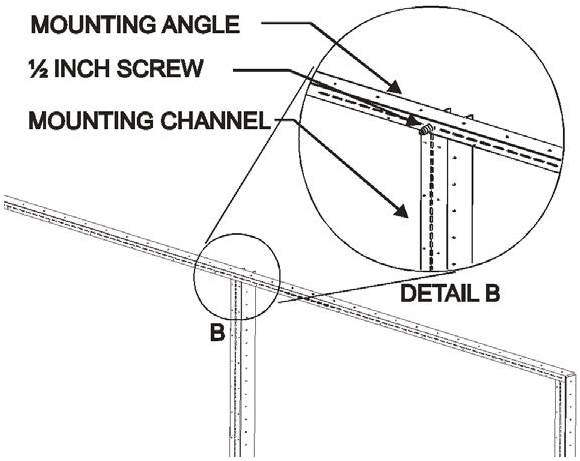


Figure 51: Mounting Channel Installation

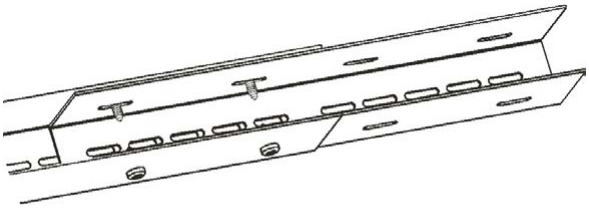


Figure 52: Mounting Channel Extension Kit

6.7.4 Installing 1 inch Screws/Studs

In the final step of this instruction Media Clamping Strips are used to secure the media to the frame. In this step the screws used to fasten the Media Clamping Strip to the finished assembly must be installed. Each Media Clamping Strip requires 3 screws evenly spaced. Clamping strips are 46 inches in length upon arrival from the factory however if the Clamping Strip is cut to fit the duct size it will still require 3 screws evenly spaced to properly secure it. After each screw is installed use the factory supplied nuts to lock them in place.

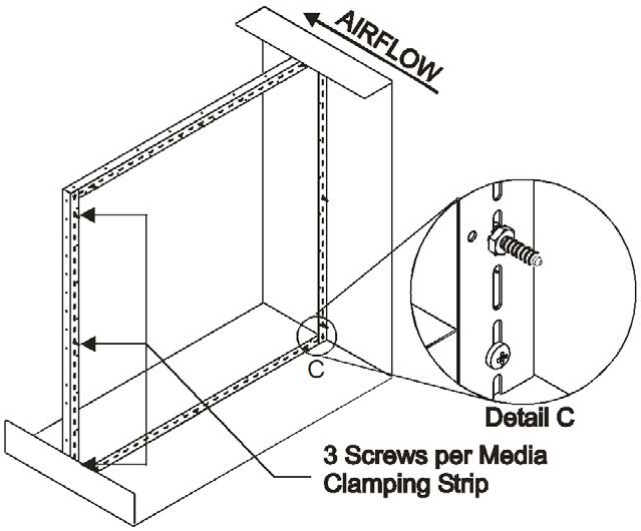


Figure 53: Inch Screw / Stud Installation

6.7.5 Installation of Wire Mesh

The 4ft wide Wire Mesh can now be cut to length (duct height or top mounting stud to bottom mounting studs.) To fasten the Wire Mesh to the assembly use the factory supplied selfthreading ½ inch screws starting from the top angle and middle channels working out and down. Be sure to install the wire mesh square when first fastened otherwise it will not align properly at the opposing end. Notch around screws previously installed for best results.

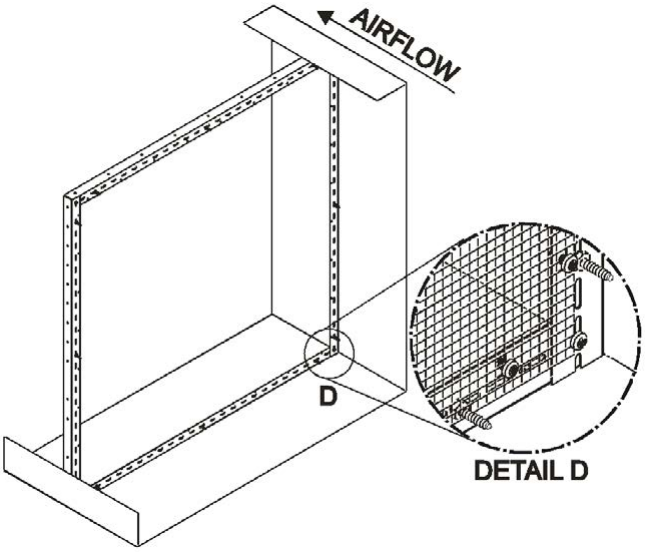


Figure 54: Mesh Installation

6.7.6 Media Installation

The recommended way to install the media is taking the entire roll and securing its leading edge to the top of the assembly by working the 1 inch screws/studs though the media, see *Figure 55 – Media Installation*. Then carefully rolling it downward until it reaches the bottom of the duct. Cut the media at the bottom of the assembly to fit. Once cut, go back and work the rest of the screws through the media. If the recommended method cannot be followed, use a flat, clean surface to pre-cut the media. Be sure to cut the media with precision so not to be short on the final section of the assembly.

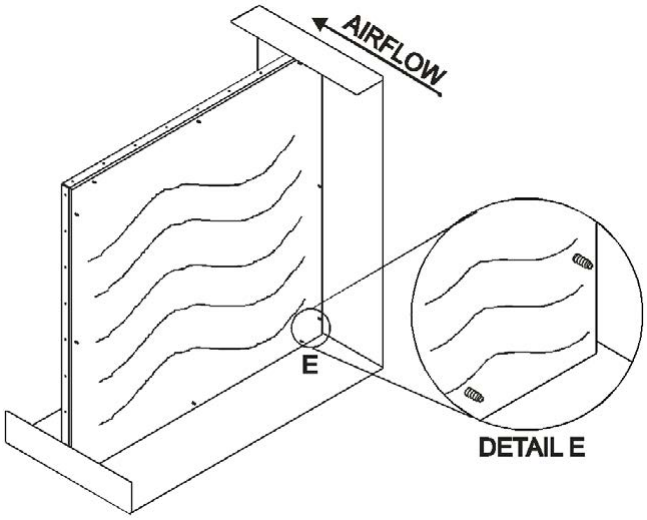


Figure 55: Media Installation

6.7.7 Media Clamping Strip Installation

The final step is to secure all components of the assembly using the media clamping strip. Place the strips so the 1 inch screw/studs pass through the slotted holes on the media clamping strip then fasten a factory supplied nut to hold the assembly in place. See *Figure 56 – Clamping Strip Installation*.

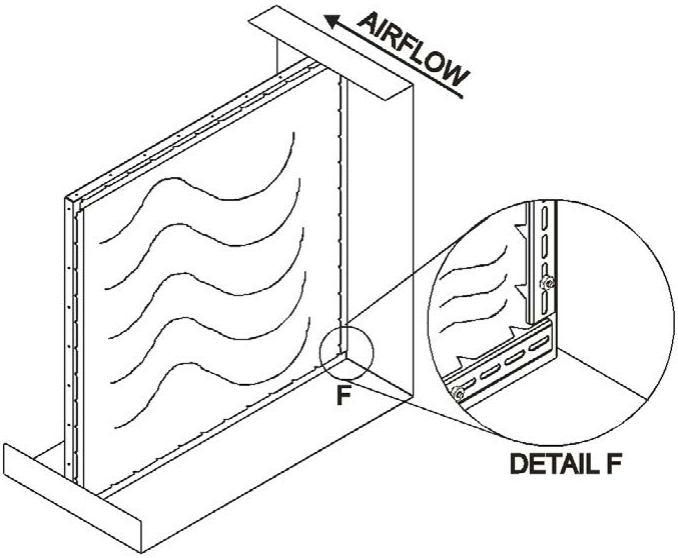


Figure 56: Clamping Strip Installation

7 Start-up and commissioning

This chapter describes the initial commissioning step-by-step. The procedure described hereafter assumes that the system has been installed correctly in accordance with guidelines in the installation chapter.

CAUTION!

It is mandatory that the initial commissioning be carried out by an authorized Nortec service technician appointed by your local Nortec supplier.

When fitting water filters, RO membranes, hoses and other components in direct contact with water please wear sterile gloves or touch only packing paper to keep the filter bacteria-free.

7.1 Cabinet layout

Important: make sure that S1 and main power switch S3 are both set to the off position

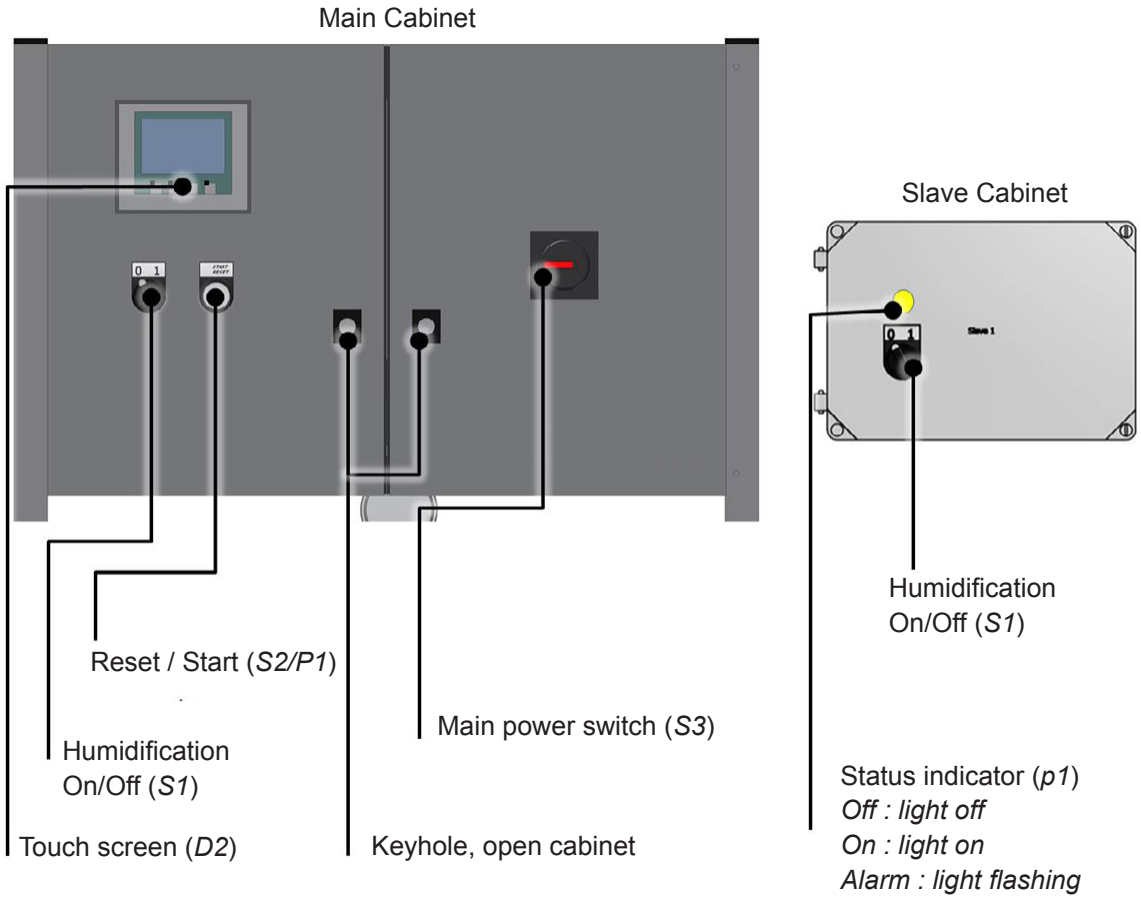


Figure 57: Overview cabinet

7.2 Insert inlet filter

- Unscrew the filter housing using a filter wrench, part number 104570000
- Insert filter, and make sure that it is centered on the guide knob in the bottom of the white filter vessel
- Tighten the filter as much as possible by hand and then use the filter wrench to tighten approx. 1/4 turn.
- Slowly open water supply
- If the filter is hard to tighten or leaks, unscrew it and check that it is centered, the O-ring is undamaged and the sealing surface is smooth.

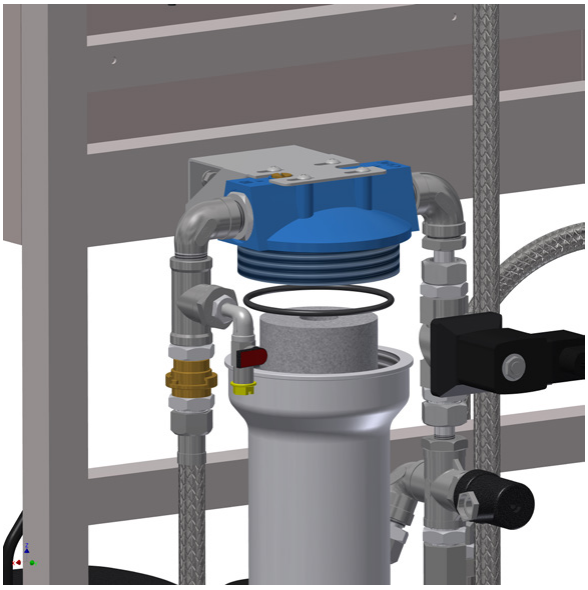


Figure 58: Inlet filter installation

- Bleed the filter by loosening the air screw on the filter until water leaks. Retighten air screw.

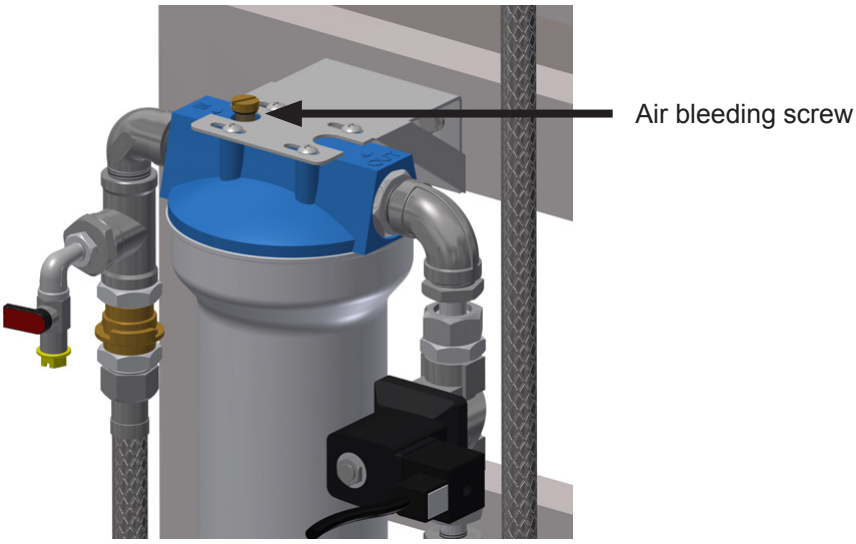


Figure 59: Air bleeding screw

7.3 Insert RO membrane (only for Nortec HP RO models)

- Remove the top part of the membrane housing
- Carefully cut open the protective bag of the RO membrane in the bottom end (the end with no O-rings)
- Lower the membrane down the membrane housing, O-rings up!

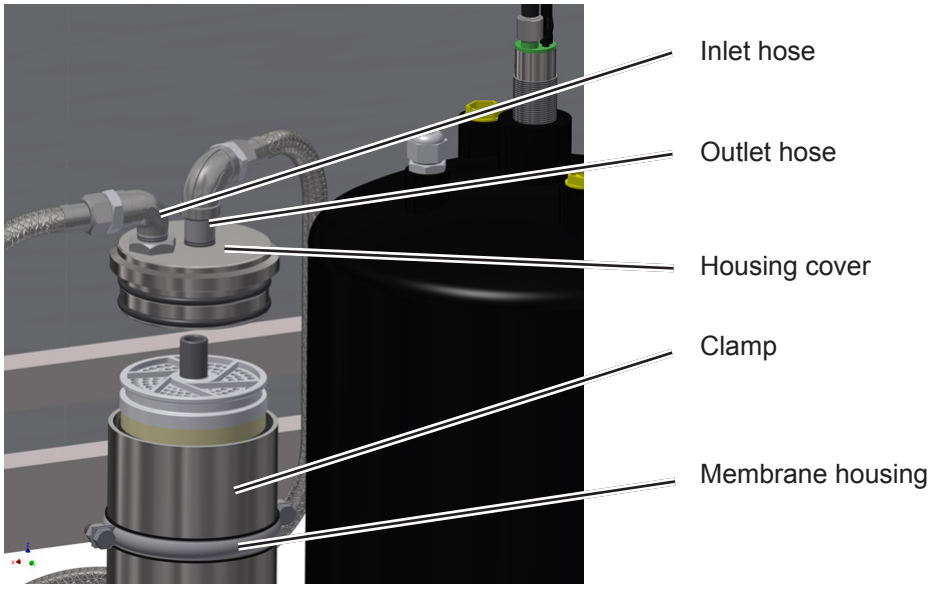


Figure 60: Inserting membrane

- Press the top part back in position and secure it with the clamp, do not use any lubricant for the O-rings, moisten them with water if it is a tight fit.
- Retighten the inlet and outlet hoses

7.4 Mount sterile breathing filter (only for Nortec HP RO models)

- Unpack the filter and moisten the O-ring with running water, avoid touching nipple and O-ring with your bare hands.
- Remove protective yellow cap
- Press the sterile breathing filter in place on top of the permeate vessel (RO tank).

Note: If the sterile breathing filter has been wet, it must be replaced.

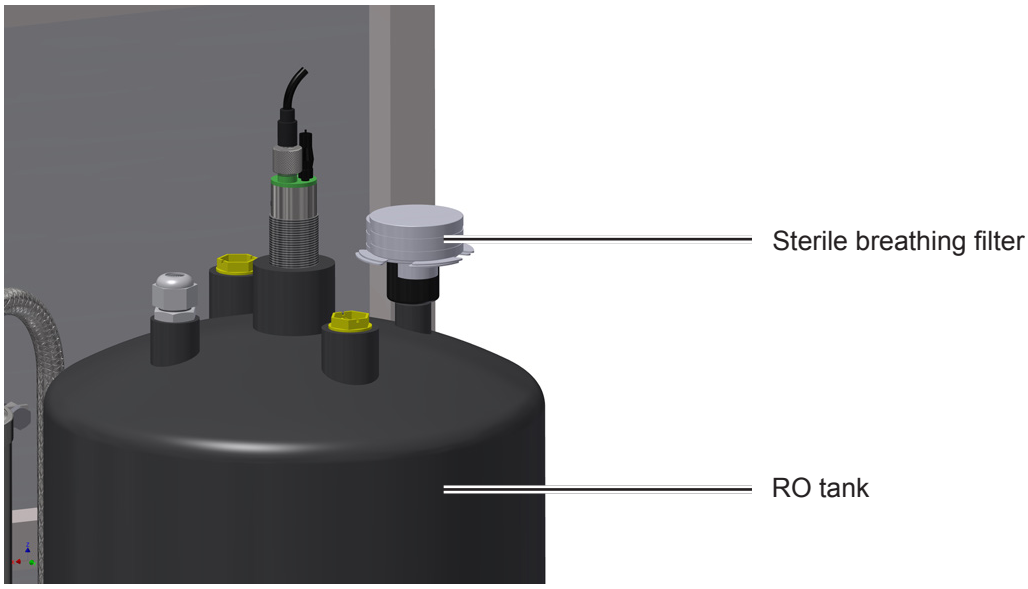


Figure 61: Mounting sterile breathing filter

7.5 Set up the controller

See *chapter 8*.

7.6 Flushing procedure

In order to get the conservation / anti-freeze fluid out of the system and avoid damaged valves and clogged nozzles, it is important to flush the system.

- Remove yellow cap from high-pressure hose and lead hose to drain.
- Now the pump is ready for start-up and flush sequence.

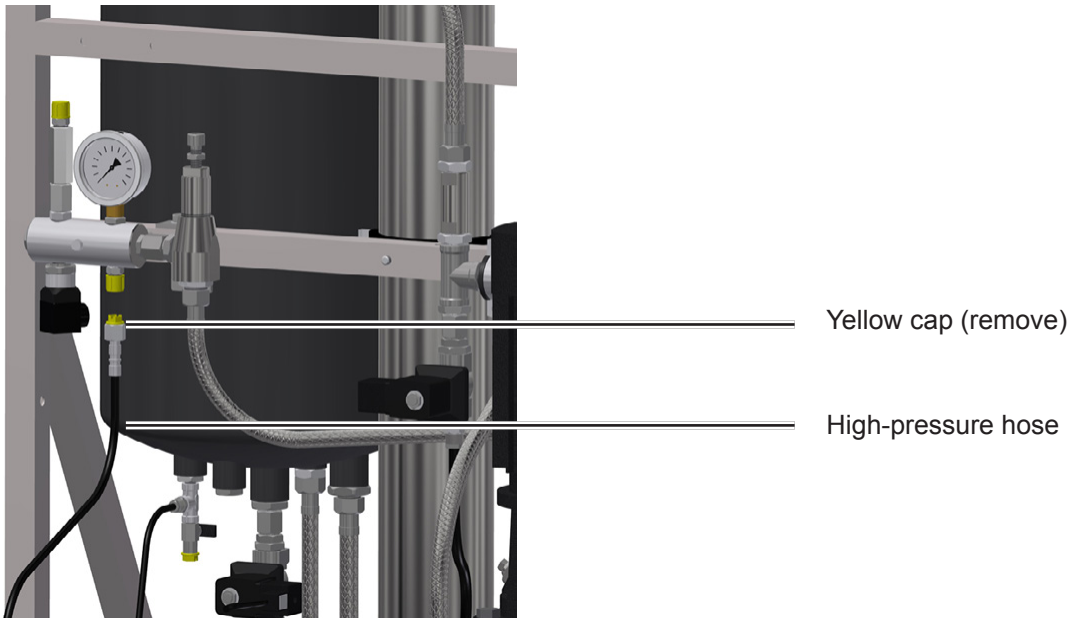
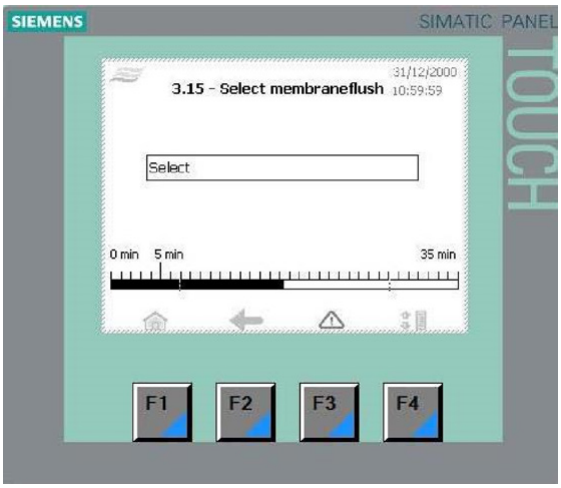


Figure 62:

7.6.1 Flushing the HP RO pump unit and RO membrane

- Make sure the water supply is fully open
- Turn the main power switch S3 to ON position (keep S1 in off)
- If hygienic flush starts, skip it
- Go to 3.15 Select membrane flush

3.15 - Select membrane flush screen	
	Always perform a membrane flush in the following situations: – First time the RO system is placed into operation. – After changing RO membrane(s). – If RO has been shut off for a longer period. • Select <membrane flush> from the dropdown menu. • Turn S1 to on, membrane flush starts. • Bleed the RO pump. • After the membrane flush program is finished (35 minutes) select <normal mode> from the dropdown menu and go to home screen.

- Now the RO system produces water and fills the RO tank, wait until the tank is full (RO pump stops)
- Now follow the "flushing the HP pump unit" procedure
- High-pressure pump might start immediately after termination of the flush procedure: please monitor the system during the flush procedure.

7.6.2 Bleed air from the RO pump

If the RO pump does not build up pressure or is noisy, bleed it.

- Open the air screw until all air is out, while the pump is running.

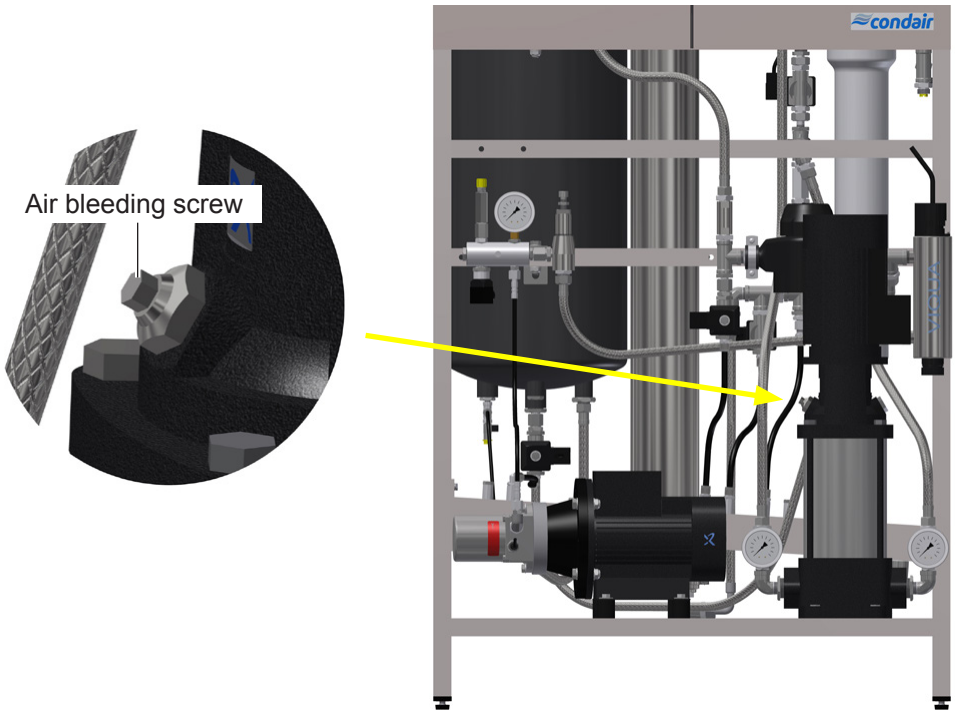


Figure 63: Bleeding RO pump

7.6.3 Adjusting the reverse osmosis

Explanation of technical terminology

Permeate:
Processed, desalinated water which is produced by the HP RO system and supplied to the reservoir tank.

Concentrate:
The water led to the outlet. This water contains salts and minerals that have been removed from the water.

Feed water:
The water which is led directly to the HP RO.

TDS:
The amount of dissolved salts, measured in mg/l.

Conductivity:
The designation of the water's salt concentration measured in (µS/cm). The lower the value, the higher the water quality.

Membranes:
Is the system filter which desalinates the feed water using high-pressure.

RO:
The abbreviation for reverse osmosis.

Transport pump (only on HP RO 800):
The pump which transports the processed water from the system reservoir's high-pressure pump.

Level switch:
A switch/sensor which emits a signal when the RO system must either be started or stopped, and it stops the transport pump in case of dry running of the reservoir tank.

Softening:
A pre-filter which softens the water, i.e. it removes hardness from the water.

7.6.4 Water quality

The feed water, which is to be treated in the HP RO system, must be of drinking water quality. Please read requirements for inlet water in section 5.5 Entering Water Requirements, on page XX and under product data at the end of this manual.

If there are doubts about the raw water composition, a water analysis must be made. The HP RO must be connected to a water pressure of minimum 36 psi and maximum 101 psi. The quality of the treated water will be less than 20 µS/cm at 50 °F.

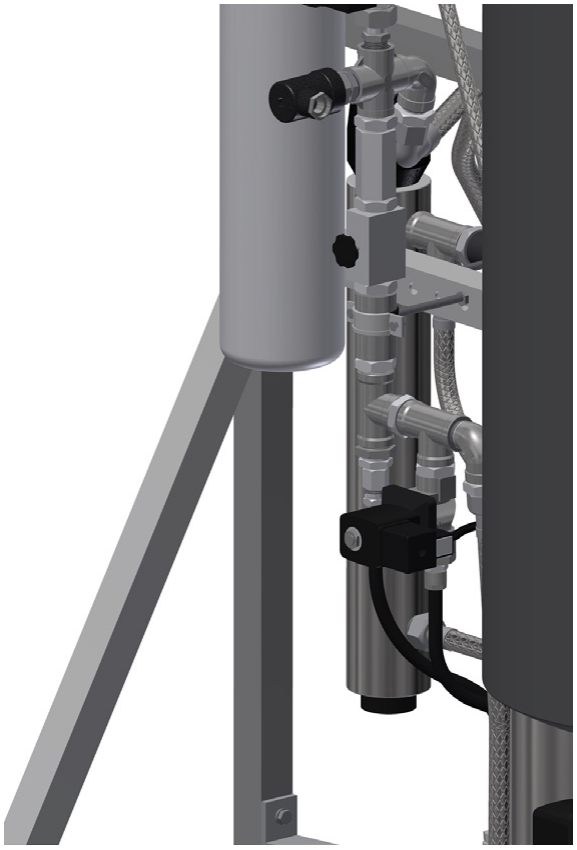
The HP RO will be adjusted from the factory to the following parameters :

HP RO 100 & 300	20 °dH / 50°F	Permeate/concentrate ratio: Approx. 50/50
HP RO 500 & 800	1 °dH / 50°F	Permeate/concentrate ratio: Approx. 75/25

Water quality (contact Nortec Humidity for technical advice)		
Content	Symptom	Preventive action
TOC, BOC and COD	Can cause slimy as well as firm hard film.	Can in some cases be micro-filtrated or removed by means of a carbon filter.
Iron, Manganese (ocher)	Precipitation of iron gives a red-dish-brown film and precipita-tion of manganese gives a black deposit.	Sand filter – oxidation, softening, greensand.
Calcium, magnesium (hard water)	The membrane scales.	Softening, anti-scaling agent
Silica	The membrane scales.	Anti-scaling agent
SDI (silt)	The membranes gets clogged.	Microfiltration (absolute), ultrafil-tration, flocculation.
Oil	The membrane is greasy from oil.	Carbon filter.
Particles	The membrane gets clogged due to hard deposits.	Microfiltration.
Chlorine, pesticides, organic solvents	Membrane deformed. Permeate capacity and quality changed and cannot be CIP-cleaned back to the original capacity. The defor-mation is not visible.	Free chlorine shall be removed by active carbon filter and chem-ical cleaning, either with thiosul-fate or sulphite.
Bacteria	Membrane is clogged by slime.	Chlorination + de-chlorination, UV, micro-filtration 0.2 µS/cm and ultra- filtration.

7.6.5 Adjustment of outlet amount

Important! Read the entire chapter before adjustment is started.

	Disconnect drain hose from drain manifold and put into bucket.
	Open both the recirculation valve (V2) and the outlet valve (V3). Note: the outlet valve (V3) could be a nozzle depending on configuration, if so just leave it in.

The outlet (concentrate) amount must be adjusted. Which amount is suitable on your system depends on the feed-water quality. Too high water recovery will damage the system membranes. On condition that the raw water complies with the water quality requirements, it can operate at a recovery rate of 70-80% with softening depending on the amount of organic material in the water.

HP RO size	Max Permeate capacity (gph)*	Outlet amount (gph) (with softened water)		Outlet amount (gph) (with tap water)	
		Surface water (75% ecovery)	Groundwater (80% ecovery)	Surface water (50% ecovery)	Groundwater (55% ecovery)
100	21,996	7,258	5,499	21,996	18,037
300	60,491	20,237	15,177	60,491	49,493
500	109,984	36,734	27,496	-**	-**
800	164,976	54,992	41,354	-**	-**

* For every degree the inlet water is below 50°F (10°C), the permeate capacity (gph) must be adjusted down with 3%.

** We recommend always using softening for HP RO 500 and 800, as the water consumption and wear on membranes will be relatively high. However, local water conditions may in some cases justify running without. Please ask Nortec Humidity for advice.

Ex.: HP RO 500 with 80% recovery

$$\textit{Outlet amount Gal/h} = \frac{\textit{100 x Permeate capacity Gal/h}}{\textit{Recovery\%}} \textit{ - Permeate capacity Gal/h}$$

$$\textit{Outlet amount} = \frac{\textit{100 x 109,984}}{\textit{80}} \textit{ - 109,984 = 27,496 Gal/h}$$

Start the RO system and adjust the outlet so the desired amount of outlet water has been obtained.

7.6.6 Adjustment of permeate amount

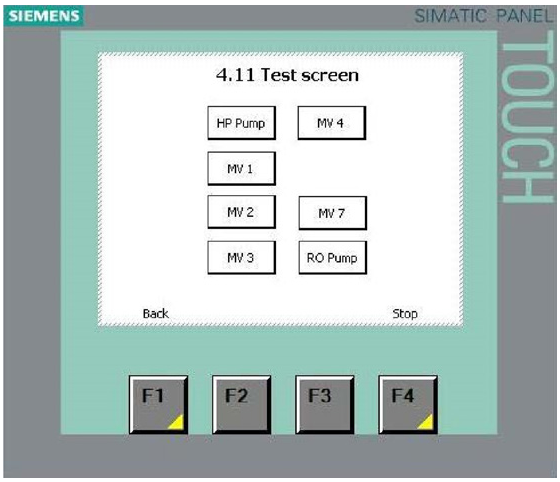
- Adjust the permeate amount with the recirculation valve. Adjust the amount of permeate produced to Max Permeate capacity (gph) of the specific system remember to temperature withdraw 3% from Max Permeate capacity (gph) For every degree the inlet water is below 50°F (10°C).

  E.g. if the feed water temperature is 46 °F (8°C), for an MLP RO 300 it means that the permeate capacity will be 6% below the normal 72.6 gph, e.g. 68.2 gph.
- When the requested pressure and permeate capacities have been obtained, check again if the outlet amount has been adjusted correctly.
  Note: The system must be started and stopped two times, and then the flow must be re-checked. The valves can then be readjusted if necessary.
- Check on the RO pump outlet manometer that it shows the correct operating pressure, 87 - 145 psi. (6-10 bar).
  Please note that the operating pressure may vary by different temperatures and capacities.
- Now check the quality of the processed water on the permeate hose; the conductivity must be below 20 µS/cm (conductivity meter is available as optional equipment).
- Check that the outlet water is below 1000 µS/cm.
- Check that the MLP RO automatically starts and produces treated water.
- Check if the HP RO automatically shuts down by too low feed water pressure or lacking feed water supply. This is done by slowly closing the feed water supply while the MLP RO is in operation. When the water supply has been interrupted, the HP RO must stop automatically within 10 sec. In order to put the HP RO back into operation, the water supply must be re-established and the reset button pushed once. The HP RO will automatically revert back to normal operation! The system is now commissioned and ready for use.

7.6.7 Flushing the HP pump unit

- Make sure the water supply is fully open
- Turn the main power switch S3 to ON position (keep S1 in off)
- If hygienic flush starts, skip it
- Go to 4.11 test screen

Display 4.11 - Test Screen



From this screen you can operate valves and start pumps manually, BE CAREFUL! all safety features are now deactivated

To Start the high-pressure pump and flush the pump:

- Turn S1 to ON position (1).
- Press <MV1> button to open inlet valve.
- Press <HP pump> to start high-pressure pump.
- After 2 seconds the pump should run smoothly without any rattling, hammering or vibrations, if not turn off immediately! Air out the system, make sure MV1 is opening and check water supply before turning on again.
- Flush the pump 10 minutes. Then set S1 in off.
- Return to home screen F1.

7.6.8 Flushing hoses and nozzle lines

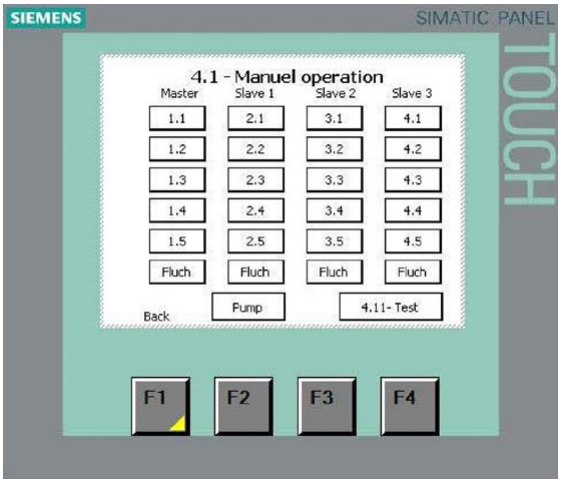
CAUTION!

Never let a solenoid valve be activated without running the pump. The solenoid valve will overheat if it does not have water running though.

To prevent any dust and particles in the hoses and pipelines from clogging up the nozzles during start-up, it is necessary to flush thoroughly.

- **Very important: remove the last nozzle on each nozzle pipe!**
- Go-to 4.1 Manual operation page

Display 4.1 - Manual Operation



- Operate valves on master and each slave unit
- The <Pump> button starts the high-pressure pump.

- Start the pump and open MV5 / flush valve(s) on all valve blocks.
- Check that water is coming out of all the flush valves, keep flushing for 10 minutes.
- Close MV5 / flush valve (s) and open/close reg 1, 2 & 3 in order to flush nozzle pipes depending on the system size you could flush more than one step at the time, be careful since the high-pressure pump can cavitate if output pressure gets too low.
- Flush each pipeline for minimum 10 minutes.
  - Return to home screen F1
  - After end flushing remember to put in the nozzles removed.

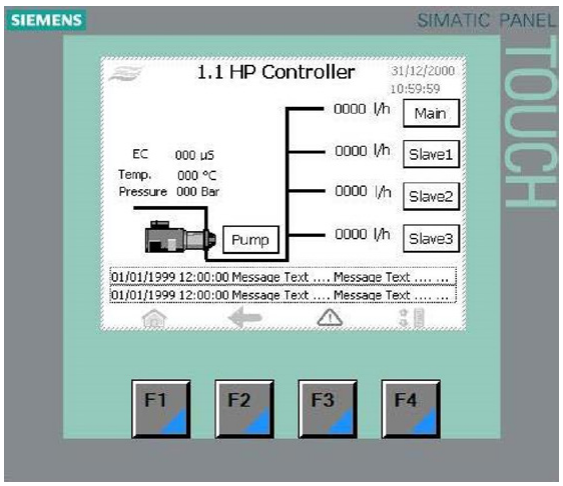
The system is now ready for operation.

8 Controller setup & Operation

8.1 Controller Setup

The Nortec HP and HP RO are controlled by a Siemens PLC with a Siemens touch panel. Many settings are already pre-set from the factory based on the info given when the unit was ordered. It is nevertheless important to go through all the basic settings before the unit is commissioned. Please go to all setup parameters in this chapter.

Display 1.1 - HP Controller



The interface panel, has a touch sensitive screen and four fixed buttons F1, F2, F3, F4

F1: Home, go to home screen.

F2: Back step, go to previous screen

F3: Settings, go to settings and maintenance menu

F4: History, go to list of alarm and warning messages

Pressing the Nortec Logo in the upper right corner changes menu language and units (Metric / US)

Tip! Use the tip of a pen or similar when typing numbers on the touch screen.

8.1.1 Menu structure

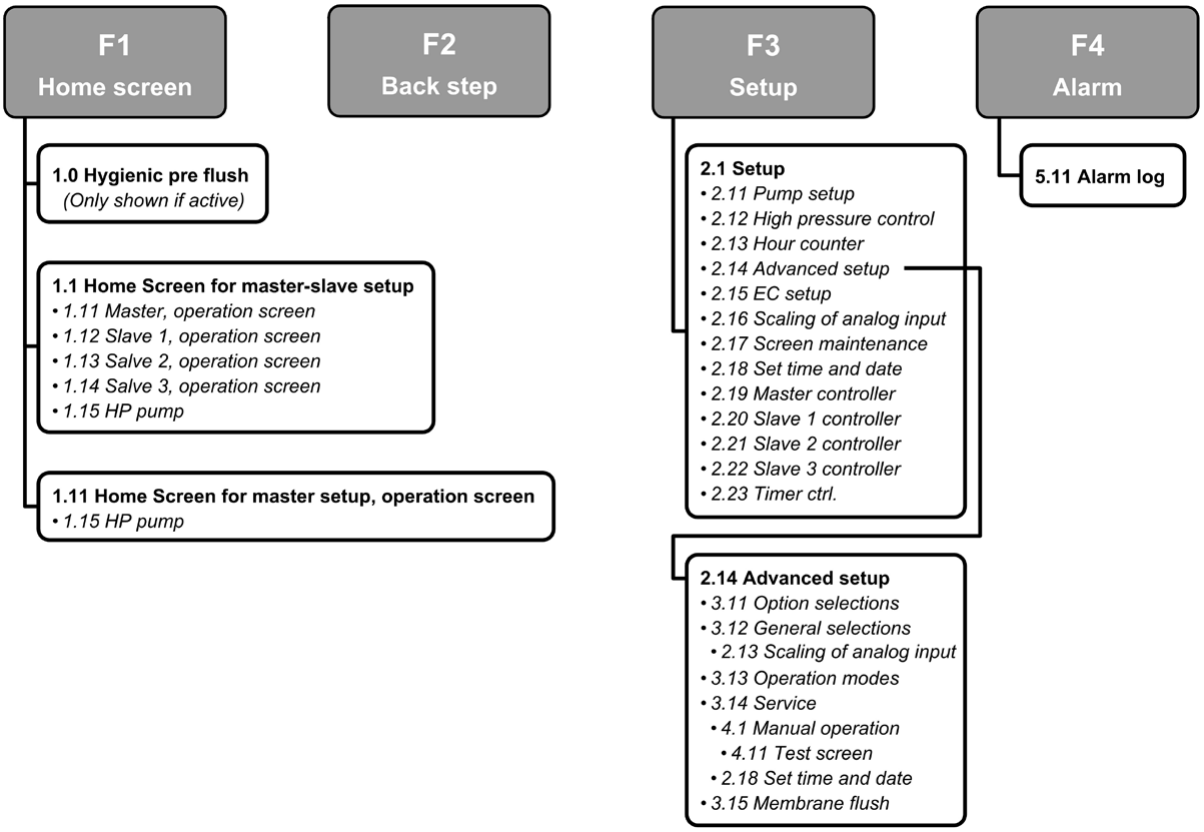


Figure 64: Menu structure

8.1.2 Basic settings

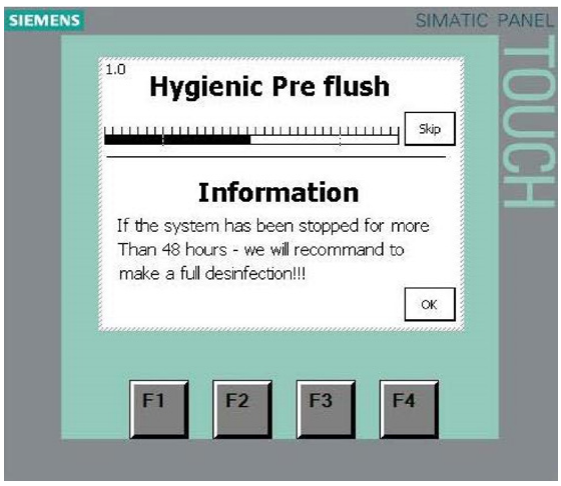
WARNING!

It is possible to deactivate or change hygienic precautions / settings. Intentional or unintentional changes in the menu may cause unintended health risk for people or animals. Only trained Nortec personnel should change basic settings.

CAUTION!

It is possible to change or deactivate settings that can lead to malfunctions or damage the equipment.

Display 1.0 - Hygienic pre flush

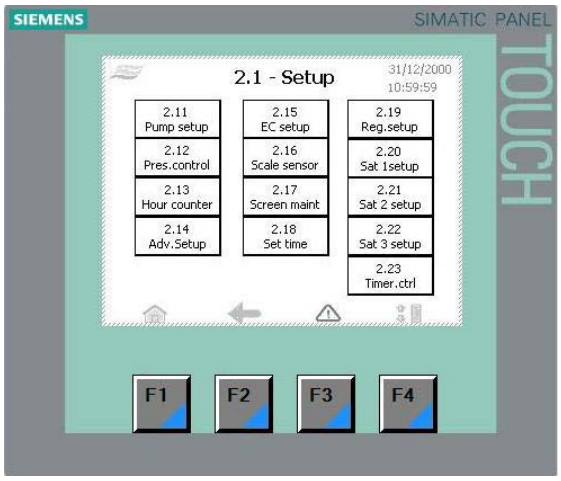


The HP has a safety feature that performs a hygienic pre flush if the system has been switched off for more than 48 hours. This is done to ensure that the water in the pipe leading to the unit is filled with fresh water before humidification starts. Default is 10 minutes flush.

Press <Skip> if you already flushed the pipes leading to the pump.

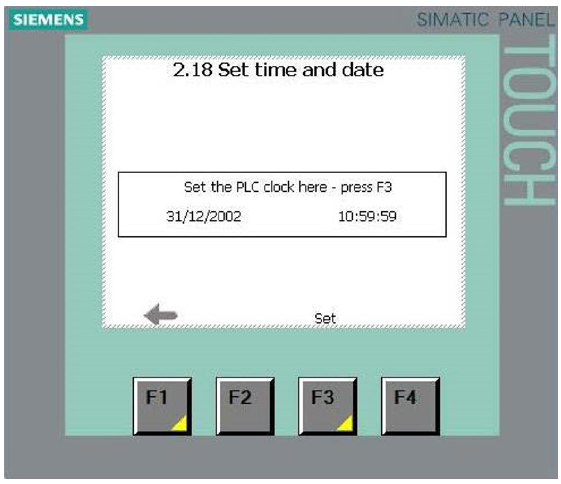
After pre flush, you will come to the home screen 1.1 or 1.11.

Display 2.1 - Setup menu



From the setup menu, it is possible to enter sub-menus and change settings.

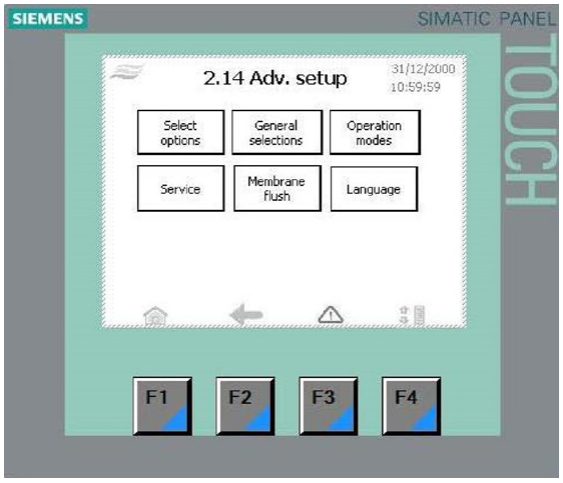
Display 2.18 - Set time and date



Tap the date or time in order to set.
Enter the date/time exactly as shown.

Clock: 10:59:59
Date: dd/mm/yyyy

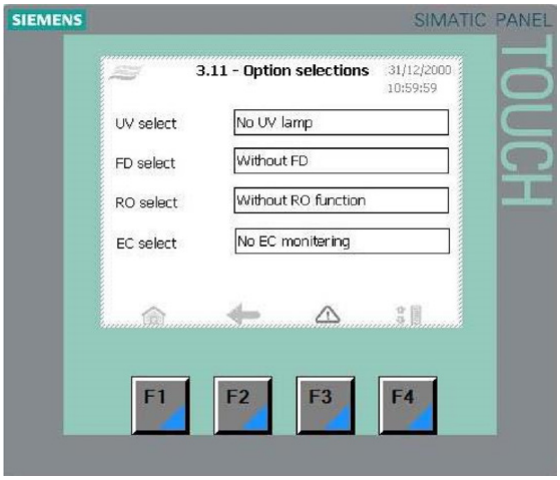
Display 2.14 - Adv. Setup



Password 8599

Settings in this menu should only be changed by trained personnel!

Display 3.11 - Option selections



Check that the options are correctly selected for the pump. Only options already mounted from the factory can be selected.

- UV select (Ultra Violet lamp)
  - No UV lamp
  - UV Monitoring
- FD select (frequency drive)
  - Without FD
  - With FD
- RO select (Reverse Osmosis)
  - Without RO function
  - With RO function
- EC select (Conductivity monitoring)
  - No EC monitoring
  - EC monitoring + alarms (optional)

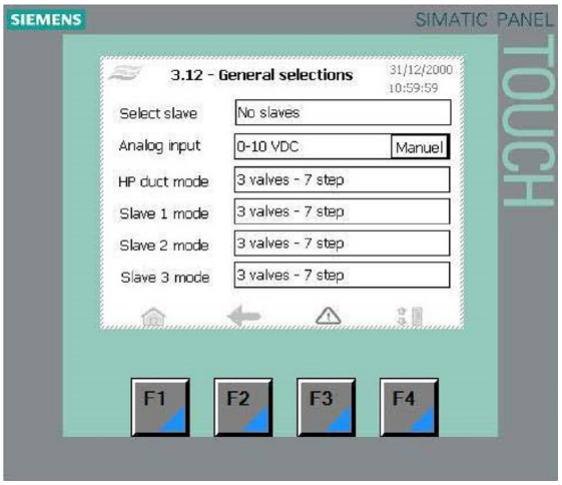
- EC monitoring + al + RV/CO2 (not selectable)
- EC monitoring + al + MB + RV/CO2 (not selectable)

al= Alarms

RV/CO2= Raw water mixer / CO2 for conductivity control

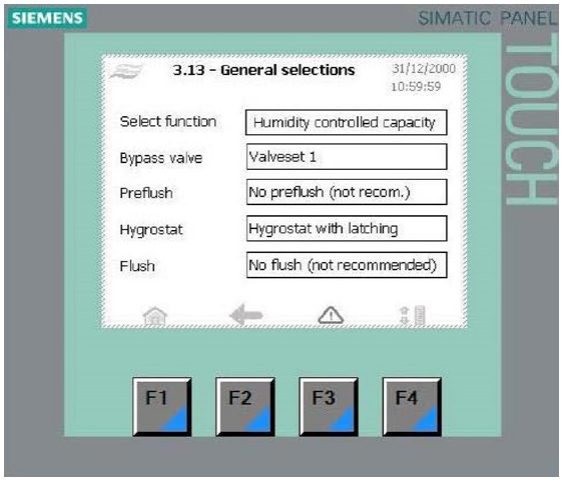
MB= Mix Bed filtration (ultra.pure water)

Display 3.12 - General selections



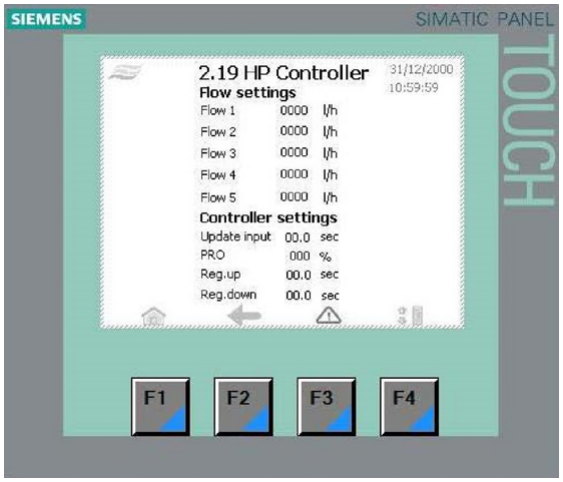
- Select Slave (select number of slaves in the system)
  - No Slave (only master)
  - 1 Slave
  - 2 Slaves
  - 3 Slaves
- Analogue input (type of humidity control signal)
  - 0-10 VDC
  - 2-10 VDC
  - 4-20 mA (see Subsection: mA control signal connection)
  - 0-20 mA (see Subsection: mA control signal connection)
  - 0-10 VDC scaled 20-80 %RH (humidity sensor signal)
  - 4-20 mA scaled 20-80 %RH (humidity sensor signal)
  - Manuel scaling (3.121 Manuel scaling)
- HP duct mode / Slave mode. Choose number of step valves on each valve block (without flush valve)
  - 3 valves – 7 step
  - 4 valves – 15 step
  - 5 valves – 31 step (not selectable)

Display 3.13 - General selections



- Select function (Duct hum control)
  - Direct controlled capacity (default)
  - Humidity controlled capacity
- Flush/bypass valve MV5, chose which valve is set to work as bypass valve. Choose the valve farthest away from the pump station, to secure the most effective flushing of the system.
  - Valve set 1
  - Valve set 2 (slave 1)
  - Valve set 3 (slave 2)
  - Valve set 4 (slave 3)
- Pre flush (the length of the pre flush period should be long enough to ensure that all stagnant water in the pipeline to the pump station has been drained out).
  - No pre flush (not recommended)
  - 1 minute pre flush
  - 5 minutes pre flush
  - 10 minutes pre flush (default)
  - 20 minutes pre flush
- Hygrostat
  - Hygrostat with latching
  - Hygrostat without latching (manual reset required)
- Flush
  - No Flush (Not recommended!)
  - Standard flush (flush though nozzle and flush valve)
  - Flush only through flush valve

Display 2.19 - HP Controller / Slave 2.19…2.22



- Flow settings, Enter value in l/h for each step valve, this will allow the controller to show correct water volume being sprayed into the duct.
  e.g.
  flow 1: 6*10 lb/h (4,5 l/h) nozzles= 60 lb/h (27 l/h)
  flow 2: 12*10 lb/h (4,5 l/h) nozzles= 120 lb/h (54 l/h)
  flow 3: 24*10 lb/h (4,5 l/h) nozzles= 240 lb/h (108 l/h)
- Controller settings
  - PRO proportional band standard 20%. For more aggressive regulation lower PRO e.g. 15%
  - Reg.up delay time for step jumps up
  - Reg.down delay time for step jumps down

8.2 Operation

8.2.1 Daily operation

Important! The procedure described hereafter assumes that the system has been installed correctly and initial commissioning has been carried out by a service technician from the manufacturer/distributor.

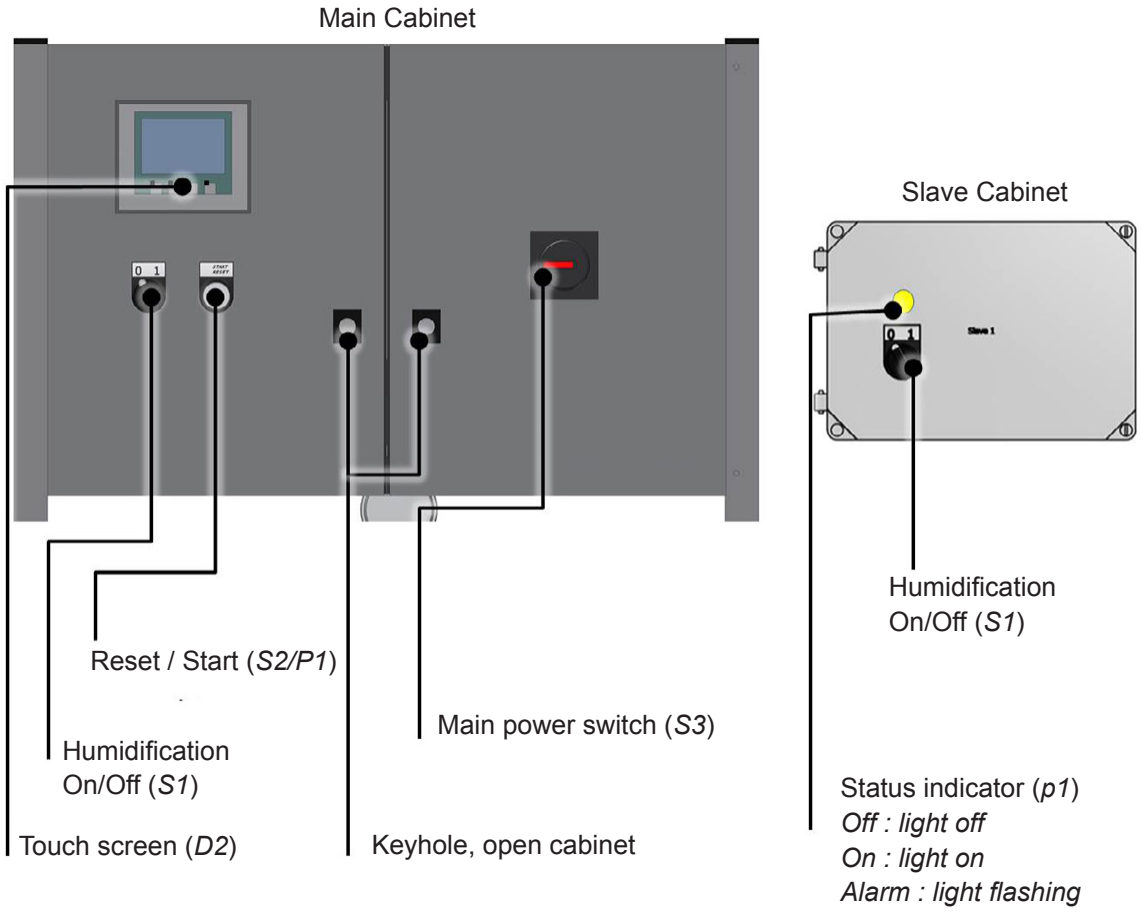


Figure 65: Overview cabinet

Check all system components and installations for possible damage.

- Open the stop valve of the water supply line
- Switch on the main power switch (S3), and on/off (S1) of the Slave control unit.
- If the system has integrated RO, the RO pump will start flushing and producing RO water to the tank
- Turn the humidification on/off button (S1) to 1
- If it is more than 48 hours since the system has been powered down, an automatic hygienic flush sequence should start, progress will be shown on the screen. Let the pump complete the flush sequence (It's recommended to disinfect the system if It has been switch off for more than 48 Hours)
- The touch screen will show the home screen.
- If a humidity demand/signal is present, high-pressure pump starts. A number of regulation valves open corresponding to the incoming signal.
  Note: HP RO pumps with integrated RO might need time to fill the RO tank before humidification starts.

8.2.2 Weekly inspection

During operation the Nortec HP and the humidification system have to be inspected weekly. On this occasion check the following:

- Entire humidification system for leakage.
- Electric installation for damage.
- Operating display for warning or error messages
- UV filters
- Pressure drop over filters
- Water treatment systems such as carbon filter, softener, RO

If the inspection reveals any irregularities (e.g. leakage, error indication) or any damaged components take the Nortec HP out of operation. Let the damage or malfunction be resolved by a qualified specialist or service technician.

Fill in the "Service form for weekly monitoring of humidifying systems" provided in the Appendix of this manual, failing to do so might affect you warranty.

8.2.3 Taking the HP/HP RO out of operation

WARNING!

For hygienic reasons we strongly recommend to leave the Nortec HP on all the time, even in periods when no humidification is required. This way the water circuit is flushed on a regular schedule and the UV filtration is active, thus preventing the formation of unwanted microorganisms

CAUTION!

If the system is turned off for a longer period it could damage components, such as RO-membranes, valves, filters and UV filter. If taking the system our for a longer period, please contact Nortec service for advice regarding preservation.

Proceed a follows to put the Nortec HP out of service, e.g. for maintenance work:

1. Switch off the pump station and/or all Slave control units (if present).
2. Close the stop valve of the supply line and secure it to prevent inadvertent opening.
3. Open the test tab on the discharge manifold to relive pressure.
4. Turn off the service switch in the mains supply lines to the pump station and to the Slave control units (if present), then secure the service switches against inadvertent switching on.
5. Hygiene! Let the fan of the ventilation system run until the humidifier unit is dry.
6. In case you need to carry out maintenance work, switch the ventilation unit off and secure it to prevent in-advertent power up (see instruction manual of the ventilation system).

8.2.4 Dismantling and disposal

Dismantling

1. Take the Nortec HP out of operation as described in “Taking the HP/HP RO out of operation"
2. Have the system components dismantled by a qualified service technician.

Disposal/Recycling

Components not used any more must not be disposed of in the domestic waste. Please dispose of the unit or the individual components in accordance with local regulations at the authorized collecting point.
If you have any questions, please contact the responsible authority or your local Nortec representative.
Thank you for your contribution to environmental protection.

9 Maintenance

9.1 Important notes on maintenance

Qualification of personnel

All maintenance work must be carried out only by well-qualified and trained personnel authorized by the owner.

Maintenance and repair of the electrical installation of the Nortec HP must be carried out only by qualified personnel (e.g. electrician) who are aware of possible dangers and implications. It is the owner's responsibility to verify proper qualifications of the personnel.

General note

The instructions and details for maintenance work must be followed and upheld.

Only the maintenance work described in this documentation may be carried out.

Only use original Nortec spare parts to maintain the warranty on the system.

Safety

Before maintenance is initiated, the Nortec HP must be taken out of operation in accordance with instructions in section "Taking the HP/HP RO out of operation" and protect against unintentional switching on. Before servicing the humidification unit, the ventilation system must be set out of operation (consult the documentation of the ventilation system).

The Nortec HP must be cleaned and disinfected at the intervals, described in chapter 9.2 and the cleaning work has to be carried out correctly.

WARNING!

Poorly maintained humidification systems may endanger health. Therefore it is mandatory to **observe the specified maintenance intervals** and to **carry out maintenance work in strict accordance with the instructions**.

9.2 Maintenance work

To ensure safe, hygienic and economic operation of the Nortec HP, its components must be checked and maintained periodically according to the table below. The maintenance intervals and maintenance work stated below are guideline values. Local conditions (quality of the supply air, the water, etc.) could influence the maintenance intervals. After having carried out the maintenance work, fill in the maintenance checklist and sign it and reset possible maintenance indications. The relevant personnel are fully liable for any maintenance work not carried out.

Checklist for planned service

To be performed	Half-year	Each year	Every 2 years	Every 4 years
Review of the system				
Testing of the system's overall function	X	X	X	X
Meter reading of water consumption (if present)	X	X	X	X
Reading of pump running hours	X	X	X	X
Logbook registration	X	X	X	X
Control weekly monitoring checklist is filled out	X	X	X	X
Water treatment system / incoming water				
Analysis of water hardness (in case of water softening)	X	X	X	X
Pump unit				
Replacement of filters	X	X	X	X
Check the condition of the pump (pressure & noise)	X	X	X	X
Testing of solenoid valves and replacement if necessary	X	X	X	X
Change gasket kit in high-pressure relive/reduction valve		X	X	X
Functional testing of max humidifier and duct release safety loops	X	X	X	X
Functional testing of high-pressure gauge and high-pressure transmitter (on VFD models)	X	X	X	X
Functional testing of pressure switch (pressostat)	X	X	X	X
Service inspection of PAHT pump (age 2 years or 8000 running hours)			X	X
Testing of ON/OFF valve and replacement if necessary		X	X	X
Reverse osmosis systems/RO (if Present)				
Measurement of conductivity	X	X	X	X
Replacement of pre-filter	X	X	X	X
Testing of overall function and settings for the RO system	X	X	X	X
Look for leaks	X	X	X	X
Disinfection / cleaning of tank	X	X	X	X
Performance test (produced water, drain water)	X	X	X	X
Testing of valves	X	X	X	X
Replacement of sterile breather filter		X	X	X
Testing of membrane and replacement if necessary	X	X	X	X

To be performed	Half-year	Each year	Every 2 years	Every 4 years
If UV system is present (also applicable for UV integrated in RO systems)				
Functional testing of UV systems	X	X	X	X
Cleaning of quartz glass on UV systems	X	X	X	
Replacement of UV-lamp		X	X	X
Replacement of quartz glass				X

To be performed	Half-year	Each year	Every 2 years	Every 4 years
Solenoid valve block(s)				
Functional test of solenoid valves and replacement of wear parts if needed	X	X	X	X
Humidification units / Nozzle arrangement				
Functional testing and airing if necessary	X	X	X	X
Testing of atomization quality and replacement of nozzles if necessary	X	X	X	X
Mist eliminator, cleaning or replacement if necessary	X	X	X	X
Check drain(s) in humidifier section of the duct, clean drip tray.	X	X	X	X
Humidity sensors				
Testing and adjusting of humidity sensors. Replace by +/- 10% deviation	X	X	X	X
Checking of max humidity controller (maximum humidistat)	X	X	X	X
Control units				
Transfer relay replacement		X	X	X
Testing of contact K1 and replacement if necessary		X	X	X
Extraction of water sample from pump and nozzle				
	X	X	X	X
Disinfection of the system				
	X	X	X	X

9.3 Part list for preventive maintenance

Nortec HP & HP RO recommended preventive/critical spare parts list, 4 year maintanace cycle																									
		HP 100	HP 200 VFD	HP 300	HP 500	HP 500 VFD	HP 800	HP 800 VFD	HP 1300 VFD	HP RO 100	HP RO 200 VFD	HP RO 300	HP RO 500	HP RO 500 VFD	HP RO 800	HP RO 800 VFD	Technical lifetime	6 month	First year	6 month	second year	6 month	Third year	6 month	Fourth year
Description	Part number	Pieces needed for one service																							
Water filter																									
Filter 1 micron 20"	104550000				1	1	1	1	1								6 months	Change	Change	Change	Change	Change	Change	Change	Change
Filter 5 micron 20"	104551000									1	1	1	1	1	1	1	6 months	Change	Change	Change	Change	Change	Change	Change	Change
Filter 1 micron 9 7/8"	104560000	1	1	1													6 months	Change	Change	Change	Change	Change	Change	Change	Change
O-ring for water filter	430020050	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24 months	Check	Check	Check	Change	Check	Check	Check	Change
Air Filter for RO tank																									
Sterile breather filter 0,2 my	104581000									1	1	1	1	1	1	1	12 months	Check	Change	Check	Change	Check	Change	Check	Change
UV Filter (not on all Pump stations), 30 mJ/cm²																									
S212 bulb (optional), UV SC1	104594000	1	1														12 months	Check	Change	Check	Change	Check	Change	Check	Change
S287 bulb (optional), UV SC2,5	104594500			1	1	1				1	1	1					12 months	Check	Change	Check	Change	Check	Change	Check	Change
S463 bulb (optional), S5Q-PA/SSM-24	104596000						1	1					1	1	1	1	12 months	Check	Change	Check	Change	Check	Change	Check	Change
S810 bulb (optional), S8Q-PA/SSM-37	104597000								1								12 months	Check	Change	Check	Change	Check	Change	Check	Change
Quartz UV System (not on all Pump stations)																									
Quartz Sleeves for UV SC1	104582000	1	1														48 months	Check	Check	Check	Check	Check	Check	Check	Change
Quartz Sleeves for UV SC2,5	104582501			1	1	1				1	1	1					48 months	Check	Check	Check	Check	Check	Check	Check	Change
Quartz sleeve for S5Q-PA/SSM-24	104584000						1	1					1	1	1	1	48 months	Check	Check	Check	Check	Check	Check	Check	Change
Quartz sleeve for S8Q-PA/SSM-37	104586000								1								48 months	Check	Check	Check	Check	Check	Check	Check	Change
RO membrane																									
4" for HP RO: water quality 250 µS and higher	150460000										1	1	2	2	3	3	95% salt removal	Check	Check	Check	Check	Check	Check	Check	Change
2.5" for HP RO: water quality 250 µS and higher	150465000									1							95% salt removal	Check	Check	Check	Check	Check	Check	Check	Change
4" for HP RO: water quality 250 µS and lower	686020010										1	1	1	2	3	3	95% salt removal	Check	Check	Check	Check	Check	Check	Check	Change
2.5" for HP RO: water quality 250 µS and lower	686020005									1							95% salt removal	Check	Check	Check	Check	Check	Check	Check	Change
Electrical control system																									
Print frame relay Pump and On/Off valve	680010177	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	12 months		Change		Change		Change		Change
Print frame relays (use 4 pcs per valve block)	680010177	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	12 months		Change		Change		Change		Change
Contactor (K1) Siemens	349010205	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	48 months		Check		Check		Check		Change
High-pressure pump																									
Service kit for PAHT 2	104466001	1	1							1	1						8000h/24 months				Overhaul				Overhaul
Service kit for PAHT 4/6.3	104466002			1	1	1						1	1	1			8000h/24 months				Overhaul				Overhaul
Service kit for PAHT 10	104466003						1	1	1						1	1	8000h/24 months				Overhaul				Overhaul
High-pressure pump motor coupling																									
Service kit coupling PAHT 2/4	240020072	1	1							1	1						-				Check				Check
Service kit coupling PAHT 6.3	240020072				1	1							1	1			48 months				Check				Change
Service kit coupling PAHT 10	240020073						1	1	1						1	1	48 months				Change				Change
Valve block (high-pressure)																									
Repair kit for one valve; core, spring, o-rings (230V)	190021030	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	36 months		Check		Check		Overhaul		Check
Repair kit for one valve; guide tube, core, spring, o-rings (230V)	190021031	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	4xVB	36 months		Check		Check		Check		Check
Solenoid coil for valve block (230V)	190020030																-	Check	Check	Check	Check	Check	Check	Check	Check
Pressure regulator																									
Service kit	104481000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12 months	Check	Overhaul	Check	Overhaul	Check	Overhaul	Check	Overhaul
On/off valve																									
On/off valve	106521000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	48 months	Check	Check	Check	Check	Check	Check	Check	Change
Check valve at manifold																									
Check valve 1/4"	510020000	1	1	1						1	1	1					24 months	Check	Check	Check	Change	Check	Check	Check	Change
Check valve 3/8"	510020005				1	1	1	1	1				1	1	1	1	24 months	Check	Check	Check	Change	Check	Check	Check	Change
Nozzles																									
Nozzle ML 4.5 Stainless	103150000	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	5-10 % yearly	Check	Check	Check	Check	Check	Check	Check	Check
Nozzle ML 2,5 Stainless	103160000	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	0,1xN	5-10 % yearly	Check	Check	Check	Check	Check	Check	Check	Check
Disinfection																									
Sanosil S010 Ag (1 liter bottle)	155404000	1	1	1	2	2	2	2	2	1	1	1	1	2	2	2		Change	Change	Change	Change	Change	Change	Change	Change
Water softener (not on all Pump stations)																									
Service kit Kinetico 30/2030 - 60/2060	150110002									1	1	1	1	1	1	1	24 months	Check	Check	Check	Change	Check	Check	Check	Change
Test set of softness	150400000									1	1	1	1	1	1	1	12 months	Check	Change	Check	Change	Check	Change	Check	Change
Additional water filter (not on all Pump stations)																									
Filter 20 micron 20"	104553000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6 months	Change	Change	Change	Change	Change	Change	Change	Change

9.4 Maintenance indications

The HP / HP RO have the possibility to give a warning when it is time for maintenance, the message is shown on the touch screen. If the system has a remote fault indication relay this will also give a signal.

For detailed information regarding settings and reset of the maintenance indicator please read the information given in the operating manual.

10 Troubleshooting

10.1 Important notes on troubleshooting

Qualification of personnel

Have faults eliminated by qualified and trained personnel only. Malfunctions caused by the electrical installation must be repaired by authorized personnel (e.g. electrician) only.

Repair work on the high-pressure pump may only be carried out by your Nortec representative's service technician.

Safety

When eliminating faults, the Nortec HP must be taken out of operation, as described in chapter 8.3, and prevented from further inadvertent operation.

Make sure the power supply to the pump station /Slave control units is cut off (test with voltage tester) and that the stop valve in the water supply line is closed.

10.2 Malfunction with error indication

Malfunctions during operation are indicated by a corresponding warning message in the display of the pump station or the Slave control unit. Detailed information can be found in the separate operating instructions for HP control unit.

Error message	Cause	Remedy
Max. humidistat	Maximum humidistat has been tripped, due to high humidity	Check that ventilation is on Set point is correct Incoming set point signal OK
	Max. humidistat defect or incorrectly set	Change max humidistat Set correct, e.g. 85 % RH
	Max. humidistat circuit damaged or not installed correctly	Check circuit for faults Check settings for max. humidistat in controller are correct If no max. humidistat, a jumper must be installed over terminals (4 & 4+)
Inlet water pressure too low	The inlet water pressure is too low	Check the inlet pressure at maximum flow for pump station according to product data
	The Inlet water pressure is too low for short periods (if inlet pressure and flow seems ok when measured)	Check the water installation for periodically high consumption e.g. cleaning, tank filling and maintenance work
	Defect Inlet pressure switch [PS]	Replace pressure switch
Sensor error	Humidity sensor missing or defect	Install humidity sensor
	Wiring to humidity sensor damaged or incorrectly installed	Replace wiring according to electrical diagram
	Humidity outside range (under 20 % RH or above 80 % RH)	Check the humidity at sensor and reset if below 20 % RH
	Sensor scaling is wrong	Scale the sensor correctly in the controller
Emptying tank - water too hot (only for HP RO systems)	Ambient temperature too high at pump location (max 77 ºF)	Lower ambient temperature in pump room (max 77 ºF)

Error message	Cause	Remedy
Stop - Pump too hot	Water flow through high-pressure pump too low.	Check flush valve MV5 at step valve block opens and nozzle are not clogged
	Ambient temperature too high at pump location (max 77 ºF)	Lower ambient temperature in pump room (max 77 ºF)
	Incoming water to warm	Lower Inlet water temperature (max 59 ºF)
	Inlet pressure / flow missing	Defect inlet valve [MV1] Water supply blocked / closed
	Damaged thermostat or cable [T]	Change thermostat and cable
	High-pressure pump defect	Locate cause of failure e.g. running hours exceeded 8000, particles / dirt in the system, missing water pressure, defect inlet valve. Change pump when cause of failure has been established and corrected
Tank full (only HP RO)	Top float switch on RO tank level stick has been activated	RO pump does not stop, check motor start relay Inlet valve [MV1] leaks, change / overhaul valve
Thermo relay error	RO or high-pressure pump motor overheated	Check the pump is not jammed Check electrical motor for defects
FD error	Frequency converter error	Turn of the main power to pump station, wait 15 seconds then restart the system Check the settings on the Frequency converter according to the electrical diagram Check if pressure in high-pressure system is too high/low
High-pressure low/high	Outlet high-pressure side outside pre-set value in 40-70 bar	Check high-pressure at pressure gauge Check pre-set value in the controller, if pressure seems ok at pressure gauge Check pressure regulating valve functions correctly and is set to 65 bar Low pressure can be caused by leaks, defect valves, missing nozzles on the high-pressure line. Check high-pressure pump Check pressure sensor functions correctly Check pressure sensor relay functions correctly
Phase sequence relay	Phase sequence are not correct	Change phase sequence
	A phase is missing	Restore missing phase
	There has been a short-term power failure	Reset

10.3 Resetting the error indication

To reset the error indication:
Press the reset button underneath the touch screen.

Note: If the fault has not been eliminated, the error indication reappears after a short while.

10.4 Malfunction without error indication

The following table provides malfunctions that do not issue messages, notes on the cause of malfunction and information on how to eliminate the source of trouble.

Malfunction	Cause	Remedy
Water deposits in the duct section outside of the water tub	Mist eliminator defective.	Check/Replace mist eliminator
	Excess air velocity (>4 m/s) in duct.	Reduce air velocity in duct (<4 m/s).
	Faulty location of spray nozzles or spraying circuits not connected to appropriate nozzles.	Check location of nozzles and piping of spraying circuits according to the nozzle diagram. Relocate nozzles and/or connect hoses correctly, as required.
Nortec HP humidifies permanently.	Nominal humidity value too high.	Reduce nominal humidity value.
	Ambient humidity very low.	No measures to be taken, just wait.
	The internal controller is activated, although an external controller is connected	Deactivate internal controller.
Maximum humidification capacity not reached.	Wrong system design (capacity too low).	Contact your Nortec supplier.
	Step valve(s) REG1, REG2 or REG3 defective.	Check the function of the step valves by increasing the nominal humidity value.
Important! Reset the nominal humidity to the correct value after checking.	Spray nozzles clogged.	Remove nozzles (see *chapter 6.4*) and replace them
	Hoses to nozzle pipes are leaking or disconnected, or nozzle pipes are leaking.	Check hoses/nozzle pipes and seal, as required
Control unit is switched on but the display of the control unit does not show anything.	Service switch in power supply line is off.	Set service switch in power supply line to On position.
	Fuses of the power supply line blown	Have an electrician replace fuses of the power supply line.
	Fuse of control unit blown	Have an electrician replace fuse of the control unit.
	Display or control board defective	Have a Nortec service technician replace the display or the control board.
Excessive fluctuations of humidity control.	Faulty electrical connection of spray valves REG1, REG2 and REG3 or spraying circuits not connected to appropriate nozzles.	Have an electrician connect spray valves REG1, REG2 and REG3 correctly (see wiring diagram in *chapter 6.6*). Check piping of spraying circuits and rectify, as required

11 Product Specifications

11.1 Technical data

11.1.1 Technical data Nortec HP

	HP100	HP200 VFD	HP300	HP500	HP500 VFD	HP800	HP800 VFD	HP1300 VFD
Capacity @ 50 Hz [lb/h] water used	220 / 50Hz	440	583 / 50Hz	968 / 50 Hz	1100	1738 / 50Hz	1760	2860
Capacity @ 50 Hz [L/h]	100	200	265	440	500	790	800	1300
Capacity @ 60 Hz [lb/h] water used	264 / 60Hz	440	693 / 60Hz	1155 / 60 Hz	1100	2079 / 60Hz	1760	2860
Capacity @ 60 Hz [L/h]	120	200	315	525	500	945	800	1300
Weight [pound]	110.2-143.3	110.2-143.3	121.3-154.3	143.3-176.4	121.3-154.3	165.3-198.4	143.3-176.4	165.3-198.4
Dimensions w x d x h [inch]	26.0x19.7x51.2	26.0x19.7x51.2	26.0x19.7x51.2	26.0x19.7x51.2	26.0x19.7x51.2	26.0x19.7x51.2	26.0x24.8x51.2	26.0x24.8x51.2
Water supply dynamic pressure [bar]	1...4	1...4	1...4	1...4	1...4	1...4	1...4	1...4
Pipe inlet "RG	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"
IP class	IP54	IP54	IP54	IP54	IP54	IP54	IP54	IP54
Sound level [dB(A)]	<80	<80	<80	<80	<80	<80	<80	<80
50Hz								
Electrical conn. 3-phased	Un= 220-240 V							
Absorbed power [kW]	0.9	1.1	1.1	2.1	2.1	3	3	3.9
Pre fuse	16 A	16 A	16 A	16 A	16 A	16 A	25 A	25 A
Electrical conn. 3-phased	Un= 308-415 V							
Absorbed power [kW]	0.9	1.1	1.1	2.1	2.1	3	3	3.9
Pre fuse	16 A	16 A	16 A	16 A	16 A	16 A	16 A	20 A
60Hz								
Electrical conn. 3-phased, Volt	Un= 208-277 V							
Absorbed power [kW]	1	1.8	1.8	2.2	2.2	3.2	3.2	4
Pre fuse	16 A	16 A	16 A	16 A	16 A	16 A	25 A	25 A
Electrical conn. 3-phased, Volt	Un= 400-480 V							
Absorbed power [kW]	1	1.8	1.8	2.2	2.2	3.2	3.2	4
Pre fuse	16 A	16 A	16 A	16 A	16 A	16 A	16 A	20 A

11.1.2 Technical data Nortec HP RO

	HP RO 100	HP RO 200 VFD	HP RO 300	HP RO 500	HP RO 500 VFD	HP RO 800	HP RO 800 VFD
Capacity, 50 & 60 Hz (Inlet water temperature 59°F)	220 lb/h	440 lb/h	583 lb/h	968 lb/h	1100 lb/h	1650 lb/h	1760 lb/h
Water consumption	440 lb/h	1320 lb/h	1320 lb/h	1540 lb/h	1540 lb/h	2420 lb/h	2420 lb/h
Water supply dynamic pressure [bar]	2.5 - 7.0	2.5 - 7.0	2.5 - 7.0	2.5 - 7.0	2.5 - 7.0	2.5 - 7.0	2.5 - 7.0
Softened water recommended	no	no	no	yes	yes	yes	yes
Water out [µS/cm]	5< EC< 30	5< EC< 30	5< EC< 30	5< EC< 30	5< EC< 30	5< EC< 30	5< EC< 30
Water utilization, %	40-60	40-60	40-60	70-80	70-80	70-80	70-80
Saline retention,%	> 95	> 95	> 95	> 95	> 95	> 95	> 95
Dimensions w x d x h [inch]	33.9x27.6x63.0	33.9x27.6x63.0	33.9x27.6x63.0	33.9x27.6x63.0	33.9x27.6x63.0	55.1x27.6x63.0	55.1x27.6x63.0
Extern RO-tank, gallons	13	13	13	52	52	132	132
Dimensions external RO-tank w x d x h [inch]	integrated	integrated	integrated	23.6x23.6x37.6	23.6x23.6x37.6	31.5x31.5x49.2	31.5x31.5x49.2
Weight pump + RO-tank, pound	275.6	308.7	288.8	485.0	485.0	551.2	551.2
Sound pressure level, dB(A)	< 80	< 80	< 80	< 80	< 80	< 80	< 80
Pipe diameter - inlet, "RG	¾	¾	¾	¾	¾	¾	¾
Pipe diameter - Drain	40	40	40	40	40	40	40
IP class	IP54	IP54	IP54	IP54	IP54	IP54	IP54
50 Hz							
Electrical conn. 3-phased	Un= 220-240 V						
Absorbed power [kW]	0.9	1.1	1.1	2.1	2.1	3	3
kW -RO	0.37	0.75	0.75	0.75	0.75	0.75	0.75
Pre fuse	16 A	16 A	16 A	20 A	20 A	25 A	25 A
Electrical conn. 3-phased	Un= 308-415 V						
Absorbed power [kW]	0.9	1.1	1.1	2.1	2.1	3	3
kW -RO	0.37	0.75	0.75	0.75	0.75	0.75	0.75
Pre fuse	16 A	16 A	16 A	16 A	16 A	16 A	20 A
60 Hz							
Electrical conn. 3-phased	Un= 208-277 V						
Absorbed power [kW]	0.9	1.1	1.1	2.1	2.1	3	3
kW -RO	0.37	0.75	0.75	0.75	0.75	0.75	0.75
Pre fuse	16 A	16 A	16 A	16 A	20 A	20 A	25 A
Electrical conn. 3-phased	Un= 400-480 V						
Absorbed power [kW]	0.9	1.1	1.1	2.1	2.1	3	3
kW -RO	0.37	0.75	0.75	0.75	0.75	0.75	0.75
Pre fuse	16 A	16 A	16 A	16 A	16 A	16 A	20 A

11.2 EC declaration of conformity

EC - Declaration of Compliance

Manufacturer:
Condair A/S
Parallelvej 2
DK-8680 Ry

We hereby declare, that the following pump systems for humidification purposes:

ML RO 100; ML RO 300; ML RO 500; ML RO 800; ML RO 1000; ML RO 1500;
HP 100; HP 200 VFD; HP 300; HP 500; HP 500 VFD; HP 800; HP 800 VFD; HP 1300 VFD
HP RO 100; HP RO 200 VFD; HP RO 300; HP RO 500; HP RO 500 VFD; HP RO 800; HP RO 800 VFD
MLP 100; MLP 300; MLP 500; MLP 800; MLP 1000; MLP 2x800; MLP 2x1000; MLP 3x800; MLP 3x1000 MLP RO 100; MLP RO 300;
MLP RO 500; MLP RO 800
MLP HRO 100; MLP HRO 300
MLPD 300; MLPD 500; MLPD 1000;
MLPG 100; MLPG 300; MLPG 500; MLPG 800; MLPG 1000;
RTN 200; RTN 500

Are manufactured in accordance with the following EC directives:

- 2006/42/EC, Directive on machinery
- 2014/30/EC, EMC (ElectroMagnetic Compatibility) Directive
- 2014/35/EC, The low voltage directive
- 2011/65/EC, ROHS Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The following harmonized standards have been applied:

- EN ISO 12100:2011, Safety of machinery – General principles for design – Risk assessment and risk reduction
- EN ISO 13849-1:2008, Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design.
- EN 55022:2011+AC, Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- EN 60204-1:2006 + amendments, Safety of machinery – Electrical equipment of machines – Part 1: General requirements

The following international standards and technical specifications are used:

- IEC 60034-1 ed. 12.0, Rotating electrical machines - Part 1: Rating and performance
- IEC 60034-5 ed. 4.1, Rotating electrical machines - Part 5: Degrees of protection provided by the integral de- sign of rotating electrical machines (IP code) – Classification
- IEC 60034-6 ed. 2.0, Rotating electrical machines - Part 6: Methods of cooling (IC Code)
- IEC 60034-8 ed. 3.1, Rotating electrical machines - Part 8: Terminal markings and direction of rotation
- IEC 60320 ed. 2.1, Appliance couplers for household and similar general purposes - Part 1: General requirements

DK-Ry, February 25, 2016

Lasse Andresen, Technical Manager

Condair A/S
Parallelvej 2, DK-8680 Ry
Tel. +45 8788 2100
www.condairsystems.dk

EC - Konformitätserklärung

Hersteller:
Condair A/S
Parallelvej 2
DK-8680 Ry

Wir erklären hiermit , dass die folgenden Pumpensysteme für Befeuchtungszwecke:

In Übereinstimmung mit den folgenden EG-Richtlinien hergestellt werden:

Folgende harmonisierte Normen wurden angewende :

Folgende internationale Normen und technische Spezifikationen werden verwendet:

A Appendix A - Controls

A.1 Modbus TCP/IP - communication

The PLC act in the communication as a Server
PLC - S7-1200 IP: 192.168.1.101 Mask: 255.255.255.0
Block 1 - Integers from PLC to BMS/CTS (7 INTEGER)
Device id: 1 - Port: 502 - MB mode 0 (mb code 5)

Humidification load - Master	int	40001	0-100	l/h	Shows actual load of humidification Master
Humidification load - Slave 1	int	40002	0-100	l/h	Shows actual load of humidification Slave1
Humidification load - Slave 2	int	40003	0-100	l/h	Shows actual load of humidification Slave2
Humidification load - Slave 3	int	40004	0-100	l/h	Shows actual load of humidification Slave3
Status Integer 1	int	40005			Send as an integer - the individuel bit is used as bool as described next
Status Integer 2	int	40006			Send as an integer - the individuel bit is used as bool as described next
Status Integer 3	int	40007			Send as an integer - the individuel bit is used as bool as described next

Status Integer 1				
System active	Bool	0	0-1	System active
Master step 1	Bool	1	0-1	Master step 1
Master step 2	Bool	2	0-1	Master step 2
Master step 3	Bool	3	0-1	Master step 3
Master step 4	Bool	4	0-1	Master step 4 (optional)
Master step 5	Bool	5	0-1	Master step 5 (optional)
Slave 1 step 1	Bool	6	0-1	Slave 1 step 1
Slave 1 step 2	Bool	7	0-1	Slave 1 step 2
Status Integer 2				
Slave 1 step 3	Bool	0	0-1	Slave 1 step 3
Slave 1 step 4	Bool	1	0-1	Slave 1 step 4 (optional)
Slave 1 step 5	Bool	2	0-1	Slave 1 step 5 (optional)
Slave 2 step 1	Bool	3	0-1	Slave 2 step 1
Slave 2 step 2	Bool	4	0-1	Slave 2 step 2
Slave 2 step 3	Bool	5	0-1	Slave 2 step 3
Slave 2 step 4	Bool	6	0-1	Slave 2 step 4 (optional)
Slave 2 step 5	Bool	7	0-1	Slave 2 step 5 (optional)
Status Integer 3				
Slave 3 step 1	Bool	0	0-1	Slave 3 step 1
Slave 3 step 2	Bool	1	0-1	Slave 3 step 2
Slave 3 step 3	Bool	2	0-1	Slave 3 step 3
Slave 3 step 4	Bool	3	0-1	Slave 3 step 4 (optional)
Slave 3 step 5	Bool	4	0-1	Slave 3 step 5 (optional)
System in alarm	Bool	5	0-1	System in alarm
Available	Bool	6	0-1	Available
Available	Bool	7	0-1	Available

B Appendix B - Checklists

B.1 Site and AHU Design Checklist

Prior to designing and selecting a Nortec HP humidification system the following preparatory steps must be carried out:

- Collecting site-specific data required for system design (see table below)
- Selecting the desired options (see *5.8 – Options*)

Important notes:

– If a particular site is to be equipped with several HP systems, determine the above data for each system separately. Your Nortec representative will then evaluate whether the particular systems may be operated in a master-slave compound configuration.

– Evaporating aerosols cools down the air inside the duct (adiabatic cooling effect). To achieve the desired air temperature the supply air must be heated prior to humidification.

Your Nortec representative needs the following data for proper system design:

Duct dimensions		
Width (inner)	inch	_____
Height (inner)	inch	_____
Length of evaporation distance, min. 800 mm, (from nozzle tip to front of mist eliminator)	inch	_____
Wall thickness of duct where the hoses will be passed through	inch	_____
Air velocity in duct	ft./min	_____
Air volume to be humidified per hour	CFM	_____
Air pressure (absolute) in housing --> not mandatory necessarily	in. H_2O wg	_____
State of supply air prior to humidification		
Temperature T1	°F	_____
Humidity x1	%RH	_____
Desired state of air after humidification		
Temperature T2	°F	_____
Humidity x2	%RH	_____

B.2 Start-up and Commissioning Checklist

The check list below must be filled out during the first commissioning and signed by the corresponding service technician.

Agency: _____ Client: _____

Location: _____ Date: _____

Pump: _____ Serial number: _____

Nozzle type: _____ Humidification capacity: _____

Demand signal: _____ Software version: _____

1. Visual inspection

Hoses properly fixed and wear protection spiral hose mounted, where necessary?	☐
Connections high-pressure piping pump station - step valve block	☐
Hose connections in the duct	☐
Connection MV REG1 to spray circuit 1/7	☐
Connection MV REG2 to spray circuit 2/7	☐
Connection MV REG3 to spray circuit 4/7	☐
Connection MV REG4 to spray circuit 8/15 (optional)	☐
Connection MV5 flush valve to drain	☐

2. Control/Configuration

Are the electric installations of the Master and the Slaves (if available) correctly done in accordance with the appropriate wiring diagram? Specially observe: • Are the cables of the step valves correctly connected? • Is the control signal correctly connected? • Is the external safety chain connected (Master and Slaves) or is a cable bridge connected instead? • Is the power supply correctly connected and correctly fused?	☐
Are the control units (Master and Slave) correctly configured (switch on control units and check configuration). Specially observe: – Is the control signal correctly configured (is the internal controller deactivated, if an external controller is connected) ? – Is the number of Slave units correctly configured in the control unit of the Master? – Test the inlet pressure switch by closing inlet valve and letting out water from V1 (while pump is off) wait until the alarm "low pressure" appears in the display?	☐

3. Pump station

Flush supply line for at least for 5...10 minutes --> then connect	☐
Flush high-pressure piping for 5...10 minutes	☐
Room equipped with floor drain?	☐
Flushing line and housing drain connected and hoses secured?	☐
Flow pressure 29 to 145 psi (2...10 bar)?	☐
Stop valve open?	☐
No leakages at the pump?	☐

4. Nozzle unit

Nozzle pipes tight?	☐
Drain within the humidification distance present and connected via a siphon? Does the height of the siphon comply with the expected duct pressure?	☐
Spray angle of the nozzles (min. 50°, optimal 70°)	☐
Minimum distance from the first nozzle to the duct wall accurate (no drop formation on the duct wall)?	☐
Step 1/7	☐
Step 2/7	☐
Step 3/7	☐
Step 4/7	☐
Step 5/7	☐
Step 6/7	☐
Step 7/7	☐

5. Mist eliminator

Mist eliminator correctly installed, according to the regulations of the manufacturer?	☐
Drain after the mist eliminator present and connected via a siphon? Does the height of the siphon comply with the expected duct pressure?	☐
No drop throw after at least 1 hour of full load (fan and humidifier)	☐

Remarks: _____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ Signature: _____

C Appendix C - Water and Parts

C.1 Entering Water Requirements

The quality of the water being used in the HP or HP RO system should be checked prior to system commissioning. Nortec Humidity Ltd. recommends that the HP RO system be connected to a clean, potable (drinking water quality) mains water supply. If the inlet water does not meet the quality specified in the preconditions table, it may be necessary to install additional water treatment.

C.1.1 Requirements for RO water coming into an HP unit:

Water supply	Reverse Osmosis or Demineralized Water
Conductivity	5-50 µS/cm
TDS	max 35 ppm
KMnO4	max 10 ppm
NTU	max 1.0
Temperature	max 59 °F
Fe	max 0.2 ppm
Mn	max 0.05 ppm
Max. Hardness	max 1º dH
Free chlorine	max 0.1 ppm

C.1.2 Requirements for Potable (drinking) water coming into an HP RO unit:

Water supply	Drinking water quality
Conductivity	250-1000 µS/cm (with standard membrane)
Silt index	max 3.0
KMnO4	max 10 ppm
NTU	max 1.0
Temperature	max 59 °F
Fe	max 0,2 mg/l
Mn	max 0.05 ppm
Max. Hardness	max 20 gpg
free chlorine	max 0.1 ppm

C.2 Valve and Tank details

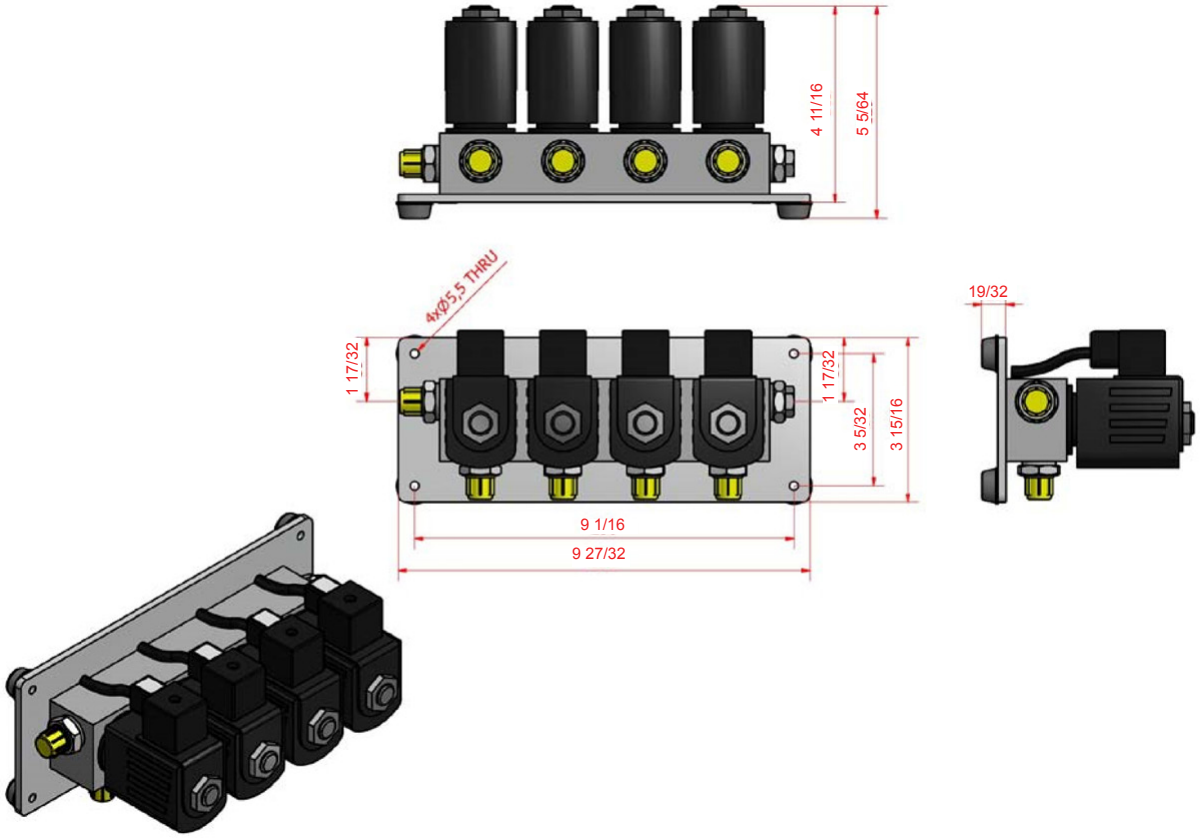


Figure 66: Valve block 3+1 INDUCT dimensions (in inch)

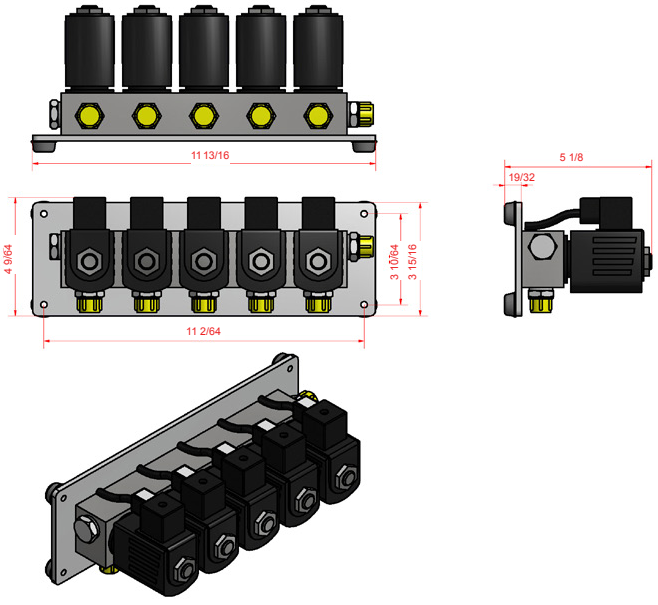


Figure 67: Valve block 4+1 INDUCT dimensions (in inch)

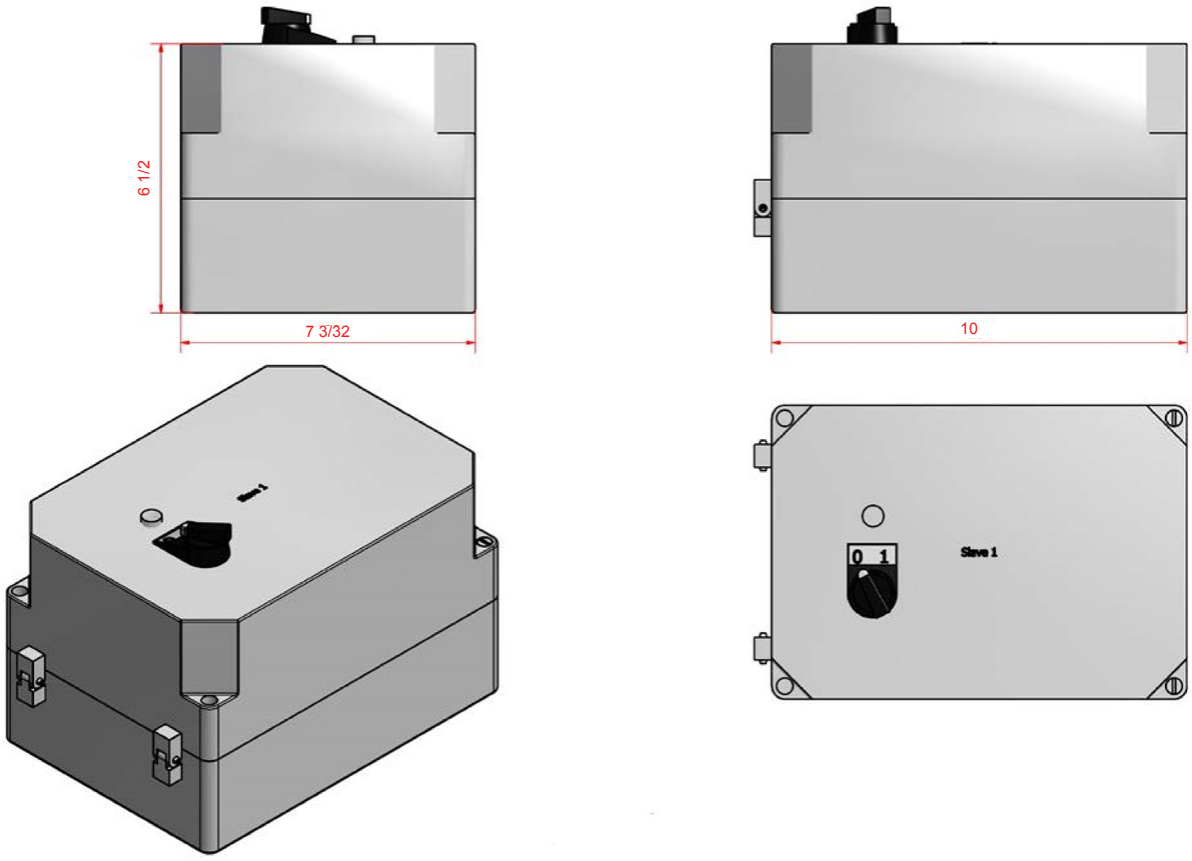


Figure 68: Slave station dimensions (in inch)

Figure 69: HP RO 500 tank 52 gallon (200 l) *HP RO 800 tank 132 gallon (500 l)*

Notes

Notes

Warranty

Nortec Humidity Inc. and/or Nortec Humidity Ltd. (hereinafter collectively referred to as THE COMPANY), warrant for a period of two years after installation or 30 months from manufacturer's ship date, whichever date is earlier, that THE COMPANY's manufactured and assembled products, not otherwise expressly warranted, are free from defects in material and workmanship. No warranty is made against corrosion, deterioration, or suitability of substituted materials used as a result of compliance with government regulations.

THE COMPANY's obligations and liabilities under this warranty are limited to furnishing replacement parts to the customer, F.O.B. THE COMPANY's factory, providing the defective part(s) is returned freight prepaid by the customer. Parts used for repairs are warranted for the balance of the term of the warranty on the original humidifier or 90 days, whichever is longer.

The warranties set forth herein are in lieu of all other warranties expressed or implied by law. No liability whatsoever shall be attached to THE COMPANY until said products have been paid for in full and then said liability shall be limited to the original purchase price for the product. Any further warranty must be in writing, signed by an officer of THE COMPANY.

THE COMPANY's parts or materials that are considered consumables, including but not limited to: cylinders, filters, nozzles, membranes, media, gaskets, O-rings, etc. are NOT covered by the warranty.

THE COMPANY makes no warranty and assumes no liability unless the equipment is installed in strict accordance with a copy of the catalog and installation manual in effect at the date of purchase and by a contractor approved by THE COMPANY to install such equipment.

THE COMPANY makes no warranty and assumes no liability whatsoever for consequential damage or damage resulting directly from misapplication, incorrect sizing or lack of proper maintenance of the equipment.

THE COMPANY makes no warranty and assumes no liability whatsoever for damage resulting from freezing of the humidifier, supply lines, drain lines, or quality of the water used.

THE COMPANY retains the right to change the design, specification and performance criteria of its products without notice or obligation.

THE COMPANY's limited warranty on accessories, not of the companies manufacture, such as controls, humidistats, pumps, etc. is limited to the warranty of the original equipment manufacturer from date of original shipment of humidifier.

Extended Warranty

Extended warranties are available to purchase under the conditions listed above.

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