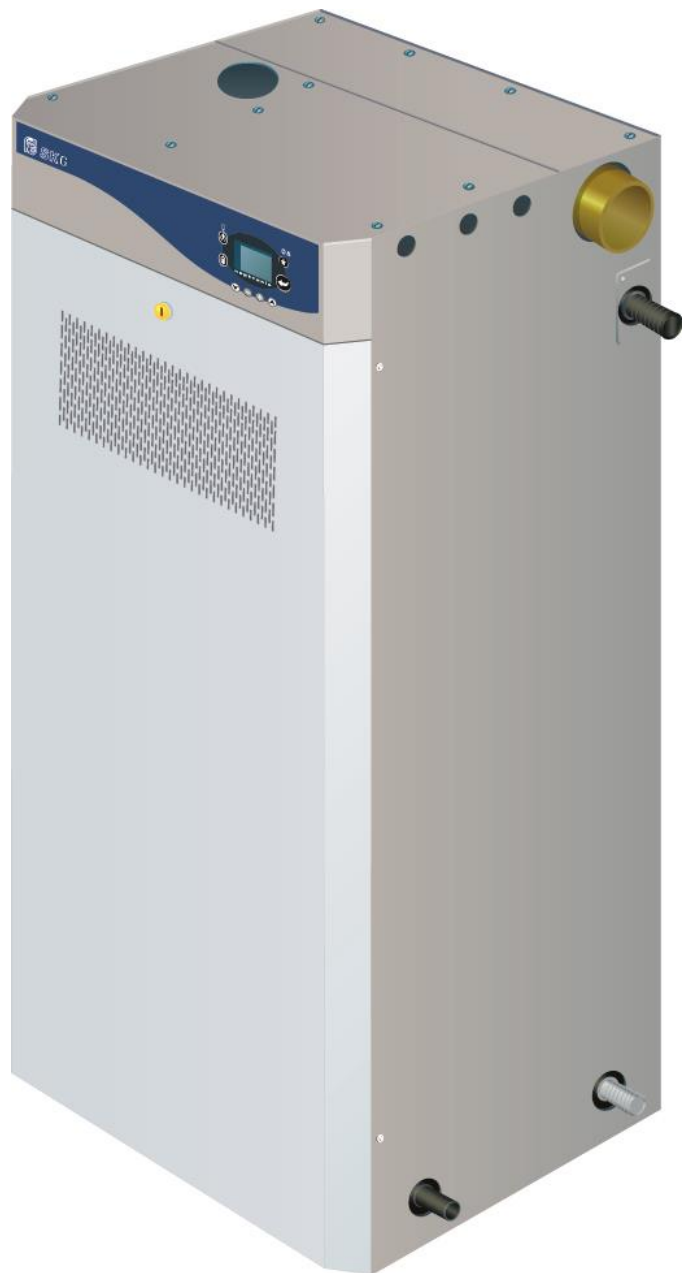




neptronic®

Gas Fired Humidifier SKGE3 Series

INSTALLATION INSTRUCTIONS



Read and save these instructions

SKGE-IOM-250225

**WHAT TO DO
IF YOU SMELL GAS!****GAS**

Do not try to light any appliance.

Do not touch any electrical switch; do not use any telephone in your building.

Immediately call your gas supplier from an off-site telephone.

Follow the gas supplier's instructions.

If you cannot reach your gas supplier, call the fire brigade.

Before installation, check that the local distribution conditions, nature of gas and pressure, and the current state adjustment of the appliance are compatible.

Improper installation, adjustment, alteration, service, maintenance or use can cause carbon monoxide poisoning, explosion, fire, electrical shock or other conditions which may cause personal injury or property damage.

This appliance **MUST** be used only in sufficiently ventilated space. Consult instructions before installation and use of this appliance

Installation and service **MUST** be performed by a qualified gas installer, service agency, or the gas supplier.

Ensure that local regulations concerning the provision of gas installations are followed.

ELECTRICITY

All work concerned with electrical installation **MUST** only be performed by skilled and qualified technical personnel (e.g. electrician or technician with appropriate training). The customer is always responsible for ensuring the suitability of the technical personnel.

Ensure that the local regulations concerning the provision of electrical installations are followed.

**HEALTH &
SAFETY**

Neptronic has considered aspects of the design of their humidification systems to reduce as much as possible the risk of Legionnaires' disease and other similar conditions, but it is important that users are also aware of their responsibilities under Health & Safety regulations in reducing the risk of legionellosis.

To prevent the growth of Legionella, users are required to:

- Avoid water temperature that favours the growth of Legionella (20-45°C).
- Avoid water stagnation.
- Clean and disinfect the humidification system in accordance to Health & Safety regulations and enclosed instructions.
- Carry out a risk assessment of the water system supplying the humidifier by a competent person, to ensure the water supply is of an acceptable quality

CORRECT USE

Neptronic® systems and products are designed only for humidification use.

Any other application is not considered as usage for the intended purpose. The manufacturer cannot be made liable for any damage resulting from incorrect use.

ACCESS

The SKGE3 cabinet keys **MUST** never be left in the door locks, as this may cause unauthorized access to live electrical parts. Always store keys centrally with a nominated responsible person.

WATER

Neptronic® systems are designed to be used with tap, reverse osmosis, de mineralized or partially softened water. On no account attempt to introduce any other fluids or chemicals into the system without first consulting Neptronic or its authorized distributor.

Water supply must not exceed the max pressure of 4.8 bar or pressure limits laid out in the specification and installation must comply with local regulations. Your attention is drawn to your responsibilities as outlined in the Health & Safety regulations. The control of Legionella bacteria in water systems and your SKGE3 steam humidifier must be included in the risk assessment of the water system in your building as a whole. In particular, if the humidifier is turned off for prolonged periods, you must ensure that the unit is drained and that stagnation is avoided in pipe work supplying it.

A competent individual or organization must be appointed to carry out water tests. A wide range of different tests are available to identify the presence of microbes in water, including total viable count (TVC), temperature-range specific tests and identification of particular species types including Legionella. **It is the responsibility of the person on whom the statutory responsibility falls to determine the type and frequency of this and all other controls and preventative measures outlined in this manual.**

WARRANTY

Failure to install this humidifier as outlined in this manual may invalidate the warranty.

Foreword

***Neptronic
Company
Overview***

Founded in 1976, we're a private corporation that designs, manufactures and distributes products for the HVAC industry. Our product line includes intelligent controllers, electronic actuators, actuated valves, humidifiers and electric heaters.

Our products are designed and manufactured by over 250 dedicated employees in our 7,500 m² (80,000 ft²) state-of-the-art facility located in Montreal, Canada. Using a vertical integration model, our entire manufacturing chain is under one roof from software and hardware development, to SMT circuit board assembly, to sheet metal fabrication, to product testing ensuring that our products are engineered to last.

We currently hold several national and international patents and with our continued commitment to research and development, we provide innovative products and technologies for the ever-evolving challenges of the HVAC industry. Exporting over 70% of our sales, we have an exclusive distribution network around the globe that provides comprehensive solutions to our worldwide customers.

About the Manual

These installation and operation instructions have been developed to facilitate the installation of the Gas Fired Humidifier.

The strict application of these instructions will ensure the conformity of your installation and operation as per the manufacturer's recommendations.

The application of these instructions is one of the conditions for the application of the warranty.

The application of these instructions does not ensure, at any time conformity to procedures, regulation or local codes, regarding electric installation and connection to local water supply.

This product has been declared to conform to applicable European safety and electromagnetic compatibility standards and directives and bear the CE mark. The certificate of conformity CE is available upon request to the manufacturer.

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Electricity

All work concerned with electrical installation **MUST** only be performed by skilled and qualified technical personnel such as an electrician or a technician with appropriate training). The customer is always responsible for ensuring the suitability of the technical personnel.

Please observe the local regulations concerning the provision of electrical installations.

Correct Use

Neptronic systems and its products are designed only for humidification use. Any other application is not considered appropriate for the intended purpose. The manufacturer cannot be made liable for any damage resulting from incorrect use.

General Warranty

This product is subject to the terms and conditions described at <http://www.neptronic.com/Sales-Conditions.aspx>.

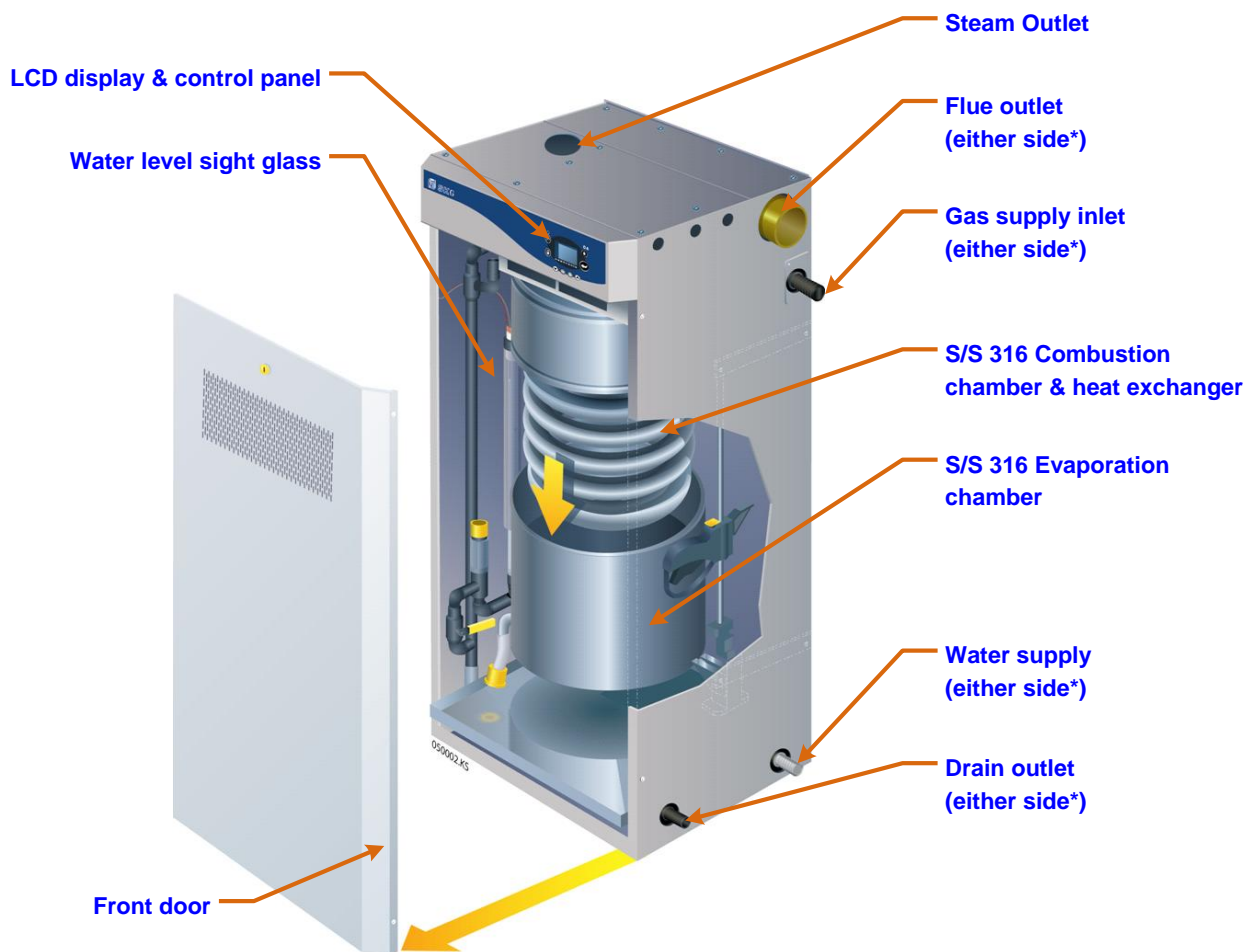
Table of Contents

Safety	1
Foreword	2
Table of Contents.....	3
Technical Specifications	4
Dimensions & Weights	5
Handling & Unpacking.....	9
Installation Overview	10
Stage 1 – Unit Positioning and Mounting	11
Stage 2 – Steam Distribution Installation	13
Stage 3 – Gas Supply Connection.....	20
Stage 4 – Water Supply Installation	21
Stage 5 – Water Drain Connection	22
Stage 6 – Combustion Air Installation	24
Stage 7 – Flue Gas Venting Connection	28
Stage 8 – Electrical Supply and Installation.....	30
Stage 9 – Electrical Control Connections.....	31
Stage 9 – BACnet® Interface Set-up	34
Initial Verification	35
Commissioning – Operation Description	37
Operation Display	38
Status Menu	39
Control Set-up Menu.....	40
System Set-up Menu.....	42
Alarms Menu	44
List of Alarms	45
Diagnostics Menu	46
Com Port Set-up Menu	47
Personal Notes.....	48
Exploded Views & Parts List.....	49
Multiple Modules Composition Table	54

Other related documents:

1. Start-up check list and Combustion Field Adjustment instructions
2. Wiring diagram
3. Service and troubleshooting guide
4. If humidifier is equipped with BACnet® option:
BACnet® communication module user guide.

Technical Specifications



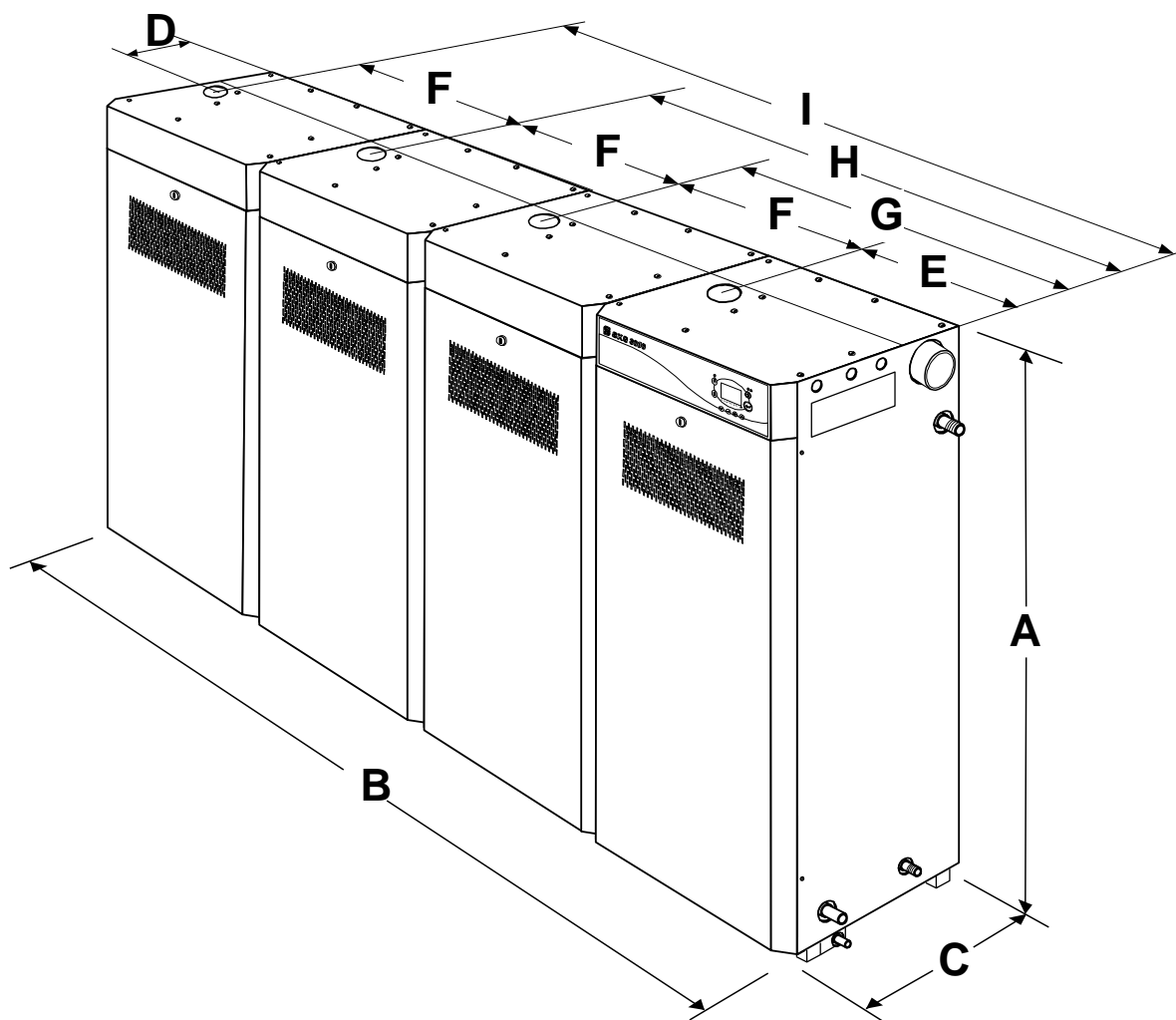
General overview - Fig.1

Model	No of Modules	Steam capacity (kg/hr)	Natural Gas		Propane Gas		Current at 230V (Amp)	Multi-Steam header diameter (mm)
			Input (kW)	Consumption (m³/h)	Input (kW)	Consumption (m³/h)		
SKGE3-0501 N/P	1	50	49	4.6	55	2.1	3.5	76
SKGE3-0701 N/P	1	70	62	5.8	68	2.6	3.5	76
SKGE3-0801 N/P	1	80	69	6.5	75	2.9	3.5	76
SKGE3-1001 N/P	1	100	72	6.8	79	3.0	3.5	76
SKGE3-1202 N/P	2	120	110	10.4	123	4.8	4.5	100
SKGE3-1502 N/P	2	150	123	11.6	136	5.2	4.5	100
SKGE3-1702 N/P	2	170	134	12.6	147	5.7	4.5	100
SKGE3-2002 N/P	2	200	144	13.6	158	6.1	4.5	100
SKGE3-2503 N/P	3	250	203	19.1	222	8.6	6.0	125
SKGE3-2703 N/P	3	270	206	19.4	225	8.7	6.0	125
SKGE3-3003 N/P	3	300	216	20.4	236	9.1	6.0	125
SKGE3 3504 N/P	4	350	275	25.9	301	11.6	7.5	(2x) 100
SKGE3-3704 N/P	4	370	278	26.2	304	11.8	7.5	(2x) 100
SKGE3-4004 N/P	4	400	288	27.2	315	12.2	7.5	(2x) 100

Notes: 1 - Maximum static duct pressure is 1.250 kPa (12.5 mbar). For higher static duct pressures, consult Neptronic or its authorized distributor.

2 - Standard humidifier is designed for natural ventilation combustion air, "Ducted Combustion Air" option is available upon request, see stage 6 of installation.

Dimensions & Weights



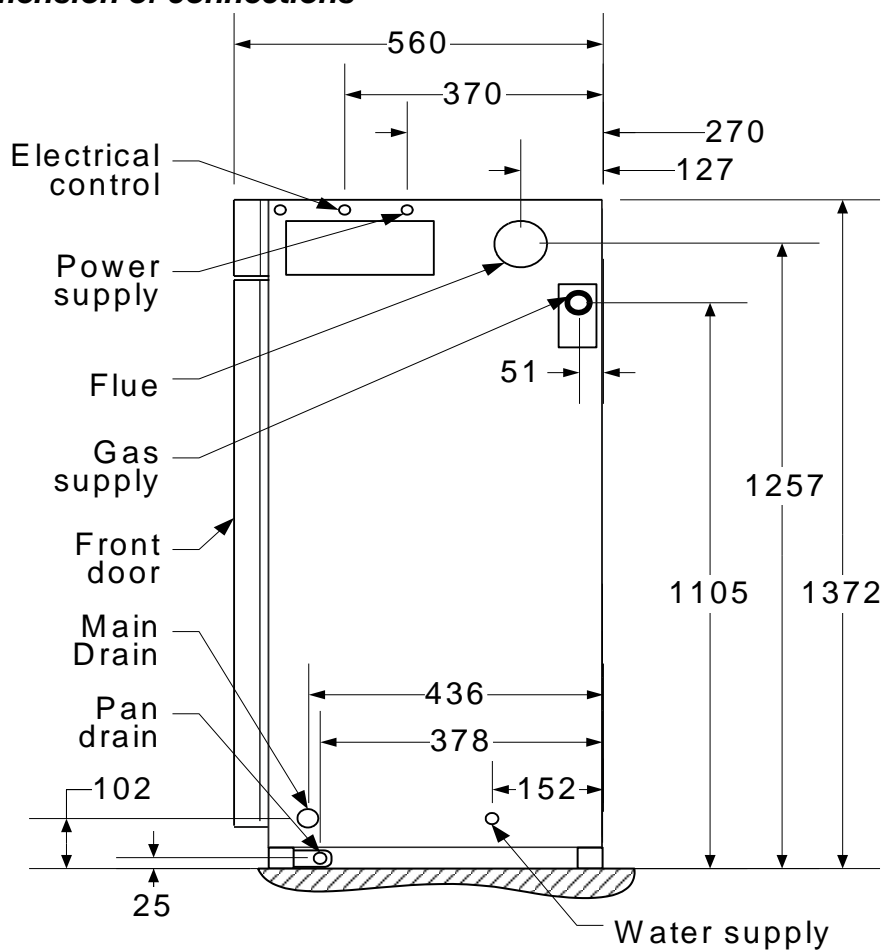
General dimensions - Fig. 2

General Dimensions, Weight & Steam Outlets detail

Model	No of module	No of Steam Outlets	Steam Outlet Diam.	Dimensions in mm									Weight (Kg)	
				A	B	C	D	E	F	G	H	I	Empty	Full of water
SKGE3-0501 N/P SKGE3-0701 N/P SKGE3-0801 N/P SKGE3-1001 N/P	1	1	Ø76	1372	610	560	230	460					145	200
SKGE3-1202 N/P SKGE3-1502 N/P SKGE3-1702 N/P SKGE3-2002 N/P	2	2	Ø76	1372	1220	560	230	460	610	920			274	384
SKGE3-2503 N/P SKGE3-2703 N/P SKGE3-3003 N/P	3	3	Ø76	1372	1830	560	230	460	610	920	1680		431	600
SKGE3 3504 N/P SKGE3-3704 N/P SKGE3-4004 N/P	4	4	Ø76	1372	2440	560	230	460	610	920	1680	2290	576	800

Dimensions & Weights

Position & Dimension of connections



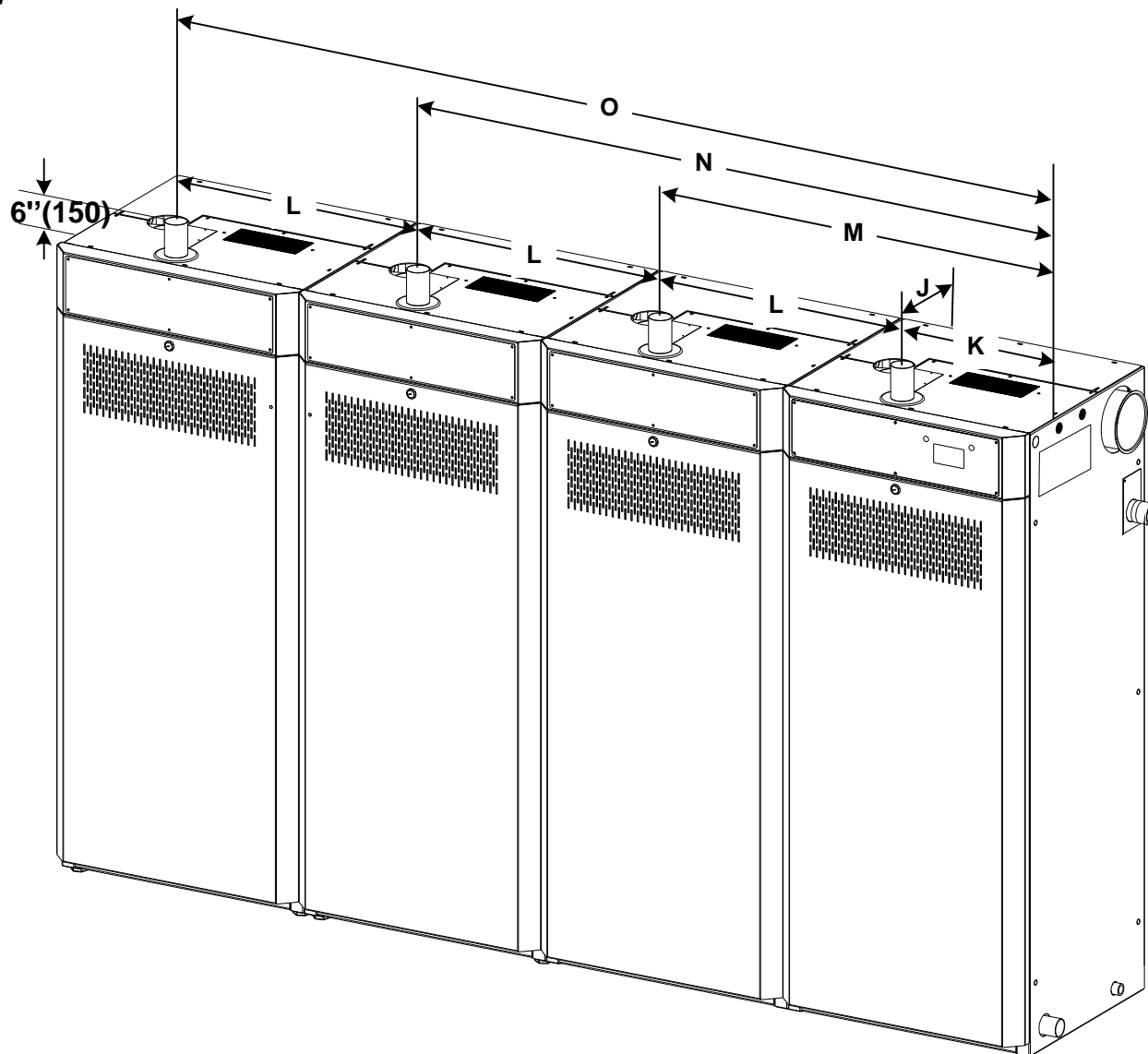
Connections position - Fig. 3
(all dimensions in mm)

Model	No of module	Dimensions in mm				
		Drain Outlet Diam.	Pan Drain Diam.	Water Inlet Diam.	Gas Inlet Diam.	Flue Outlet Diam.
SKGE3-0501 N/P SKGE3-0701 N/P SKGE3-0801 N/P SKGE3-1001 N/P	1	Ø20	Ø15	Ø15	Ø25	Ø76
SKGE3-1202 N/P SKGE3-1502 N/P SKGE3-1702 N/P SKGE3-2002 N/P	2	Ø40	Ø15	Ø15	Ø25	Ø100
SKGE3-2503 N/P SKGE3-2703 N/P SKGE3-3003 N/P	3	Ø40	Ø15	Ø15	Ø40	Ø125
SKGE3 3504 N/P SKGE3-3704 N/P SKGE3-4004 N/P	4	Ø40	Ø15	Ø15	Ø40	Ø125

Note: Drain outlet, water supply inlet, gas supply inlet and flue outlet are located on the right hand side of the humidifier. Left hand side location of any of these outlets or inlets is available upon request.

Dimensions & Weights

Option - Ducted combustion air inlet dimension

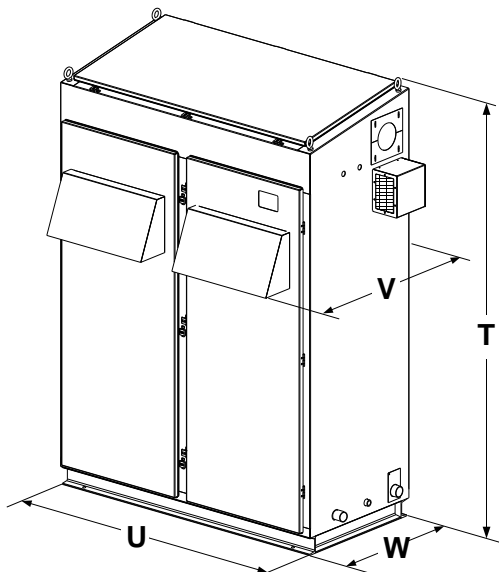


Ducted combustion air dimensions - Fig. 4
 (all dimensions in mm)

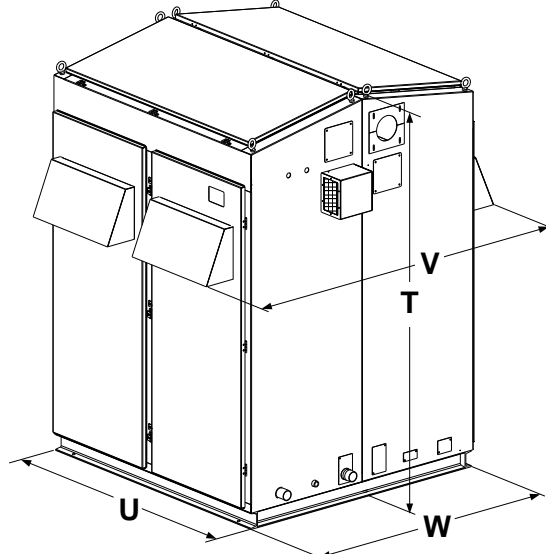
Model	No of modules	No of Air inlet	Dimensions in mm						
			Air inlet Diam.	J	K	L	M	N	O
SKGE3-0501 N/P SKGE3-0701 N/P SKGE3-0801 N/P SKGE3-1001 N/P	1	1	Ø51	448	352	-	-	-	-
SKGE3-1202 N/P SKGE3-1502 N/P SKGE3-1702 N/P SKGE3-2002 N/P	2	2	Ø51	448	352	609	962	-	-
SKGE3-2503 N/P SKGE3-2703 N/P SKGE3-3003 N/P	3	3	Ø51	448	352	609	962	1571	-
SKGE3 3504 N/P SKGE3-3704 N/P SKGE3-4004 N/P	4	4	Ø51	448	352	609	962	1571	2180

Dimensions & Weights

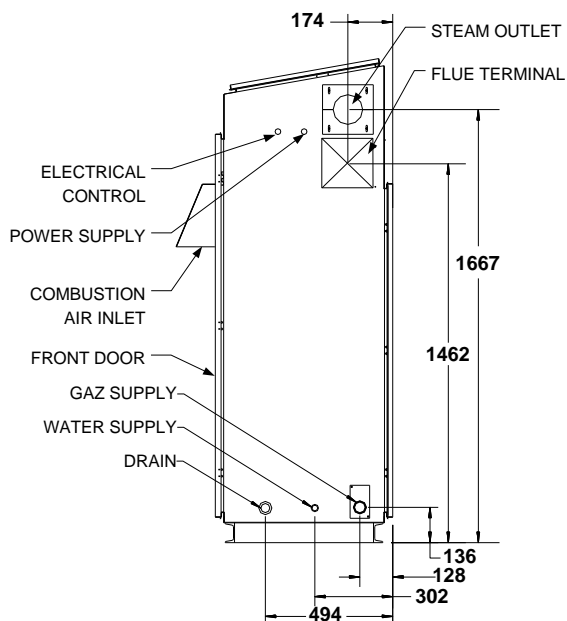
Option - Weather proof enclosure general dimension and weight



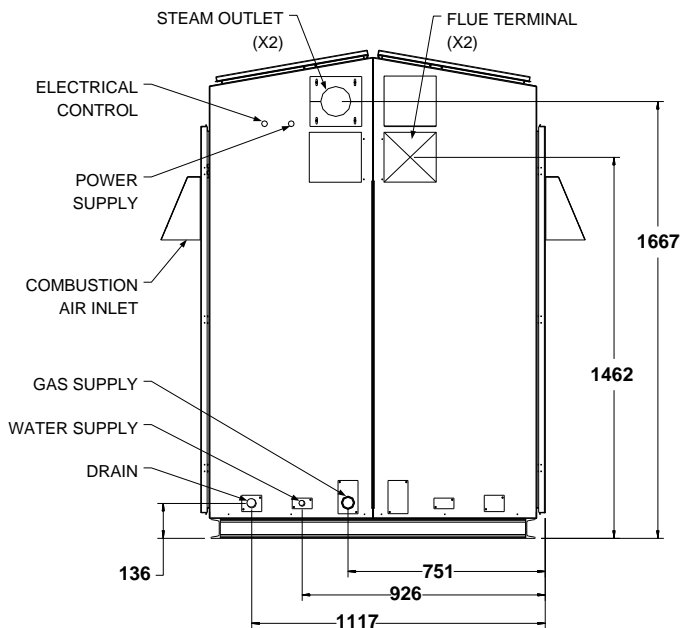
Weather proof enclos. 1 to 3 modules configuration – Fig. 5



Weather proof enclos. 4 modules configuration – fig. 6



Weather proof enclosure
Connections position 1 to 3 modules configuration – Fig. 7
(All dimensions in mm)



Weather proof enclosure
Connections positions 4 modules configuration – Fig. 8
(All dimensions in mm)

Model	No of modules	Dimensions (mm)				Weight (kg)	
		T	U	V	W	Empty	Full of water
SKGE3-0501 N/P SKGE3-0701 N/P SKGE3-0801 N/P SKGE3-1001 N/P	1	1867	762	841	762	285	340
SKGE3-1202 N/P SKGE3-1502 N/P SKGE3-1702 N/P SKGE3-2002 N/P	2	1867	1407	841	711	472	582
SKGE3-2503 N/P SKGE3-2703 N/P SKGE3-3003 N/P	3	1867	2064	841	711	653	818
SKGE3 3504 N/P SKGE3-3704 N/P SKGE3-4004 N/P	4	1867	1407	1616	1335	830	1050

Handling & Unpacking



Lifting or handling **MUST** only be carried out by trained and qualified personnel. Ensure that the lifting operation has been properly planned, risk assessed and that all equipment has been checked by a skilled and competent Health & Safety representative and effective control measures put in place.

It is the customer's responsibility to ensure that operators are trained in handling heavy goods and to enforce the relevant lifting regulations.

Any personnel handling or lifting the SKGE3 Steam Humidifier **MUST** follow the Lifting Operations and Lifting Equipment Regulations 1998 and Approved Code of Practice L113. The regulation imposes duties on employers, self-employed persons and persons who have control, to any extent of lifting equipment.

Refer to Dimensions & Weight section for system dry weights.

Handling and Lifting

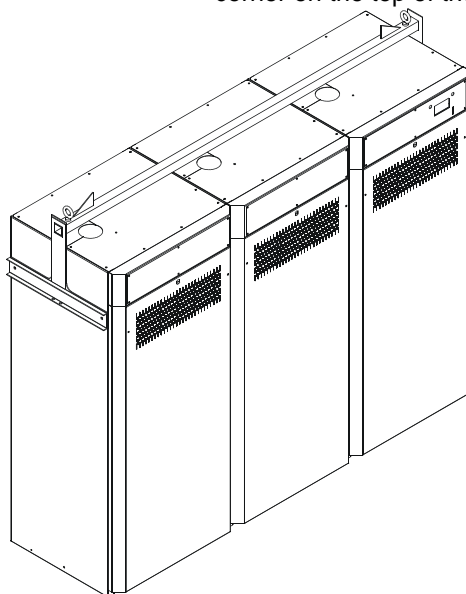
The SKGE3 Steam Humidifier **MUST** always be handled and lifted with care and must remain within its original packaging for as long as possible prior to installation

The SKGE3 Steam Humidifier package may be carried using a fork lift from the underside. Caution must be exercised to ensure balanced load before lifting.

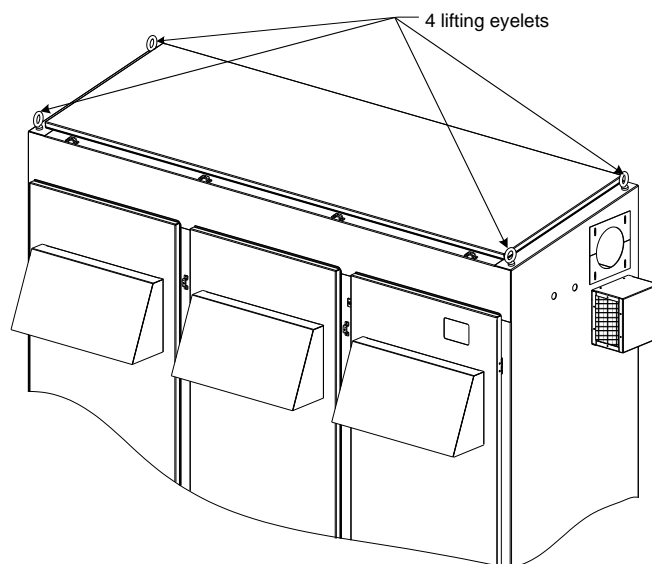
Lifting of SKGE3 Steam Humidifier **MUST** always be carried out using the appropriate Neptronic Lifting Bracket (sold separately), see fig. 9.

Lifting sling angle must be greater than 30° to the horizontal.

Optional weather proof enclosure is provided with four (4) lifting eyelets located at each corner on the top of the enclosure, see fig. 10.



(Fig. 9) Standard enclosure



(Fig. 10) Option Weather proof enclosure

Unpacking

SKGE3 Steam Humidifier is shipped in a wooden crate.

Ensure packing wooden crate and skid is removed prior to commissioning.

List of Accessories Supplied

Standard enclosure

- 2 sets of keys.
- 2 adjustable steam hose collars per module to connect on the steam output.
- *Startup check list & Combustion field adjustment instructions.*
- *The present Installation Instructions and User Manual.*
- *Wiring diagram* affixed onto the interior of the front access door.
- *Service and troubleshooting guide.*
- *BACnet® communication module user guide* (if BACnet® option is installed).

Weather proof enclosure

- 2 adjustable steam hose collars per internal steam manifold.

Installation Overview



All installation work must comply with local regulations.

All work related to the installation of the SKGE3 Steam Humidifier **MUST** only be performed by skilled and qualified technical personnel (e.g. qualified gas installer, fitters, electricians, plumbers or technicians with appropriate training).
The customer is responsible for ensuring their suitability.

To install the SKGE3 Steam Humidifier and its associated components, no special tooling is required above that of a fitter's toolkit.

Installation Method Statement

Stage1: Unit Positioning and Mounting

Stage 2: Steam Distribution Installation

Stage 3: Gas Supply Connection

Stage 4: Water Supply Installation

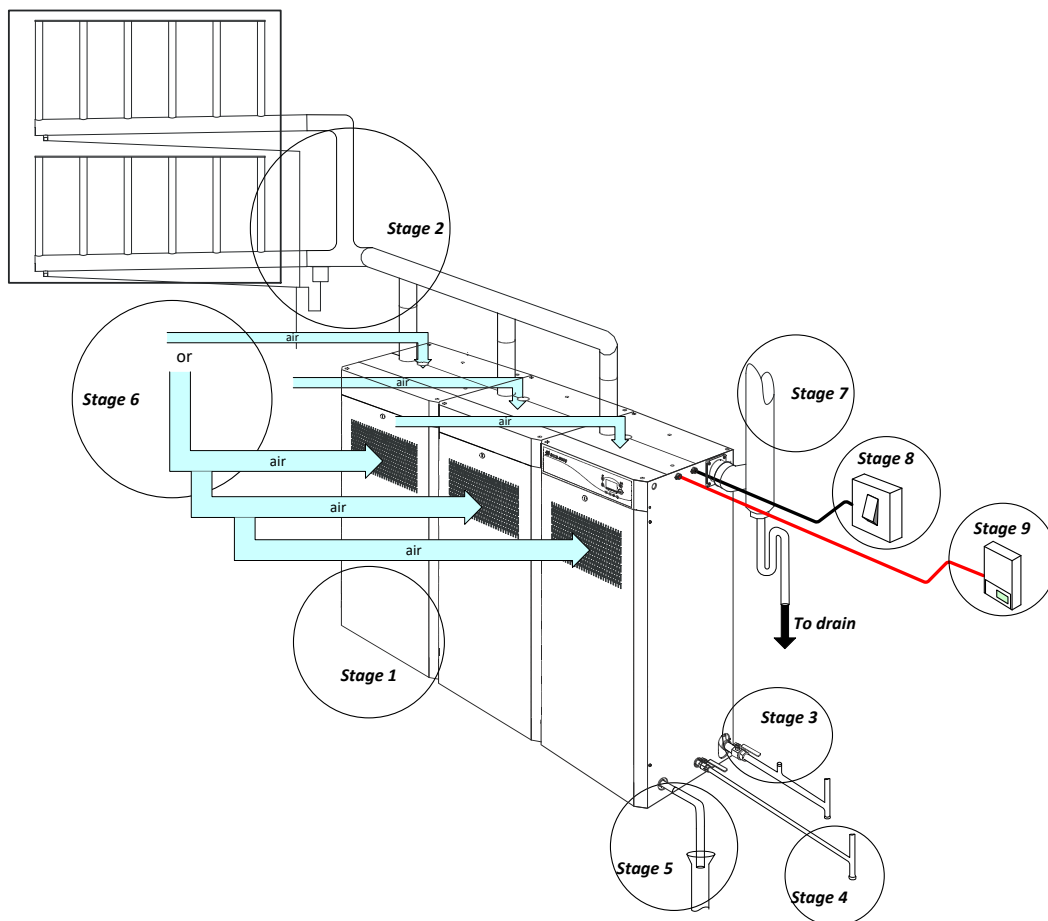
Stage 5: Water Drain Connection

Stage 6: Combustion Air Installation

Stage 7: Flue Gas Venting Connection

Stage 8: Electrical Supply and Installation

Stage 9: Electrical Control Connections



Installation overview - Fig. 11

Stage 1 – Unit Positioning and Mounting

Safety Considerations



Any installation work **MUST** be carried out by suitably qualified personnel.

The following considerations must be taken into account before deciding upon the location for the SKGE3 Steam Humidifier:

- Locate the SKGE3 Steam Humidifier in an area clear of combustible materials, gasoline, and other flammable vapours and liquids. Do not install in potentially explosive or flammable atmospheres laden with grain dust, sawdust, or similar airborne materials.
- If the appliance is installed in an insulated area, it must be kept free and clear of insulating materials, as they may be combustible. If insulation is added after the humidifier is installed, an inspection of the humidifier area must be carried out to ensure that there is no insulation coming into contact with the humidifier.
- Provide adequate room ventilation air in accordance with local codes and regulations. With the exception of ducted combustion air installation, do not locate units in tightly sealed rooms or small compartments without provision for adequate air for combustion and room ventilation. Combustion and ventilation air must be supplied through one permanent low-level and one permanent high-level opening communicating directly with the outside air.
- Humidifier flue gases must be vented to the outdoors. Locate the humidifier as near as possible to an outside wall or roof so that the flue pipe from the humidifier is short and direct.
- Locate the SKGE3 Steam Humidifier on a water proof floor or install a drain pan beneath the humidifier.
- The humidifier must be installed to ensure the steam hose length is kept to the shortest possible length.
- For flexible steam hoses: the total steam line length must not exceed 5 meters. For longer distances use insulated hard piping.
- For insulated hard piping: the total steam line length must not exceed 15 m. For longer steam line runs, consult factory.
- The humidifier must be located in an area that is fully accessible for inspection and servicing. Observe the minimum access distances as shown in figures 12 & 13.

Positioning the Humidifier

Ambient Condition & Altitude

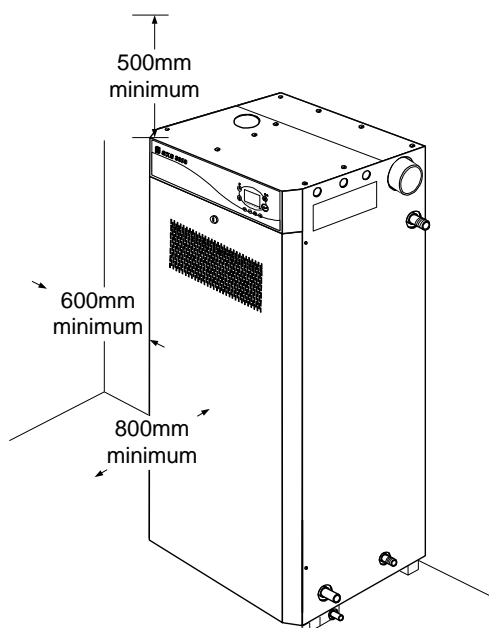
The humidifier location **MUST** have an ambient temperature of less than 30°C.

If the above condition is not respected for indoor humidifiers, the warranty of the unit will be void, as it has not been designed to operate under extreme external conditions.

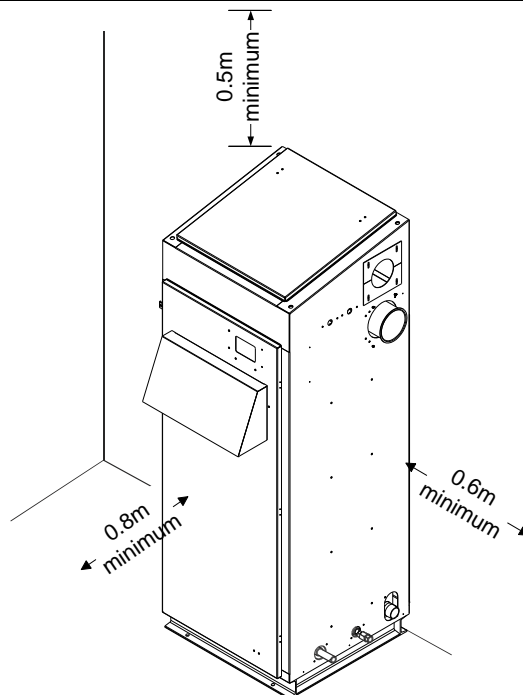
The combustion burner of the SKGE3 Steam Humidifier is self-adjusting for any altitude; the burner will maintain proper combustion and low emission at any altitude. Steam capacity will be affected by altitudes over 1050m above sea level. Please refer to the table below to anticipate the ratio of output reduction:

Altitude above sea level (m)	Output reduction (%)
0 to 1050	0
1051 to 1350	2
1351 to 1650	4
1651 to 1950	6
1951 to 2250	8

Stage 1 – Unit Positioning and Mounting



Standard enclosure clearances - Fig. 12



Weather proof enclosure clearances - Fig. 13

Minimum Clearances

Minimum clearances are :

Standard enclosure

- Top: 0.50m minimum
- Both sides: 0.60m minimum
- Front: 0.50m minimum

Weather proof enclosure

- Top: 0.50m minimum
- Connection side: 0.60m minimum
- Front: 0.8m minimum

Note: Above minimum clearances are indicated for inspection and servicing access. The SKGE3 Steam Humidifier is designed for 0 clearance to combustible materials, except on top and front, where minimum clearances to combustible materials is respectively 500 and 762 mm.

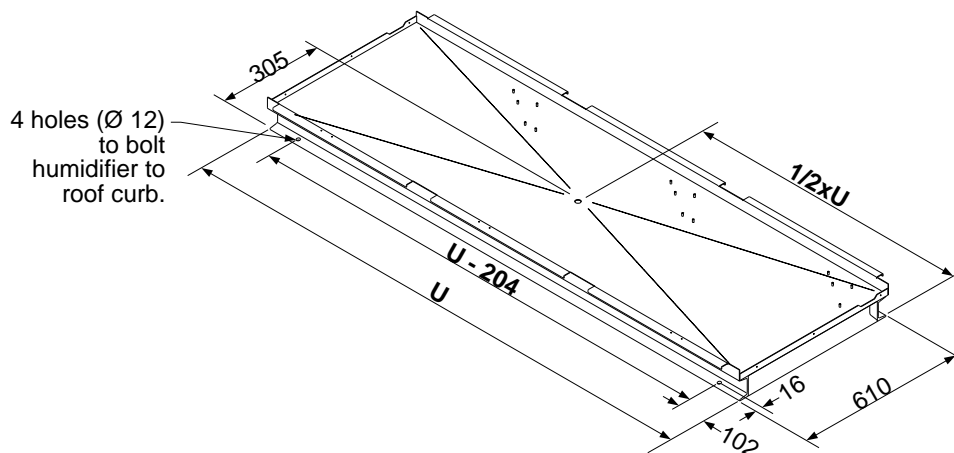
The humidifier is designed to be installed directly on the floor.

Provide a level, solid foundation for the humidifier.

Ensure that the floor beneath the humidifier is water proof to withstand any water spillage during servicing or if a problem occurs.

The humidifier is provided with adjustable legs in order to ensure proper level.

Roof Curb for Weather Proof Enclosure



Weather proof enclosure base dimensions(in mm) - Fig. 14

Ensure that roof curb is structurally built to support the weight of the SKGE3 humidifier.

Roof curb must provide proper level to the humidifier.

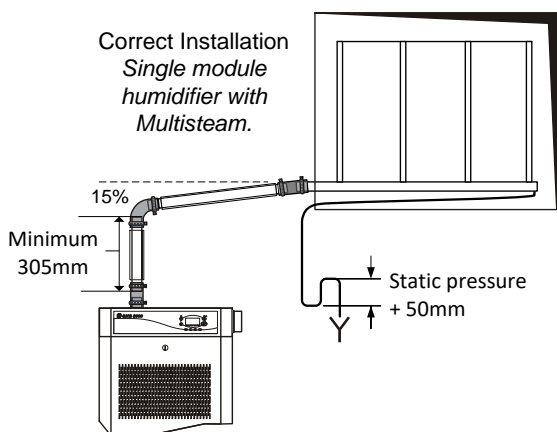
The base of the weather proof enclosure is provided with 4 holes Ø12mm to bolt the SKGE3 humidifier to the roof curb.

Stage 2 – Steam Distribution Installation

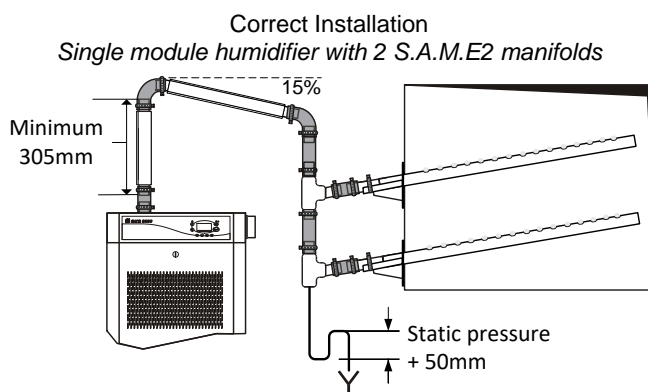
Fundamental Design Concepts



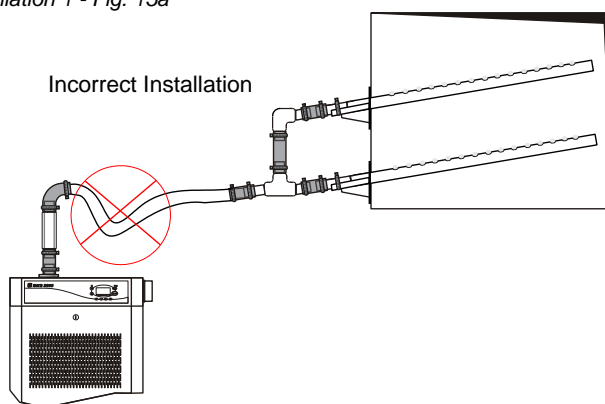
1. Minimum steam pipe gradient must be 7° i.e. 125mm rise in 1000mm run.
2. The lowest point of any steam hose or rigid pipe must be the humidifier. Otherwise, a steam trap (S trap) must be installed at the lowest point of the steam line. This steam trap must be installed higher than the static pressure of the system by at least 50mm.
3. Total length of the flexible steam hose must not exceed 5 m or insulated rigid piping must not exceed 15 m.
4. Whenever possible use rigid copper piping, flexible steam hose can be used for short runs or for interconnecting between rigid pipe runs. Ensure that there is no kink in the flexible hose.
When using rigid copper pipe, insulation must be used to diminish condensation build up.



Steam distribution correct installation 1 - Fig. 15a



Steam distribution correct installation 2 - Fig. 15b

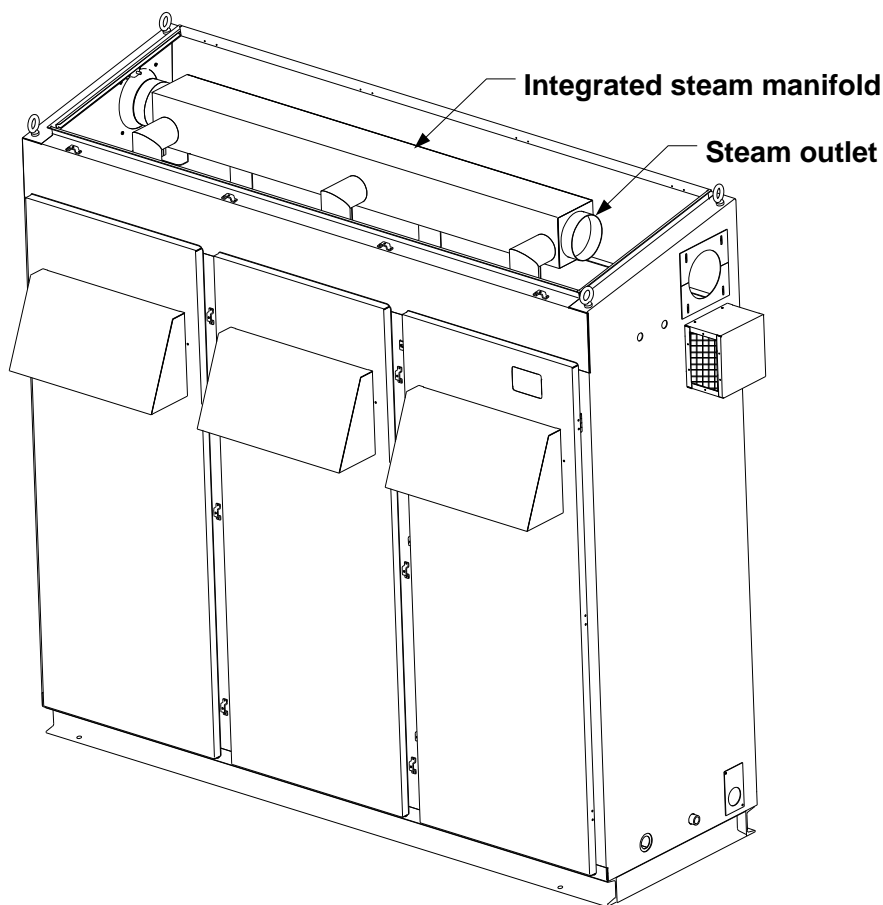


Incorrect installation - Fig. 16

5. Connection pipe sizes between the SKGE3 and the steam distributor in the duct must be:
 - 76mm up to 100kg/h
 - 100mm up to 200kg/h
 - 125mm up to 300kg/h
6. All humidifier below 100kg/h capacity must use the standard Neptronic® S.A.M.E2 Steam distribution pipes. Multi-Steam can be offered if shorter absorption distances are required.
7. All humidifiers above 100kg/h capacity must use the Multi-Steam configuration.
8. All humidifiers above 300kg/h must use 2 Multi-Steam units per Air Handling Unit (AHU) or air duct, with an equal duty split to each Multi-Steam

Stage 2 – Steam Distribution Installation

Steam Outlet Configuration for Weather Proof Enclosure



Weather proof enclosure single steam outlet - Fig. 17

The SKGE3 humidifier with weather proof enclosure is provided with an integrated steam manifold with an outlet located on either one of the sides of the humidifier.

By default, the steam outlet will be on the right side of the humidifier (when facing the control panel). Steam outlet side can be switch to left upon request to factory.

Weather Proof Enclosure Steam Outlet Dimension & Quantity

<i>Model</i>	<i>Steam outlet Qty</i>	<i>Steam outlet diameter</i>
SKGE3-0501, 0701, 0801, 1001	1	Ø76mm
SKGE3 1202, 1502, 1702, 2002	1	Ø100mm
SKGE3 2503, 2703, 3003	1	Ø125mm
SKGE3-3504, 3704, 4004	2	Ø100mm

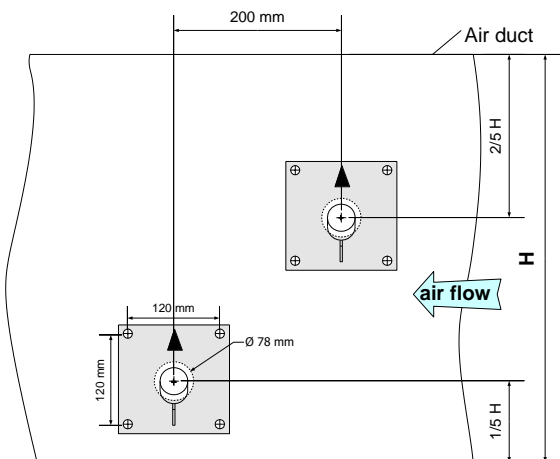


Stage 2 – Steam Distribution Installation

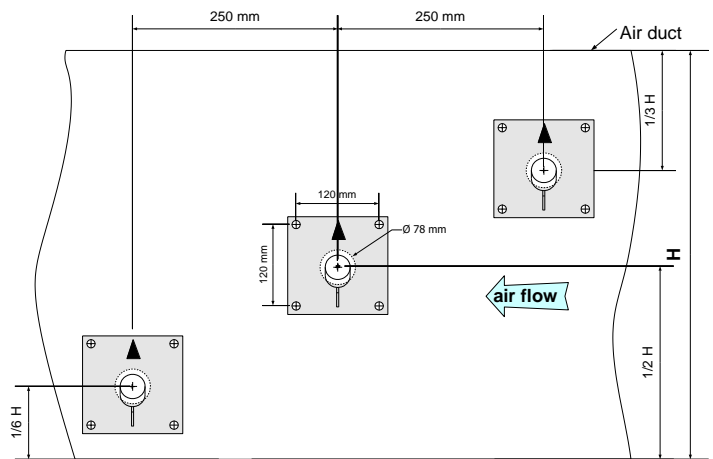
Selection of Steam Distribution Manifolds

1. The minimum steam manifold length that can be used with the SKGE3-0501 to SKGE3-1001 is 900mm. Any manifold below this dimension will have insufficient outlet spigots to allow proper steam distribution.
2. If duct size is below a width of 900mm, it will be necessary to either fit multiple pipes or use a Multi-Steam system.

Horizontal Duct

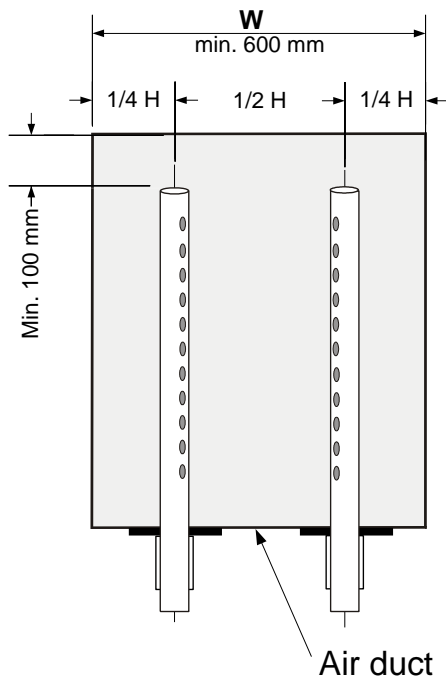


Horizontal duct – 2 manifolds - Fig. 18

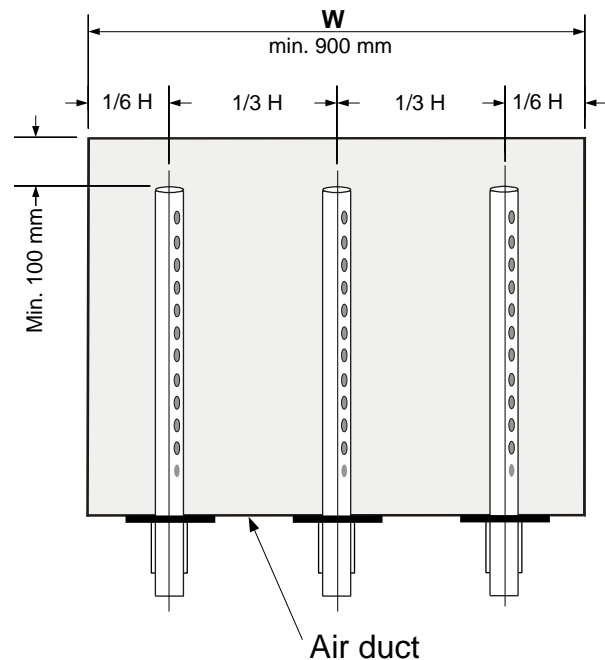


Horizontal duct – 3 manifolds - Fig. 19

Vertical Duct



Vertical duct – 2 manifolds - Fig. 20



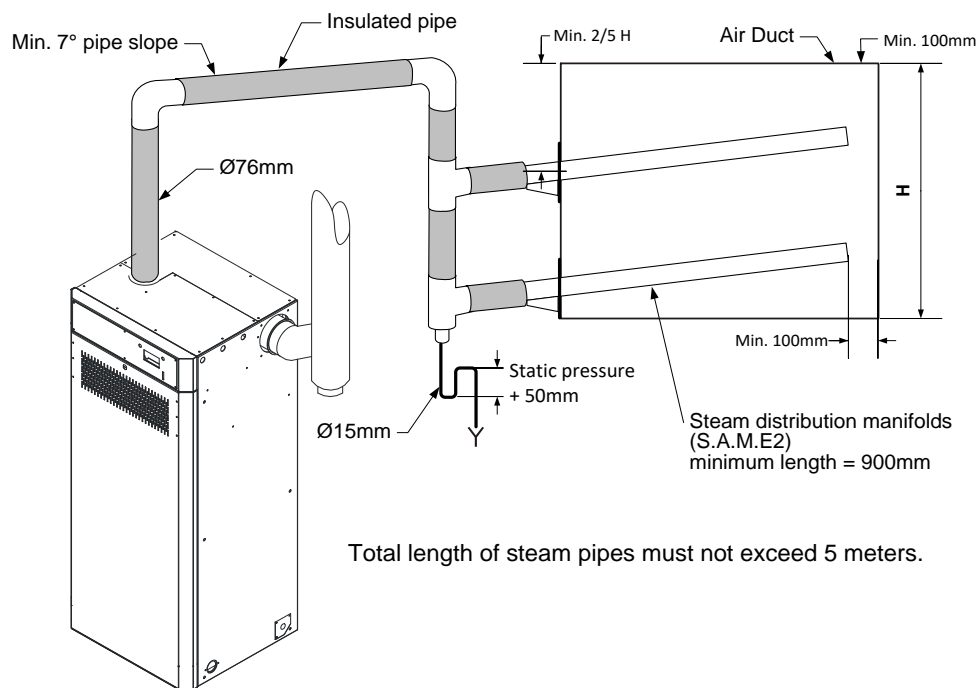
Vertical duct – 3 manifolds - Fig. 21

Stage 2 – Steam Distribution Installation

Manifolds Configurations

All humidifiers above 100kg/h capacity must use the Multi-Steam configuration.

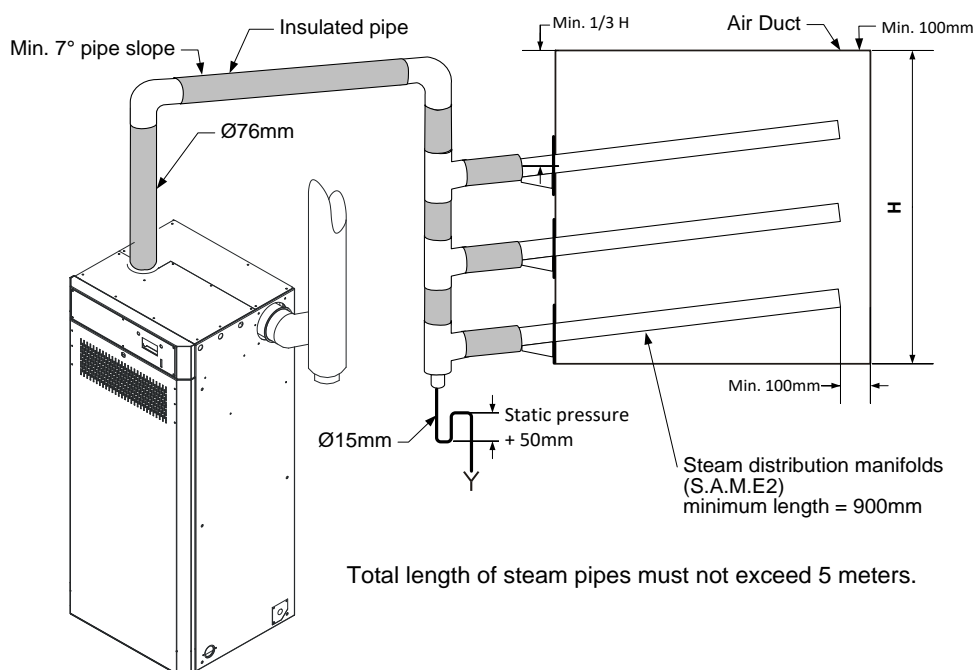
Single Module Humidifier: SKGE3-0501



Steam pipe work SKGE3-0501 - Fig. 22

A single Ø76mm feed pipe must be connected to two (2) S.A.M.E2 Steam manifolds with a suitable reduction at the lowest point to allow a Ø15mm condensate drain from the main steam supply.

Single Module Humidifiers: SKGE3-0701 SKGE3-0801 SKGE3-1001



Steam pipe work SKGE3-0701 to 1001 - Fig. 23

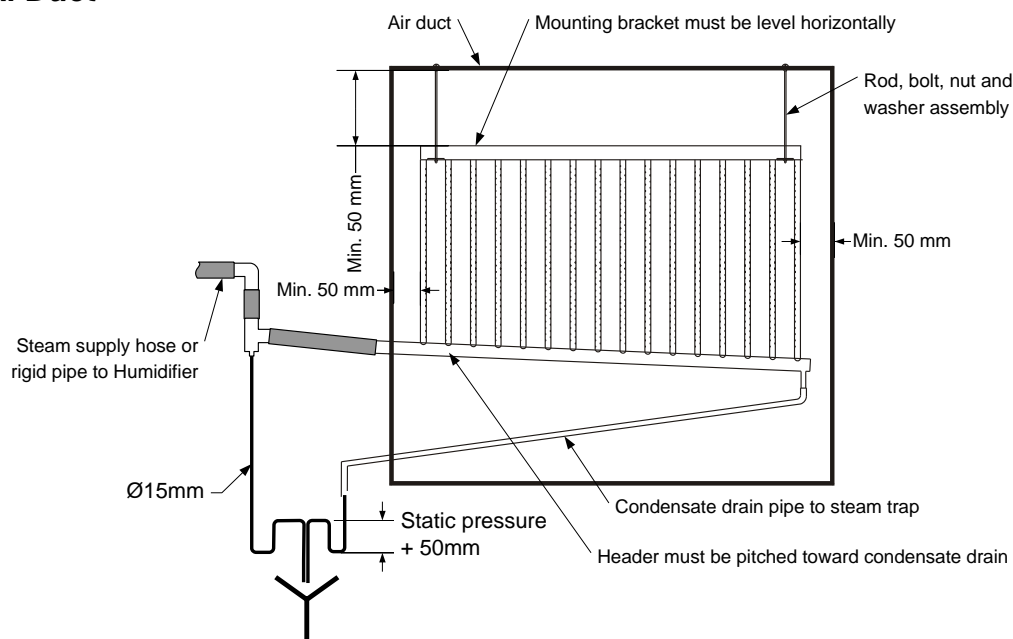
A single Ø76mm feed pipe must be connected to 3 S.A.M.E2 Steam manifolds with a suitable reduction at the lowest point to allow a Ø15mm condensate drain from the main steam supply.

Stage 2 – Steam Distribution Installation

Selection of Multi-Steam

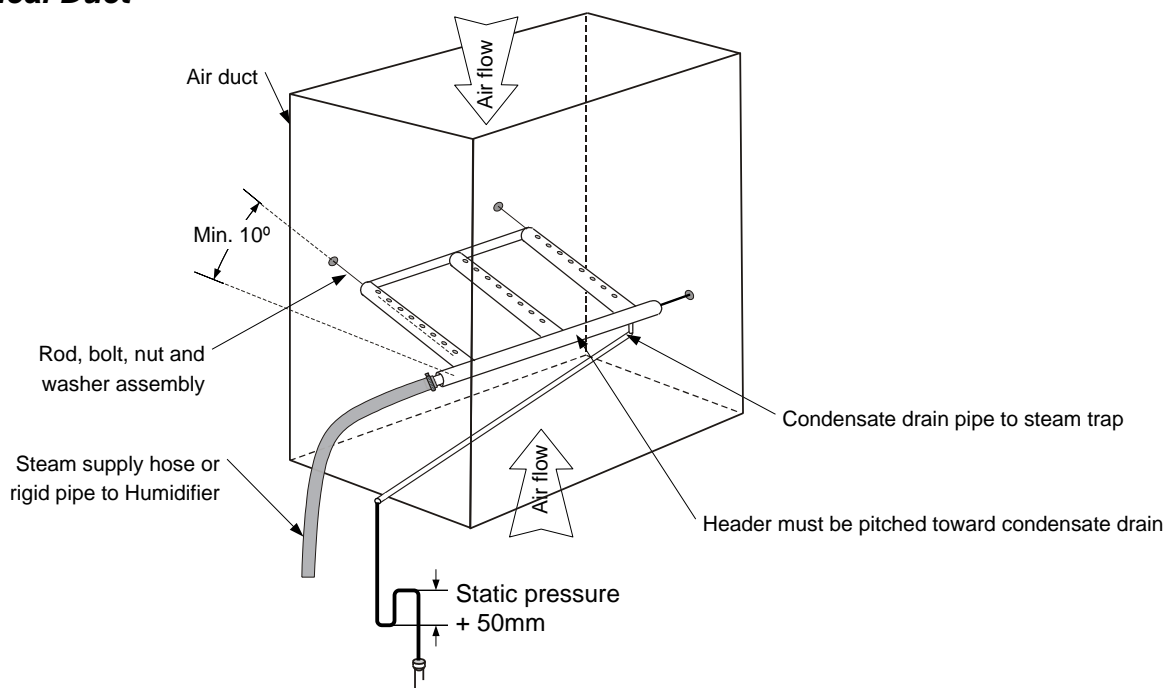
1. For all Multi-Steam units, use the Neptronic® Humidisoft program to size the unit.
2. Where two Multi-Steam units are required with duties in excess of 240kg/h, make your selection using the following rules:
 - Divide the air volume flow in half.
 - Divide the AHU / air duct **width** in half.
 - **Height** of the duct must remain at 100% its height.
 - This will size the Multi-Steam units so that they can be placed side by side.
3. For installation of Multi-Steam units please refer to Neptronic® Multi-Steam Installation Instructions.

Horizontal Duct



Multi-Steam in horizontal duct - Fig. 24

Vertical Duct

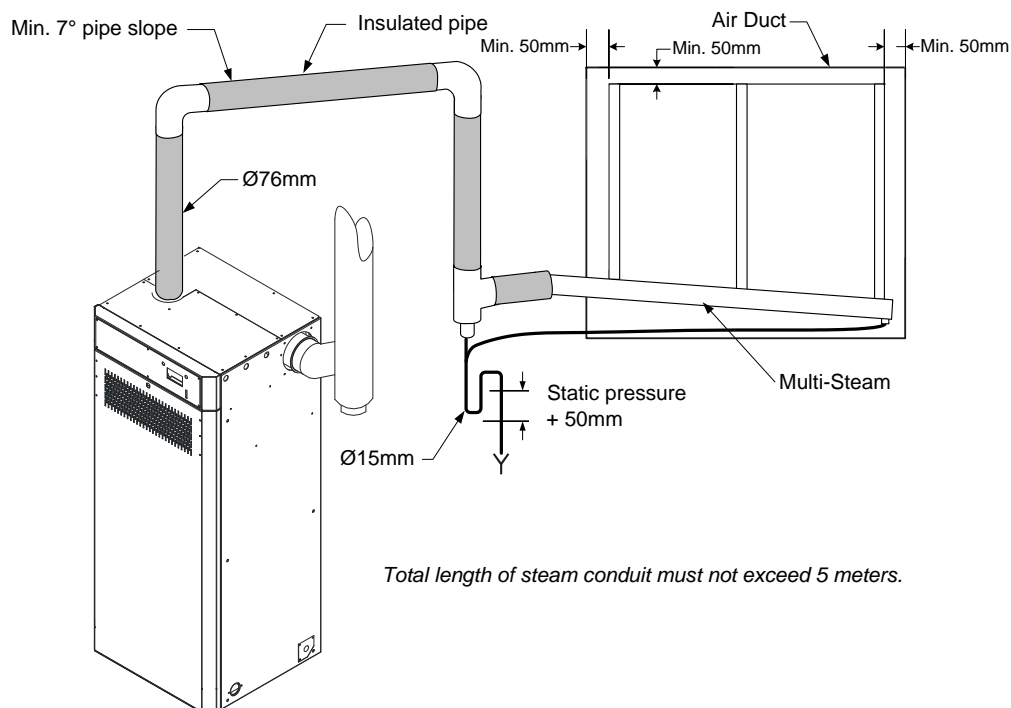


Multi-Steam in vertical duct - Fig. 25

Stage 2 – Steam Distribution Installation

Multi-Steam Configurations

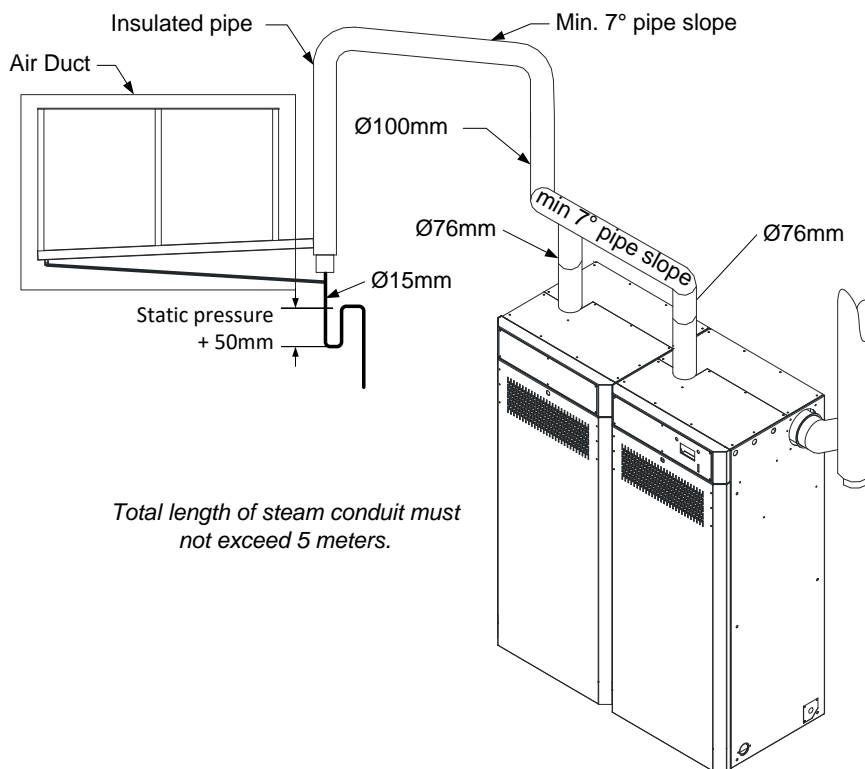
Single Module Humidifiers:
SKGE3-0501
SKGE3-0701
SKGE3-0801
SKGE3-1001



Steam pipe work SKGE3-0501 to 1001 - Fig. 26

A single Ø76mm feed pipe must be connected to a single Multi-Steam with a suitable reduction at the lowest point to allow a Ø15mm condensate drain from the main steam supply.

2 Modules Humidifiers:
SKGE3-1202
SKGE3-1502
SKGE3-1702
SKGE3-2002



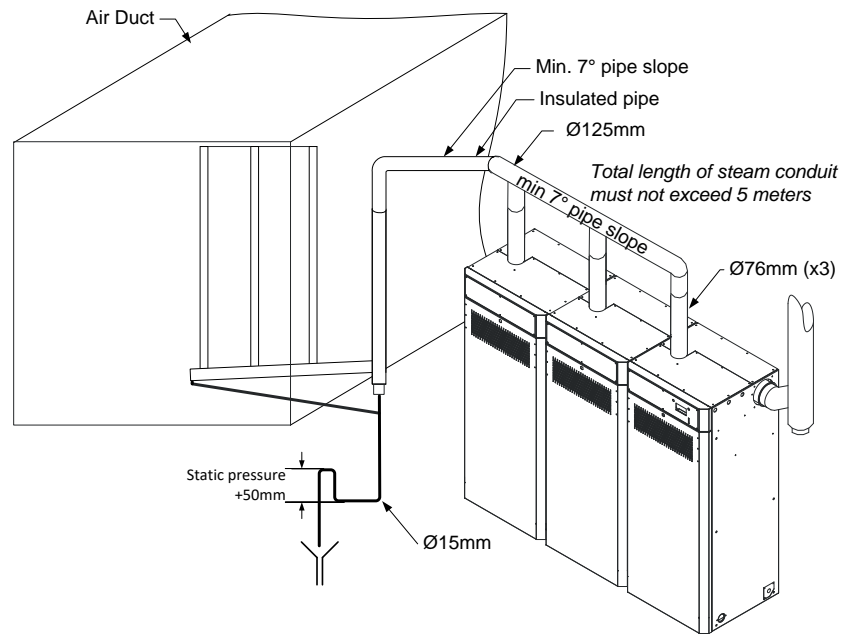
Steam pipe work SKGE3-1202 to 2002 - Fig. 27

Two Ø76mm steam outlets to a single Ø100mm feed pipe must be connected to a single Multi-Steam with a suitable reduction at the lowest point to allow a Ø15mm condensate drain from the main steam supply.



Stage 2 – Steam Distribution Installation

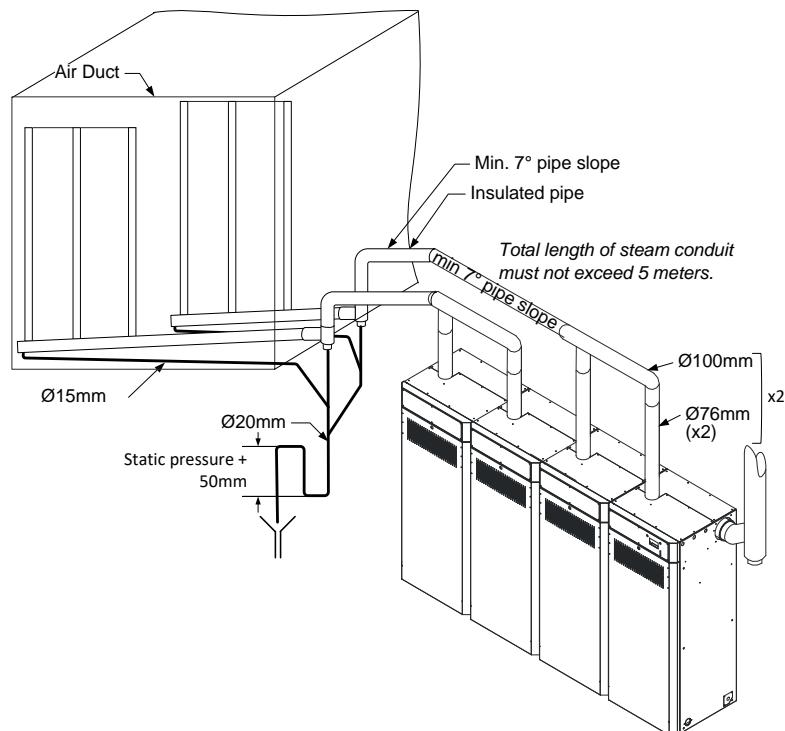
**3 Modules
Humidifiers:
SKGE3-2503
SKGE3-2703
SKGE3-3003**



Steam pipe work SKGE3-2503 to 3003 - Fig. 28

Three Ø76mm steam outlets to a single Ø125mm feed pipe must be connected to a double Multi-Steam with a suitable reduction at the lowest point to allow a Ø15mm condensate drain from the main steam supply.

**4 Modules
Humidifiers:
SKGE3-3504
SKGE3-3704
SKGE3-4004**



Steam pipe work SKGE3-3504 to 4004 - Fig. 29

Two Ø76mm steam outlets to a single Ø100mm feed pipe must be connected to a single Multi-Steam with a suitable reduction at the lowest point to allow a Ø15mm condensate drain from the main steam supply.

This must be reproduced two times.

If the two Ø15mm condensate pipes are connected, the common condensate drain must be Ø20mm.

Stage 3 – Gas Supply Connection

CAUTION Gas piping installation MUST comply with all local codes and regulations.



Gas pressure to the humidifier MUST never exceed 6kPa (60 mbar).

A manual shut off valve (not supplied) MUST be installed on the gas supply line to the humidifier. Ensure adequate size for the gas supply line (see below table).

A DN6 (1/8" BSP) plugged tapping for test pressure gauge connection must be installed immediately upstream of the gas supply line.

Pressure tapings for test gauges must be located at the Gas valve.

Pipes must be inspected for dirt and chips after threading and reaming the end of pipes.

Gas piping installation must be supported to avoid mechanical strain/stress.

Two wrenches must be used when connecting gas piping to the humidifier.

Drip pocket must be provided at any low spot in the gas line.

Minimum gas pipe gradient must be 1.5mm in 1000mm horizontal run.

Air purge must be done by disconnecting piping at the gas valve.

Air purge MUST NOT be done at the heat exchanger of the humidifier.

After installation, field piping and humidifier gas train must be checked for leaks. Do not use soap solution or open flame on the humidifier gas train. A gas leak detector must be used.

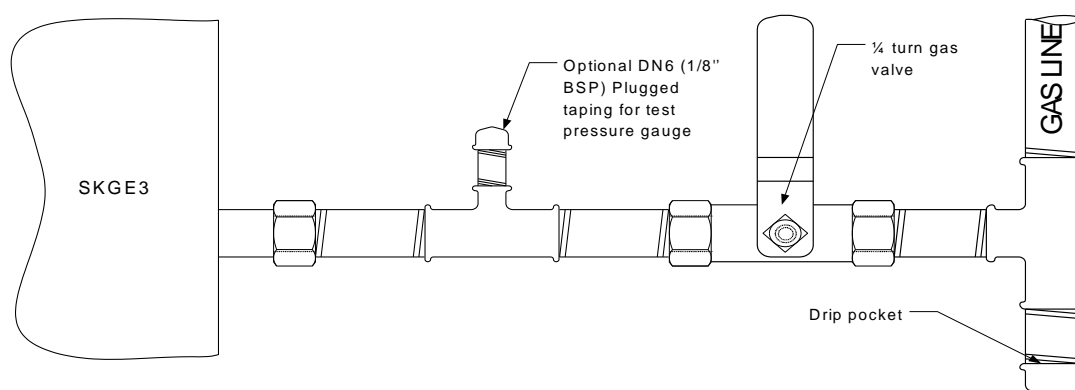
All leaks MUST be sealed prior to commissioning the humidifier.

Gas Pipe Diameter

Model	Gas Connection size
SKGE3-0501, 0701, 0801, 1001 1202, 1502, 1702, 2002	Ø25mm Male
SKGE3-2503, 2703, 3003 3504, 3704, 4004	Ø40mm Male

Please refer to local codes and regulations regarding the type and volume of gas handled, in order to obtain the pressure drop allowed in the gas line and to determine gas pipe diameter.

When multiple SKGE3 humidifier modules are installed, consideration must be taken to total capacity, gas flow and length of main.



Gas supply connection - Fig. 30

Gas Leak Test

Pressure testing of the gas supply piping must be performed by the gas Installer in accordance with local codes and regulations.

Test pressure must be relieved from the gas piping system prior to opening the manual shut off valve of the humidifier.

For any test pressure over 350kPa (3.5 bar), the humidifier MUST be disconnected (at the gas shut off valve).

Gas supply pressure at the inlet pressure tap, when all burners are running, must be:

- 1.75kPa (17.5 mbar) for Natural Gas.
- 3.5 kPa (35 mbar) for Propane and Butane.

Stage 4 – Water Supply Installation



Water supply installation must conform to local codes and regulations.
 Any installation work must be carried out by suitably qualified personnel.

Water Inlet Specifications

The Neptronic® SKGE3 Humidifier is designed to be used with tap, reverse osmosis, deionised and de-mineralized water.

Maximum water supply pressure: 70 to 480kPa (0.7 to 4.8 bar).

Minimum water temperature: +4°C

Maximum water temperature: +40°C

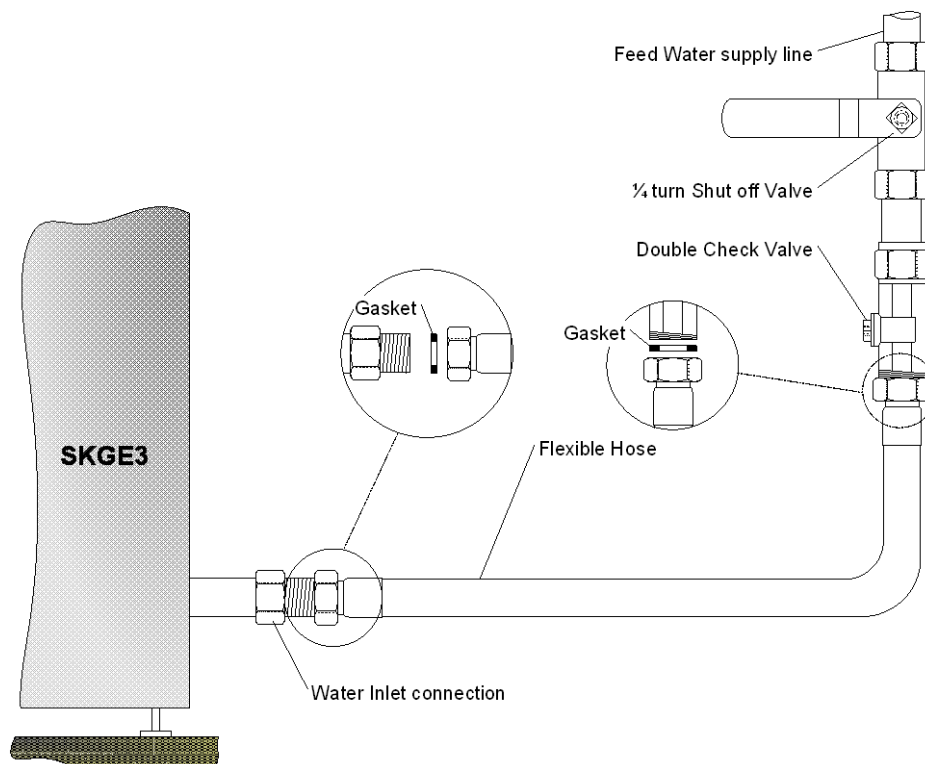
<i>Model</i>	<i>Water inlet Connection size</i>
SKGE3- 0501, 0701, 0801, 1001 1202, 1502, 1702, 2002 2503, 2703, 3003 3504, 3704, 4004	Ø15mm Male

Water Supply Line Installation

To facilitate servicing, a shut off valve (not supplied) must be installed in the water line, within 1 meter of the humidifier.

It is recommended to install a water hammer arrestor, in order to absorb hydraulic shock and minimize water hammer when the fill valve closes.

For outdoor installations in which the ambient temperature is below 0°C, ensure that all outdoor water supply pipe lines are properly insulated and heat traced in order to prevent freezing.



Water supply connection - Fig. 31

Double Check Valve

In order to comply with WRAS (Water Regulations Advisory Scheme) regulations in force in the United Kingdom, a double check valve must be installed as indicated in the above figure.

All connections must be made using the gaskets provided. On the inlet side of the check valve shown is a compression fitting for a 15mm pipe.

Stage 5 – Water Drain Connection



Water drain installation must conform to local codes and regulations.
 Any installation work must be carried out by suitably qualified personnel.

Water Drain Specification

Water drain temperature: +60°C

Model	Water Drain Outlet Connection size	Pan Drain outlet connection size
SKGE3-0501 to 1001	Ø20mm	Ø15mm
SKGE3-1202 to 4004	Ø40mm	

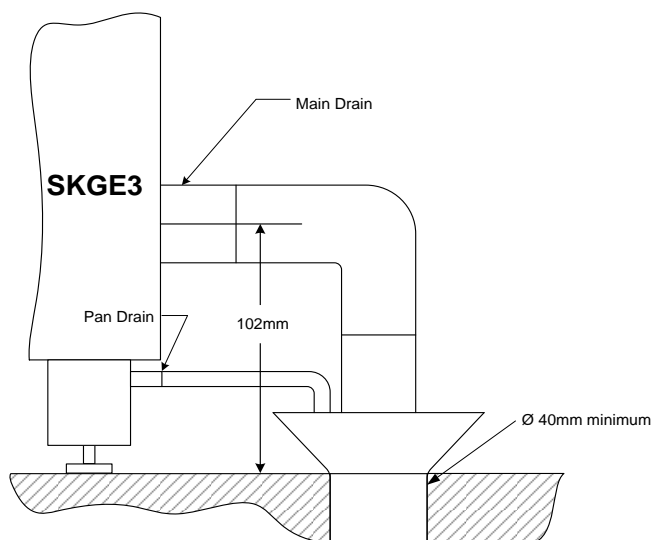
Water Drain Installation

Water drain outlet connection must be connected to drain pipe of sufficient size.
 It is recommended to use Ø40mm minimum standard copper hydraulic pipes.

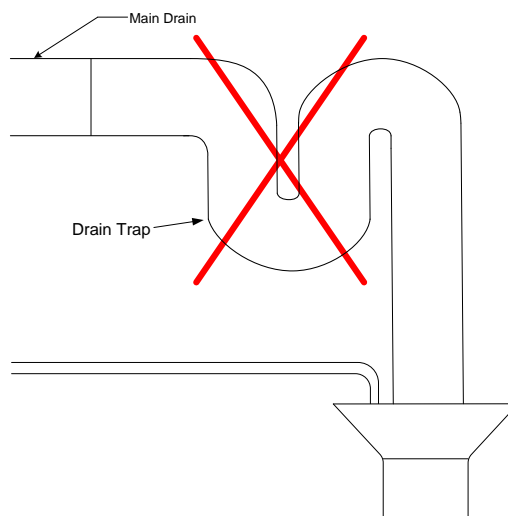
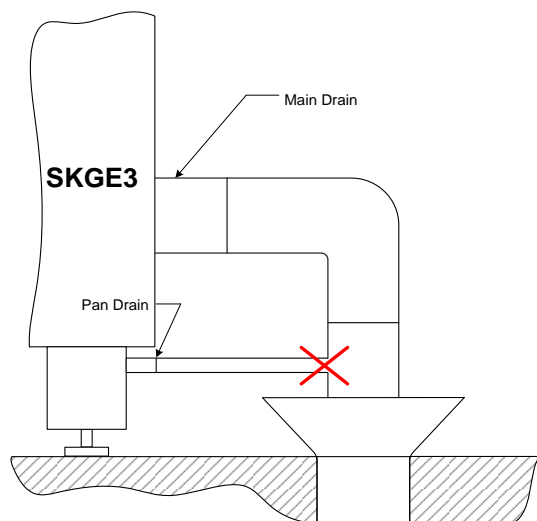
Minimum water drain pipe gradient must be 6.5mm in 300mm horizontal run.

No drain trap is required.

Pan drain connection must be connected to drain pipe through separated line.



Drain connection: Correct installation - Fig. 32



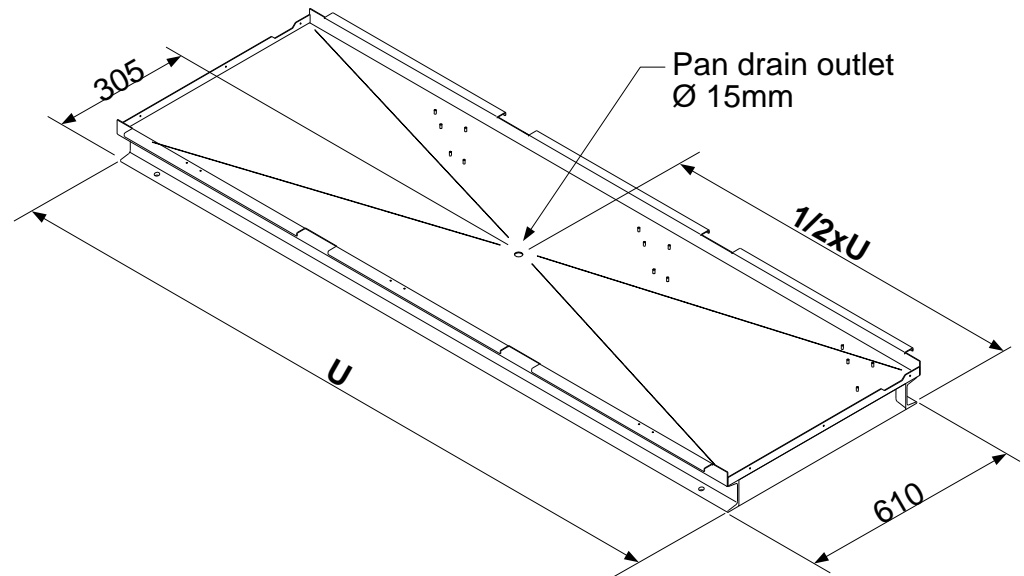
Drain connection: Incorrect installation - Fig. 33



Stage 5 – Water Drain Connection

Pan Drain Connection on Weather Proof Enclosure

The weather proof enclosure is provided with a pan drain at the base of the SKGE3 humidifier.



Weather proof enclosure base pan drain outlet dimension (in mm). - Fig. 34

Weather Proof Enclosure Water Drain Valve



The weather proof enclosure is equipped with a normally open valve, enabling the humidifier to drain all water during a power failure, in order to prevent water from freezing within the unit. During normal operation, the humidifier reduces drain water temperature to +60°C.

CAUTION: During a power failure, the drain water temperature is not reduced. Installed drain piping must be rated to +100°C.

Stage 6 – Combustion Air Installation

CAUTION



Combustion and room ventilation air must conform to local codes and regulations.

Air for combustion **MUST** not be contaminated by halogens, ammonia, bromides, chlorides, fluorides, iodides or dust. Excessive exposure of humidifier to these contaminants will result in performance related problems.

A humidifier that may be operated in toxic environments must be equipped with ducted combustion air installation.

The operation exhaust of fans such as ventilation fans or other combustion appliances can create a negative pressure condition on the humidifier. Adequate air supply must be provided for the ventilation devices, in addition to that required by the humidifier.

Any installation work must be carried out by suitably qualified personnel.

With the exception of ducted combustion air installation, do not locate units in tightly sealed rooms or small compartments.

Combustion and ventilation air must be supplied through one permanent low-level and one permanent high-level opening communicating directly with the outside air.

Air intake(s) location must be at a sufficient height above ground level to prevent blocking by accumulated debris.

Supply air intake vent(s) must be equipped with a weather cap and bird screen, in order to prevent gusts of wind or water from entering, preventing mold build up or leakage in the ducts.

The SKGE3 Steam Humidifier has filtered air openings through the front door. Do not block or obstruct the air openings of the humidifier.

The humidifier is factory adjusted for correct performance. Do not alter throttle setting or restrict blower combustion air inlet.

Combustion Air Specification - Natural Ventilation

Model	Number of Modules	Natural Ventilation Installation (2)	
		Minimum Low level opening - inlet (cm ²)	Minimum High level opening - outlet (cm ²)
SKGE3-0501 N/P	1	540	270
SKGE3-0701 N/P	1	558	549
SKGE3-0801 N/P	1	567	554
SKGE3-1001 N/P	1	743	641
SKGE3-1202 N/P	2	770	655
SKGE3-1502 N/P	2	954	747
SKGE3-1702 N/P	2	1031	785
SKGE3-2002 N/P	2	1215	878
SKGE3-2503 N/P	3	1427	983
SKGE3-2703 N/P	3	1503	1022
SKGE3-3003 N/P	3	1688	1114
SKGE3 3504 N/P	4	1899	1220
SKGE3-3704 N/P	4	1976	1258
SKGE3-4004 N/P	4	2160	1350

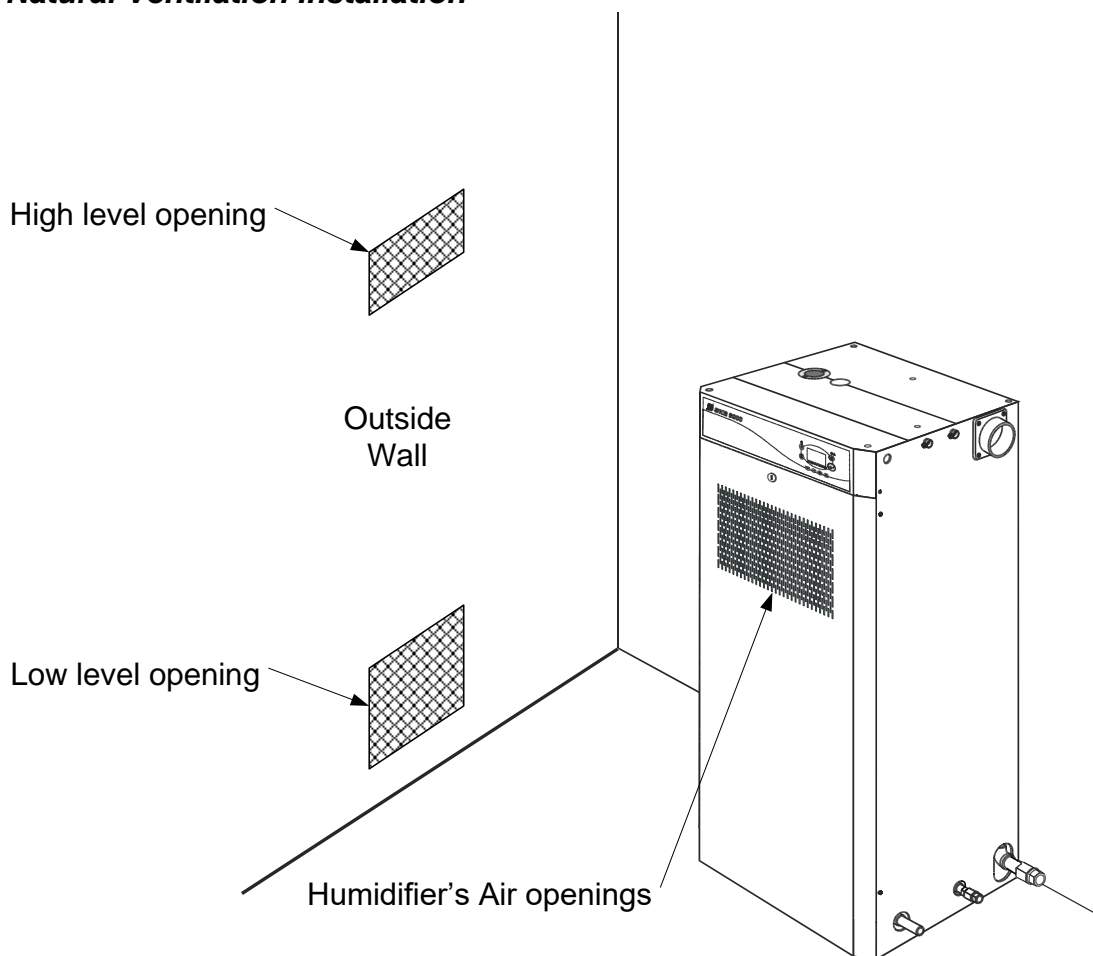
Note 1: Information of the above table is from BS6644, Specification for Installation of gas-fired hot water boilers of rated inputs between 70 kW (net) and 1.8 MW.

Note 2: These minimum openings section are specified for the combustion air requirement of the SKGE3 Humidifier. If other gas fired appliances are installed in the same room, openings will have to be increased to be able to supply adequate combustion air for all the appliances.

Note 3: For comparison with minimum flue gas venting spacing, refer to Stage 7 – Flue Gas Venting Connection.

Stage 6 – Combustion Air Installation

Natural Ventilation Installation



Natural ventilation configuration - Fig. 35

Ducted Combustion Air

“Ducted Combustion Air” option, also called Sealed Combustion, is available upon request.

Installation of the combustion air duct must be as direct as possible, minimizing the number of turns or elbows, with a maximum of 6 elbows in total.

Use only duct materials suitable to supply air from the outside to the humidifier.

Combustion air duct length and flue gases venting pipe must not exceed:
 30m – 3m x (total number of 90° elbow) – 1.5m x (total number of 45° elbow).

Combustion air duct must be insulated to avoid condensation around the duct when outside air temperature is below 0°C.

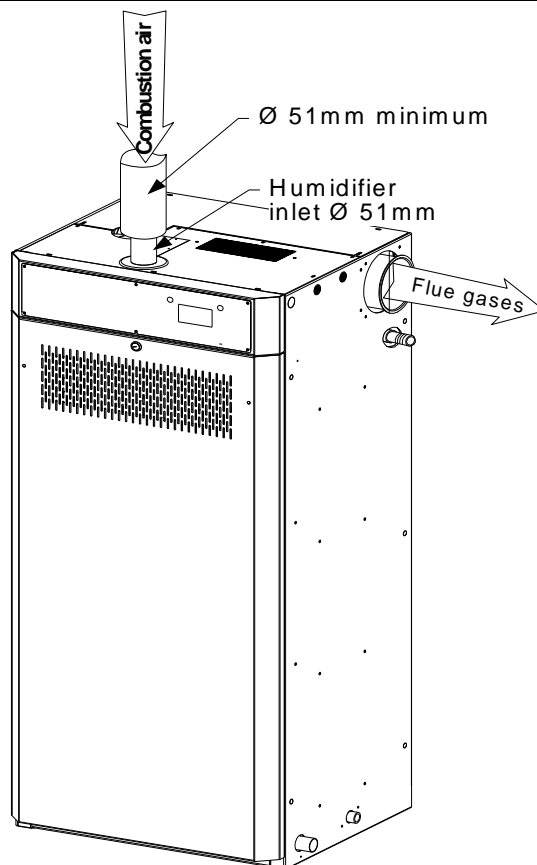
Ensure that combustion air duct connections are air tight.

Minimum combustion air duct upward gradient must be 20mm in 1000mm horizontal run.

Model	Combustion air inlet diameter per module
SKGE3-0501 to 4004	Ø 51mm O.D.

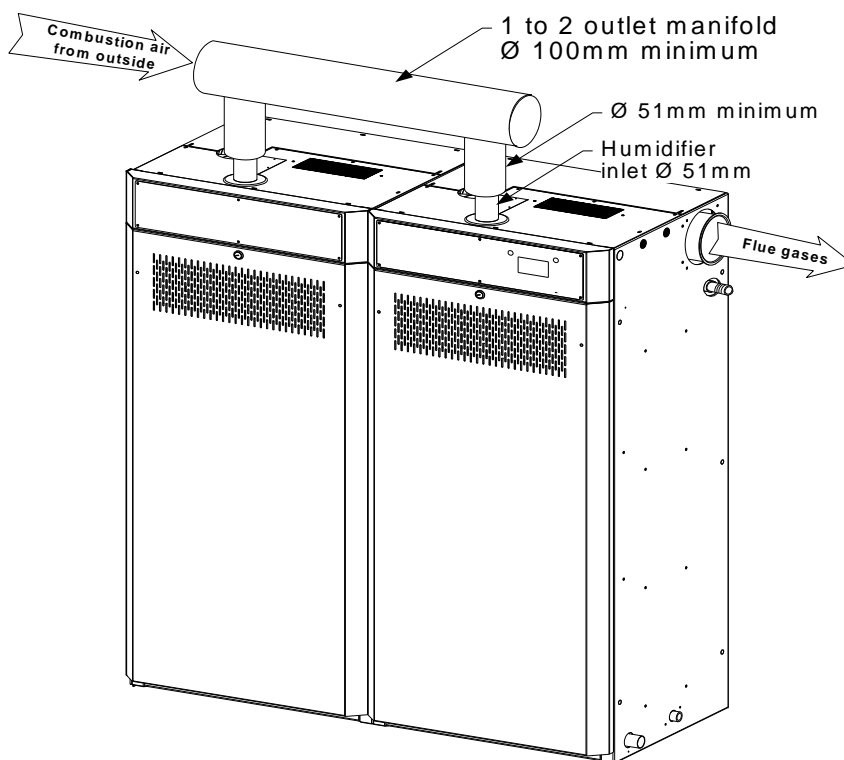
Stage 6 – Ducted Combustion Air Installation

Single Module
Humidifiers:
SKGE3-0501
SKGE3-0701
SKGE3-0801
SKGE3-1001



Ducted combustion air 1 module - Fig. 36

2 Modules
Humidifiers:
SKGE3-1202
SKGE3-1502
SKGE3-1702
SKGE3-2002

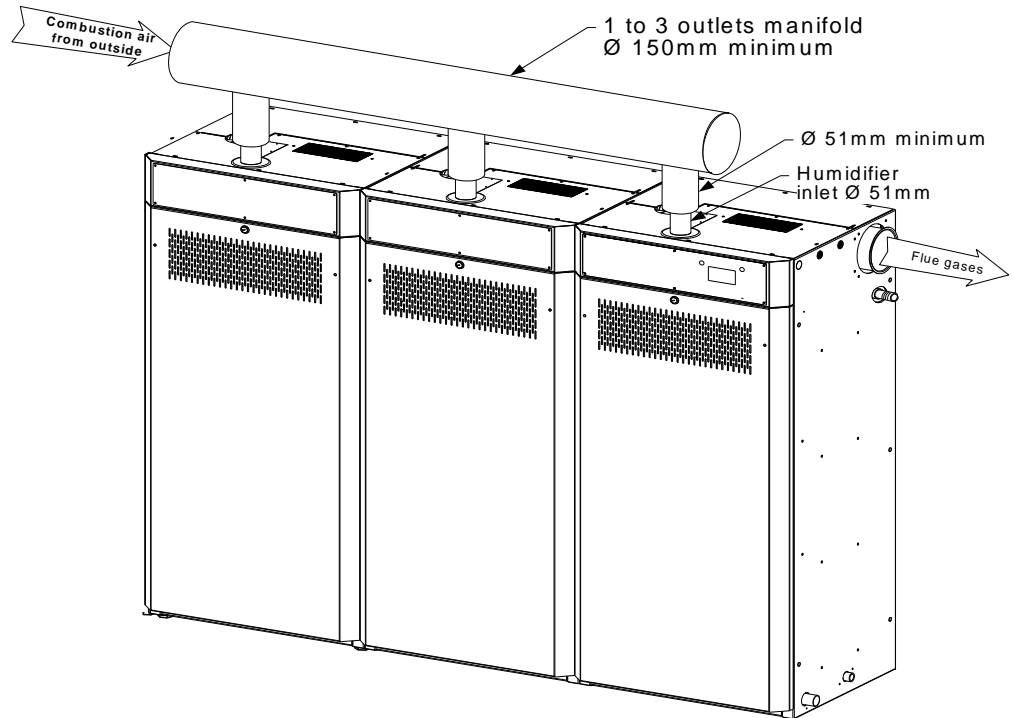


Ducted combustion air 2 modules - Fig. 37



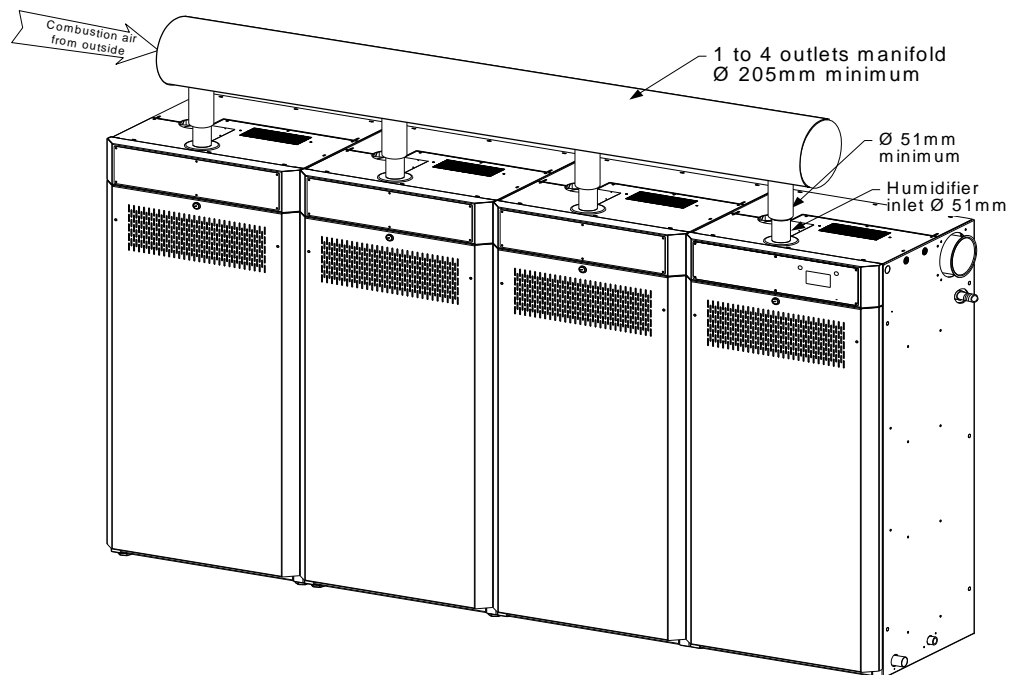
Stage 6 – Ducted Combustion Air Installation

3 Modules
Humidifiers:
SKGE3-2503
SKGE3-2703
SKGE3-3003



Ducted combustion air 3 modules - Fig. 38

4 Modules
Humidifiers:
SKGE3-3504
SKGE3-3704
SKGE3-4004



Ducted combustion air 4 modules - Fig. 39

Stage 7 – Flue Gas Venting Connection

CAUTION



For safe and efficient operation of the SKGE3 Steam Humidifier, flue gases (product of combustion) **MUST** be evacuated through a dedicated flue gas venting system to the outside air.

Flue gas venting must conform to local codes and regulations.

Install flue gas venting systems in accordance with vent manufacturer's instructions.

Do not vent the SKGE3 Steam Humidifier into another venting system serving another appliance. The humidifier must be vented by its own approved/listed flue system.

Any flue gas venting pipes passing through floors, ceilings, and walls **MUST** be installed with proper clearances to combustible materials, and **MUST** be fire stopped according to local codes and regulations.

Use only roof and wall penetration systems recommended by the flue gas venting system manufacturer.

Flue gas venting pipe **MUST** be free of any restrictions or obstructions. The flue gas venting pipe diameter **MUST** be same as the SKGE3 flue gas connector.

Do not use unlined masonry or concrete chimney as a flue gas venting system.

The flue gas venting system must not extend into, or pass through, any circulation air duct or plenum.

Installation of the flue gas venting pipes must be as direct as possible, minimizing the number of turns or elbows, with a maximum of 6 elbows in total.

If flue gas venting pipe length exceeds 6.1m, it is recommended to install an approved insulated flue gas venting pipe, in order to reduce the formation of condensate.

Ensure that the flue connection to the humidifier is air tight. Failure to do this will result in damage due to moist flue gases condensing.

Flue Gas Venting Specification

The Neptronic® SKGE3 Steam Humidifier is a fan assisted condensing positive pressure flue gas appliance.

Maximum flue gases temperature: Ambient + 217°C.

Maximum flue gases venting pipe length:

30m – 3m x (total number of 90° elbow) – 1.5m x (total number of 45° elbow).

Model	Single flue gases outlet diameter
SKGE3- 0501 to 1001	Ø 76mm O.D.
SKGE3- 1202 to 2002	Ø 100mm O.D.
SKGE3-2503 to 4004	Ø 125mm O.D. <i>flue pipe connector, Ø125mm, supplied</i>

Flue gas venting pipe diameter **MUST** be same as the SKGE3 flue gas connector.

Minimum flue gas venting pipe upward gradient must be 20mm in 1000mm horizontal run or as per flue gas venting manufacturer's instructions.

The Neptronic® SKGE3 Steam Humidifier is a condensing appliance. As such, its high efficiency may cause condensation in the flue gas venting. Condensate drip tee must be installed, as per flue gas venting manufacturer's instructions.

Flue Gas Terminal



A Proper flue gas terminal must be installed to prevent back flow or any other outside weather condition that may affect proper operation of the SKGE3 Humidifier.

Distances from the flue gas venting terminal to adjacent public walkways, buildings, and any open able windows or building opening **MUST** conform to local codes and regulations.

Flue gas terminal **MUST** be at sufficient height above the ground level to prevent blocking by accumulated debris.

Building materials **MUST** be protected from degradation by flue gases.

Vertical flue gas terminal **MUST** extend at least 1 meter above the roof top, and 0.6 meter above any ridge located within 3 meters from the terminal.

The terminal inlets and outlets from separate combustion and air supply circuits for the supply of combustion air and the evacuation of combustion products must not terminate on different walls of the building.

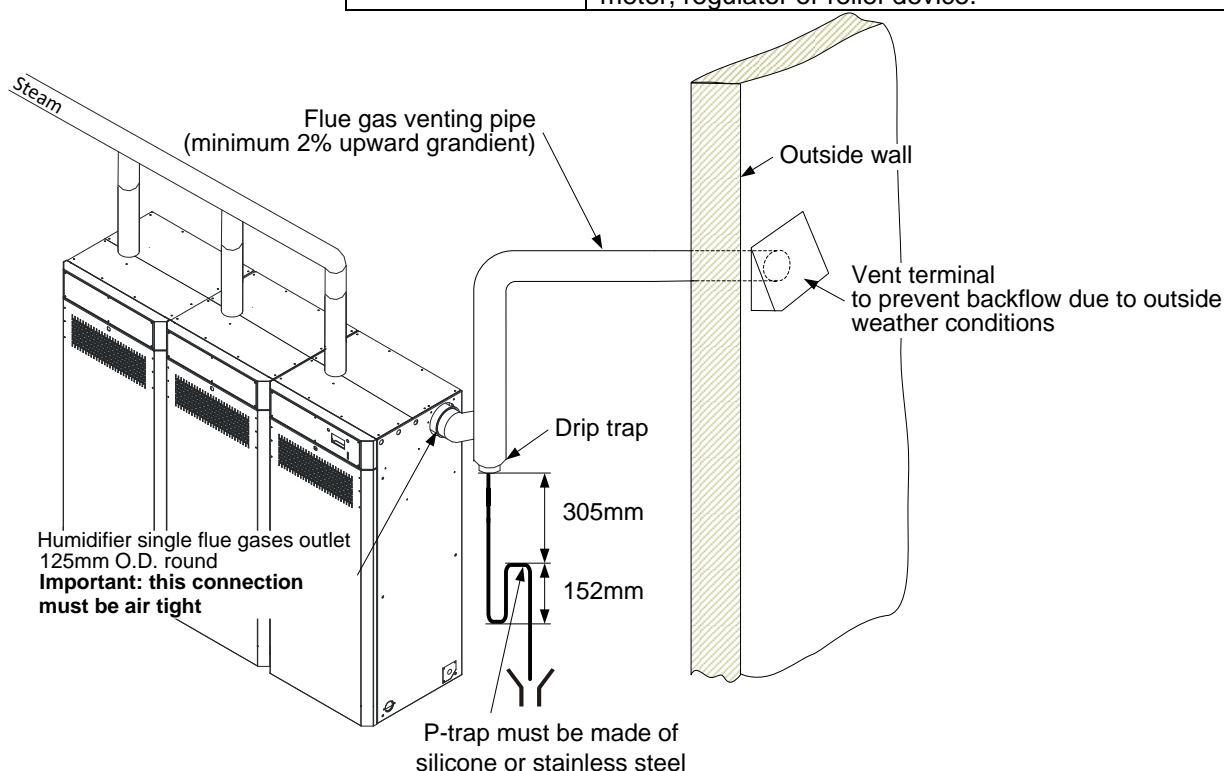
Stage 7 – Flue Gas Venting Connection

Minimum Spacing When Flue gas terminal is located at outside air.

Minimum spacing (mm)	Building or other element
300	Below adjacent opening (window, air vent or any other ventilation opening)
75	Below a gutter, drain or soil pipe
200	Below eaves catch or, balcony
75	Beside vertical drain or soil pipe
300	Beside adjacent corner or other flue gas terminal
150	Beside adjacent opening (door, window, air vent or any other ventilation opening)
300	Above adjacent ground or balcony level
2100	Above ground level, in areas accessible to public
1500	Above or below other flue gas terminal
600	From a surface facing the terminal
1200	From a facing other flue gas terminal.
1250	Above, below, beside or facing any electric or gas meter, regulator or relief device.

When Flue gas terminal is located in car port in residential building

Minimum spacing (mm)	Building or other element
200	Below car port ceiling
75	Beside vertical drain or soil pipe
300	Beside adjacent corner or other flue gas terminal
1200	Beside adjacent opening (door or window)
300	Above adjacent ground or balcony level
2100	Above ground level, in areas accessible to public
1500	Above or below other flue gas terminal
600	From a surface facing the terminal
1200	From a facing other flue gas terminal.
1250	Above, below, beside or facing any electric or gas meter, regulator or relief device.



Typical flue gas installation, 3 modules - Fig. 40

Stage 8 – Electrical Supply and Installation

Electrical Power Supply

The SKGE3 Steam Humidifier requires a 230V single phase supply.

Model	Voltage	Standard Current (Amp)	Weather proof enclosure option Current (Amp)
SKGE3 0501, 0701, 0801, 1001	230 V 1ph	3.5	3.8
SKGE3 1202, 1502, 1702, 2002	230 V 1ph	4.5	5.8
SKGE3 2503, 2703, 3003	230 V 1ph	6.0	7.8
SKGE3 3504, 3704, 4004	230 V 1ph	7.5	9.5



Electrical connection

All incoming power supplies MUST be externally fused for over current protection.

The electrical supply must also be isolated for the purpose of emergency and servicing. A disconnect switch must be installed typically within one meter of the humidifier.

The isolator must have a contact separation of at least 3 mm.

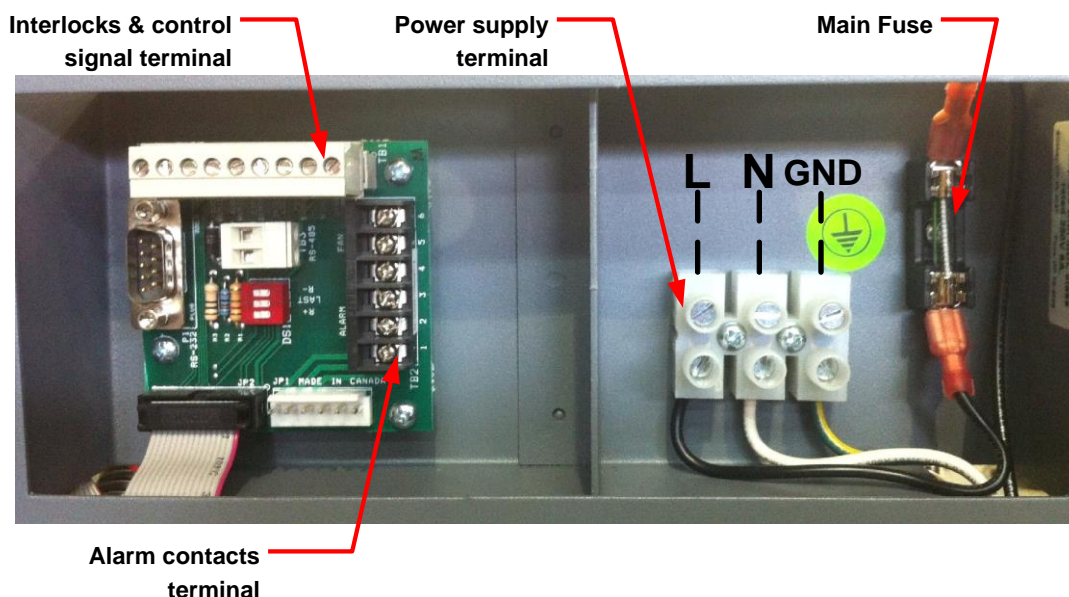
All work concerned with electrical installation MUST only be performed by skilled and qualified technical personnel (e.g. electrician or technicians with appropriate training).

Please observe local codes and regulations concerning the provision of electrical installations.

WARNING. Risk of electric Shock. Ensure that the electrical supply is isolated before commencing any installation.

The installation engineer must ensure the following:

- Use of copper power conductor only.
- Size of the power conductors are suitable for the maximum current supplied.
- Incoming power cable is secured via suitably sized cable gland.
- Each terminal connection is secured firmly with a cable ferrule.
- Humidifier cabinet has an uninterrupted or unbroken electrical ground. Do not use gas piping as an electrical ground.



Electrical connection - Fig. 41

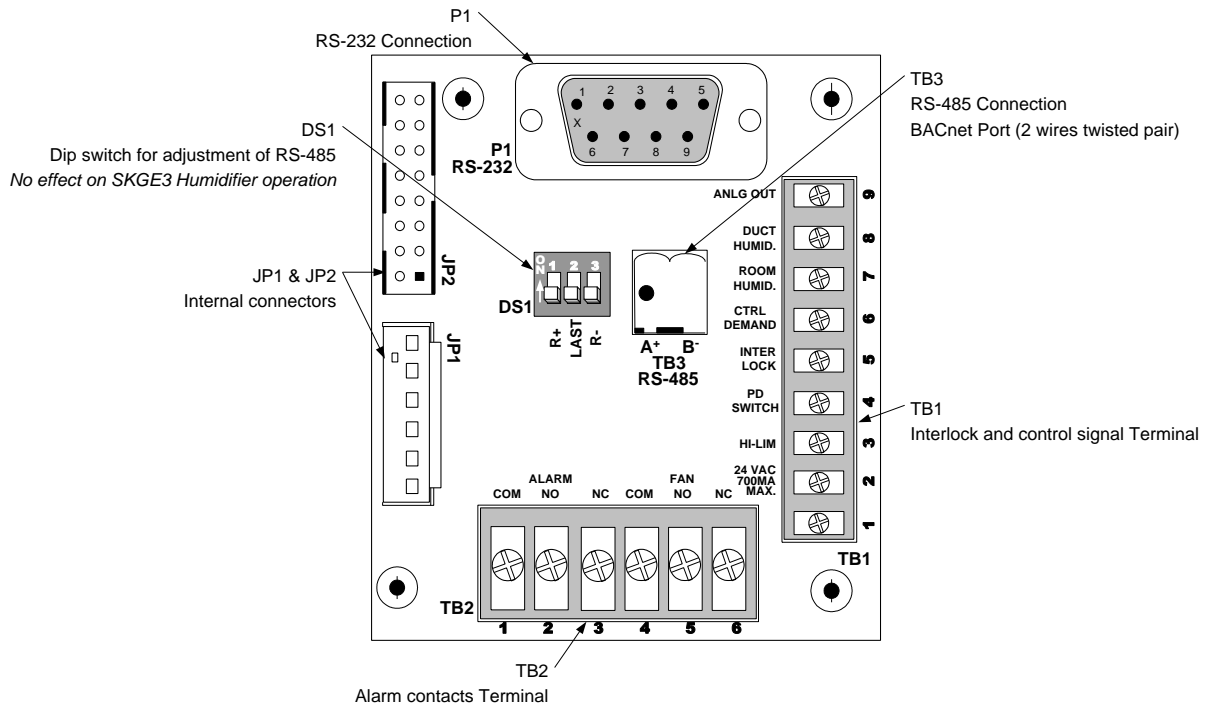


Stage 9 – Electrical Control Connections

Electrical Control Connections

The Neptronic® SKGE3 Steam Humidifier has a modulating control system and requires an analog control signal.

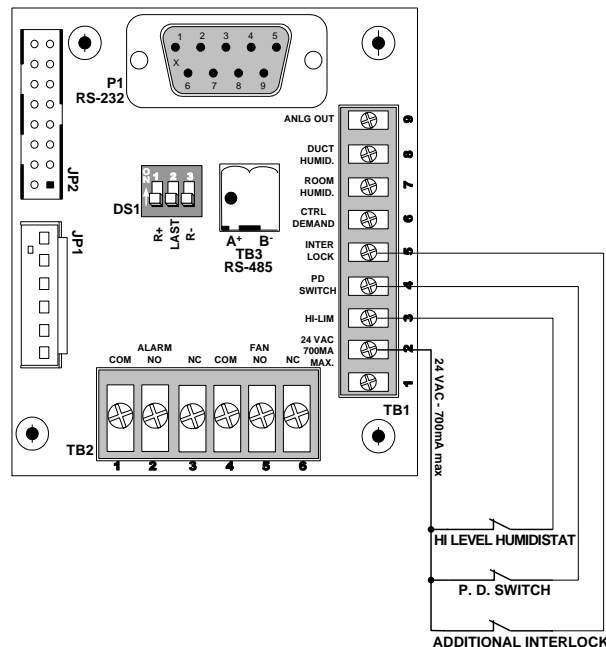
All controls connections has been grouped on a specific Interface P.C.B.



Electrical control connection interface - Fig. 42

Humidifier Interlocks

The Neptronic® SKGE3 Steam Humidifier has three interlock entries:



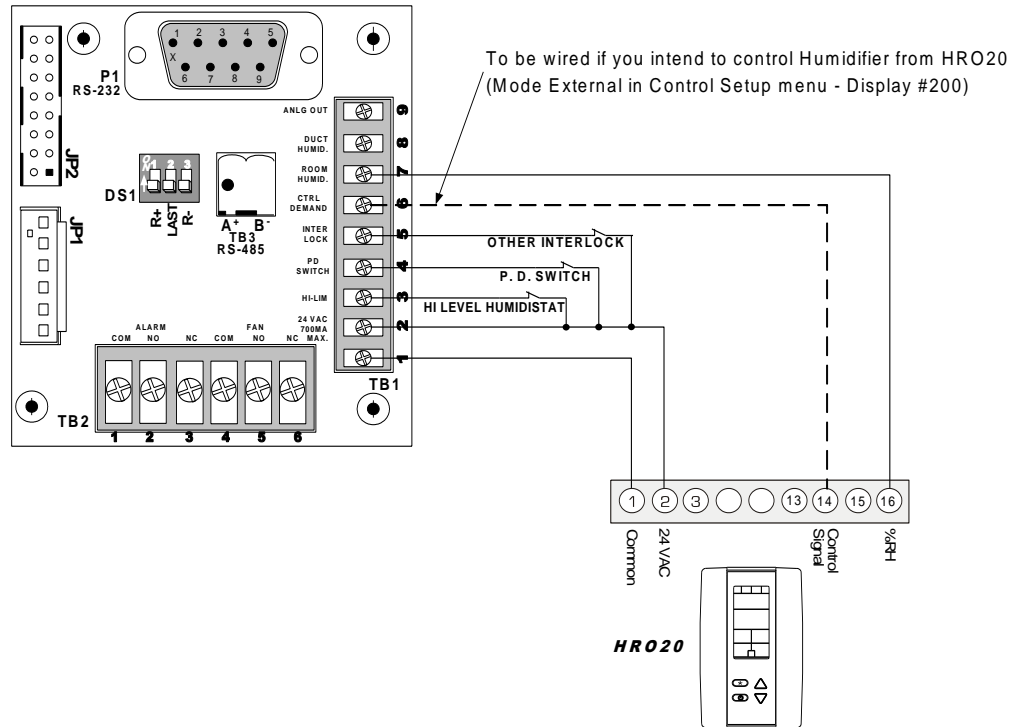
Interlocks connection - Fig. 43

- **High level humidistat** contact must be wired between terminals TB1 2 & 3. If this contact is open, operation of the humidifier will stop and an **Alarm** message will be displayed.
- **P.D. Switch** contact must be wired between terminals TB1 2 & 4. If this contact is open, operation of humidifier will stop. **No Alarm** message will be displayed.
- **A third interlock** switch can be wired between terminals TB1 2 & 5. If this contact is open, operation of humidifier will stop and an **Alarm** message will be displayed.

Stage 9 – Electrical Control Connections

Humidifier Control with Humidity Controller

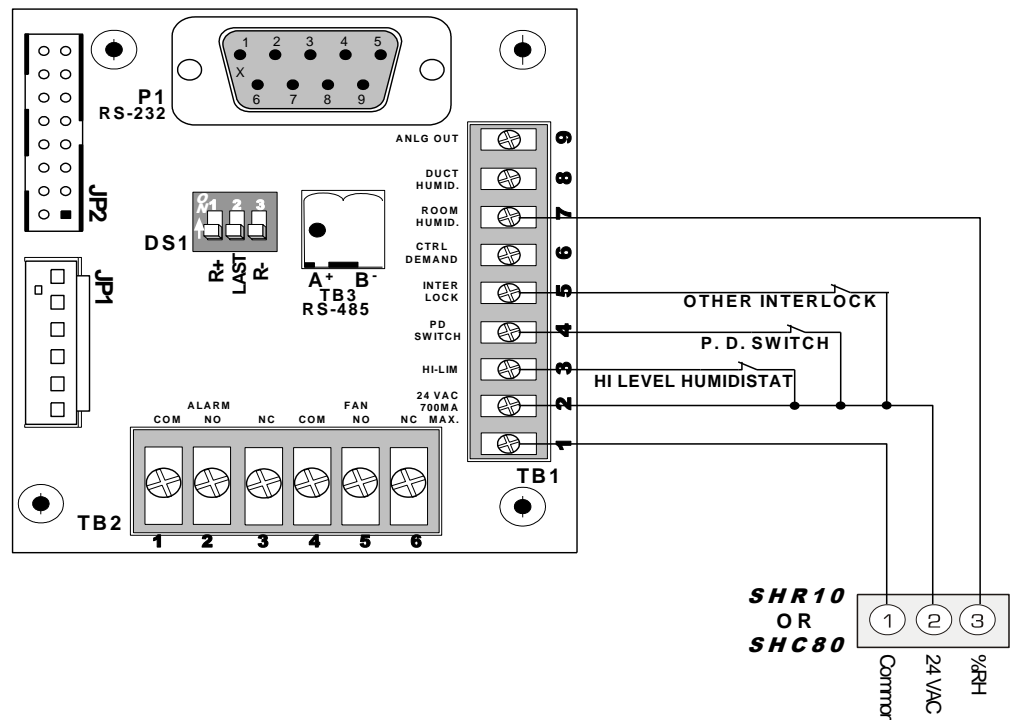
The Neptronic® SKGE3 Steam Humidifier can be installed in conjunction with the Neptronic® HRO20 humidity controller.



Control signal from HRO20 humidity controller - Fig. 44

Humidifier Control with Humidity Sensors

The Neptronic® SKGE3 Steam Humidifier can be installed in conjunction with the Neptronic® SHR10 or SHC80 humidity sensors.

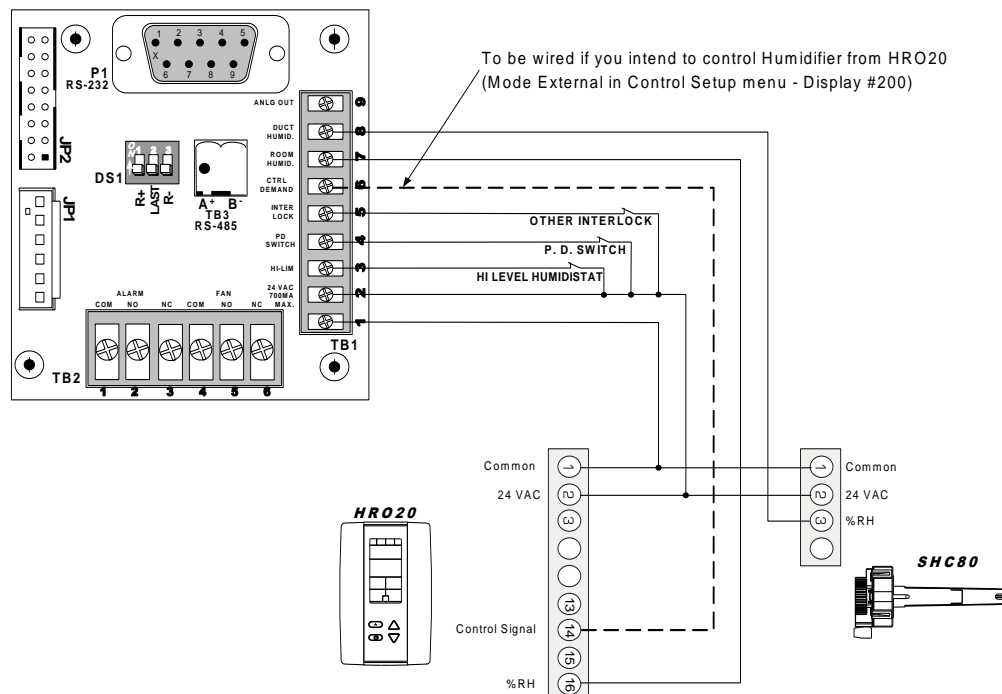


Humidity signal from humidity sensors - Fig. 45

Stage 9 – Electrical Control Connections

VAV System

The Neptronic® SKGE3 modulating Steam Humidifier can be installed in conjunction with a VAV system. In this case the Neptronic® **SHC80** duct humidity controller placed in the supply air will act as a high level duct humidity sensor. Humidity will be controlled by the Neptronic® **HRO20** room humidity controller.



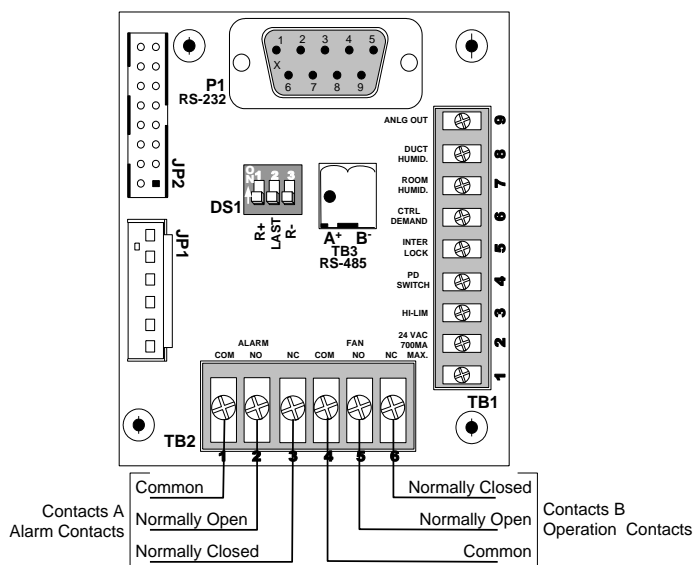
VAV configuration typical wiring - Fig. 46

Dry Contacts

Two series of volt free contacts are provided :

- Alarm contacts:
One normally connected to common and one normally open contact.
- Operation contacts:
One normally connected to common and one normally open contact.

These contacts are used to switch a low voltage control, up to 24Vac or Vdc, with a switching current of no more than 3 A.



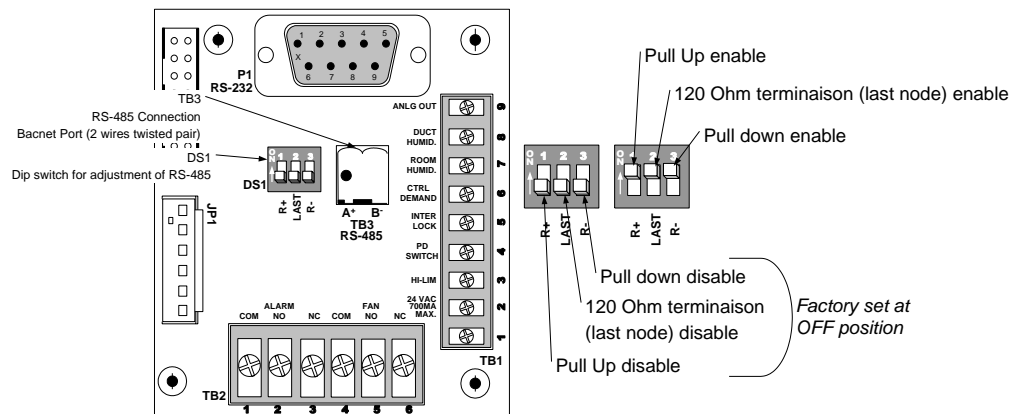
Operation & Alarm contact wiring - Fig. 47

Stage 9 – BACnet® Interface Set-up

Important Note

This page describes the BACnet® interface set-up.
The “**BACnet® interface**” option is available only upon request.

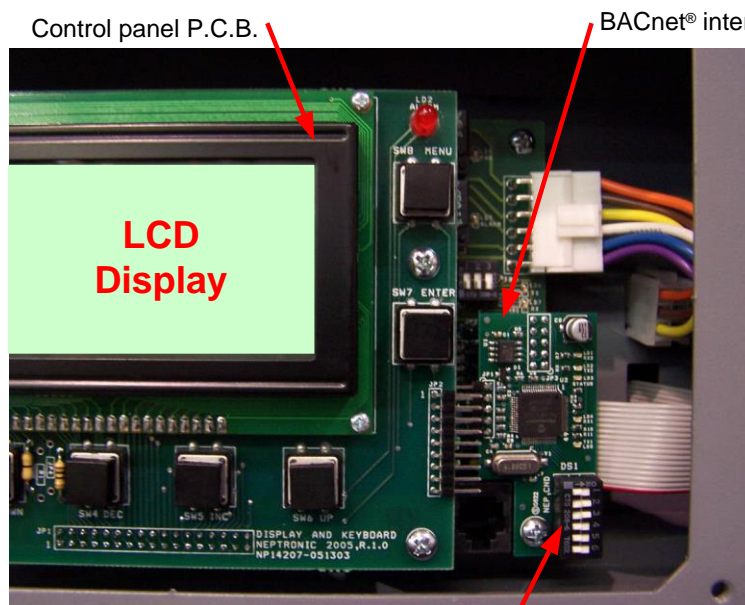
Dip Switch Adjustment for RS-485 BACnet® Port



BACnet interface - Fig. 48

Mode & Baud Rate Setting

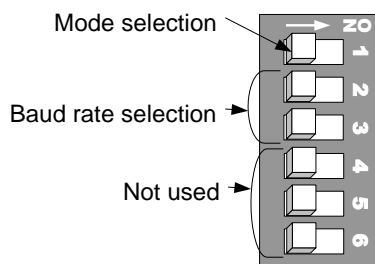
Mode & baud rate dip switch setting is located next to the Control panel P.C.B. To access it, remove the front panel plate.



BACnet® interface Dipswitch

Location of BACnet interface Dip switch - Fig. 49

BACnet® interface Dip switch setting:



Dip switch setting - Fig 50

Switch #1 : Mode selection		
OFF = Mode Operational (<i>factory setting</i>)		
ON = Mode Configuration (linked with Com Port menus #601 & 602)		
Switch #2 & 3 : Baud rate selection		
<i>Baud rate</i>	<i>Switch #2</i>	<i>Switch #3</i>
9600	OFF	OFF
19200	ON	OFF
38400	OFF	ON
76800 (<i>factory setting</i>)	ON	ON

See also the **BACnet® communication module user guide** supplied.

Initial Verification



Initial verification and start-up (commissioning) must be carried out by suitable qualified personnel.

Clearance

1. Ensure that cabinet of the humidifier is installed in a location where the humidifier can be serviced correctly. ☐

Electrical

2. Check that the power supply (voltage) conforms to the appliance name plate on the humidifier side. ☐
3. Confirm that 24Vac is present between tab 1&2 of the control terminal, located on the control connection PCB. Remove the front top cover to get to this PCB. ☐

Water

4. Ensure that water is supplied to the humidifier. A shut-off and a non-return valve must be outside the humidifier. Once the water shut-off valve is turned ON, ensure that there are no apparent leaks. ☐
5. Confirm that drain piping is properly connected with a pitch of at least 6.5mm per 300mm horizontal run. ☐

Steam

6. Check that steam distributors are properly installed into the ventilation duct. ☐
7. Verify that the flexible steam hoses and rigid steam supply pipes are shorter in total length than 5 meters, properly sloped and have condensation P traps wherever required. ☐

Gas

8. Verify that a proper regulator and gas test point have been installed on the gas line to the humidifier. ☐
9. Confirm that gas is supplied to the humidifier and that the shut-off valve located outside the humidifier is closed. Once the shut-off valve is turned ON, check for leaks, gas, smell or hissing sound. ☐

Flue Gases Venting

10. Verify the flue gases venting as follow: ☐
- a) A tee is installed with a drain trap for the flue gases condensate. ☐
- b) Check that all connections are air tight. ☐
- c) The total length of the vent equivalent is not longer than 30 meters. ☐
- d) An approved venting system is used. ☐


Note: Aluminum B vent is not acceptable. ☐

Controls

11. Ensure that a high limit duct humidistat is installed, properly connected to the humidifier and that the setpoint is properly adjusted. ☐
12. Verify that a room humidistat or return air duct humidistat is installed, properly connected to the humidifier and that the setpoint is properly adjusted ☐
13. Turn the power ON at the disconnect switch. The LCD screen located on control panel must display the model number and serial number of the humidifier, along with the message "Unit is off". ☐
14. Confirm the control set-up of the humidifier (display #200). The humidifier is factory set with EXTERNAL control set-up, which means that the humidity demand is controlled by the room or duct humidistat. ☐
15. Ensure that the type of signal (0-10Vdc, 2-10Vdc or 4-20mA) of the humidistat corresponds to the type set in the humidifier control set-up menu (display # 201). ☐

Start-Up

Start-up

1. Proceed to start-up the humidifier, as follow: ☐
 - a) Open the front access door of the humidifier cabinet; make sure that the manual drain valve is closed. ☐
 - b) Start up the humidifier by pushing the  (ON/OFF) button located on the humidifier control panel. ☐
 - c) After 5 seconds, water will start to fill. Verify that the water level slowly rises in the water level sight glass located on the side of the evaporation chamber ☐
 - d) Verify that there is a humidity demand. Humidity demand is displayed on the humidifier LCD screen. ☐
 - e) The humidifier LCD screen will display the water level in percentage (%). When the display indicates that the water level is at 100%, verify that the water level in the water level sight glass is approximately 20mm below the safety belt band of the evaporation chamber. ☐
 - f) If there is a humidity demand, the burner combustion blower(s) will start, and after approximately 90 seconds the combustion will start. From a cold water start, the humidifier will require 5 to 10 minutes to produce steam. The Humidifier LCD display will indicate water temperature and flue gases temperature. ☐
 - g) During normal operation while steam is produced, the water temperature must be 100°C and the flue gases temperature around 120 to 200°C. Water level percentage must not indicate less than 95%. ☐
 - h) Observe for water, steam and flue gases leaks. ☐



Combustion Field Adjustment

2. Please refer to the *Combustion field adjustment instructions* enclosed in this package to perform this operation ☐

Safety Test

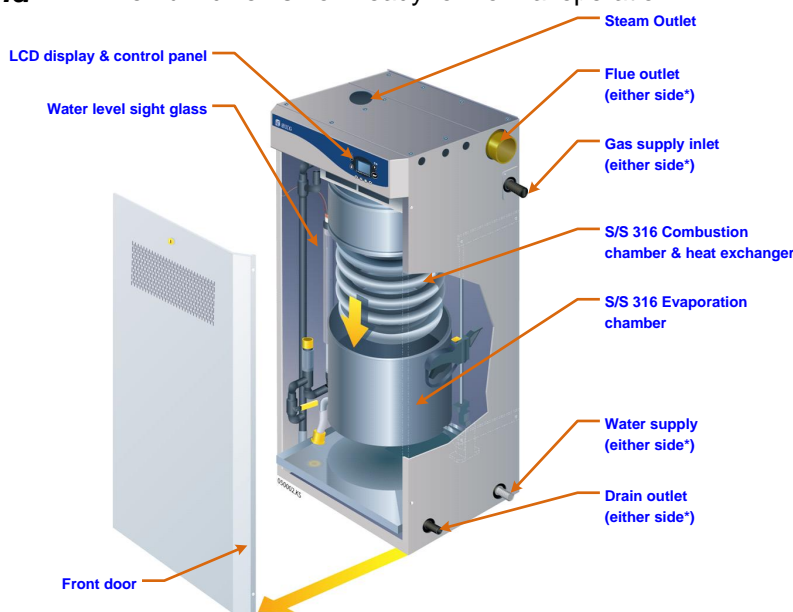
3. Check the location of the air flow switch in the system and its operation by stopping the fan. With no air movement in the air duct, the humidifier must automatically stop the combustion burner(s). ☐

Drain and Reset

4. Turn the humidifier OFF, by pushing the  (ON/OFF) push button on the control panel. ☐
5. Execute a manual drain, by pushing the  (DRAIN) push button on the control panel. A water jet directed on the water level sensor located in the water level sight glass will start and create bubbles around it. ☐
6. Reset the air flow switch and humidistat(s) to the proper value, if needed. ☐

End

7. The humidifier is now ready for normal operation. ☐

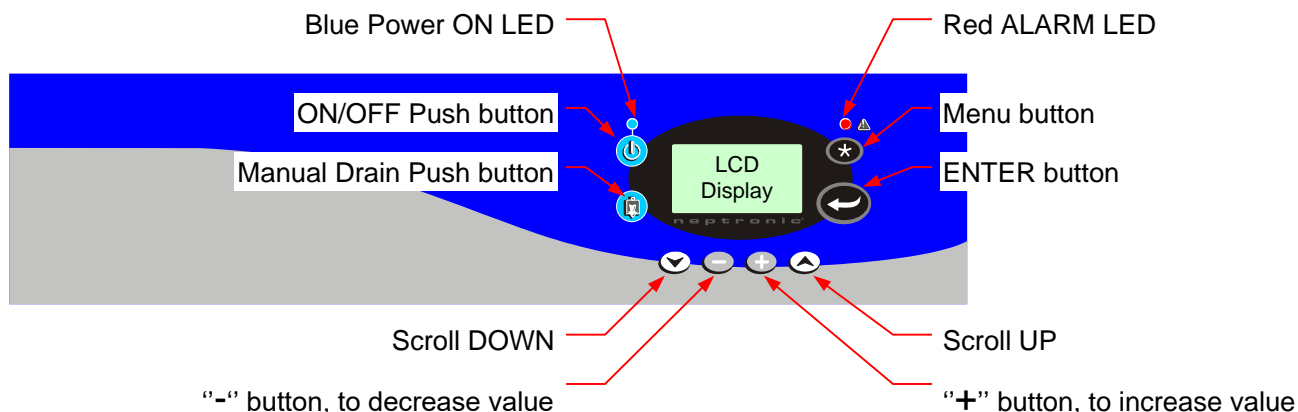


General overview reminder - Fig. 51

Commissioning – Operation Description


Control Panel Description

The control panel of the Neptronic® SKGE3 Steam humidifier is equipped with a user friendly LCD display and extensive access to status, alarms, and set-up menus.








Control panel - Fig. 52


Access to Menu

To access the menu, press on the  button. The LCD will display the following list of menus:



1. Status
2. Control Set-up
3. System Set-up
4. Alarms
5. Diagnostics
6. Com Set-up


Use the  or  buttons to scroll up or down, and access a menu by pressing the  button.

Within a menu, press on the  or  buttons to pass from one screen to another.

The initial menu may be returned to at any time by pressing the  button.

Changing Values

Within the selected screen, press the  or  buttons until you have reached the desired value.

Validate your selection by pressing on the  button.

Operation Display

Operation Scrolling Messages on Display

During normal operation, the following display will indicate main information about the system:

DEMAND: 100%
 OUTPUT: 100%
 ROOM HUMIDITY
 30%RH

Scrolled Message	Description
ROOM SETPOINT	Current room setpoint in % RH.
ROOM HUMIDITY	Current room humidity reading in % RH.
HI-LIMIT SETPOINT	Current high limit duct setpoint in % RH.
WATER LEVEL	Current water level reading in the evaporation chamber for each module in %.
WATER TEMPERATURE	Current water temperature reading in the evaporation chamber for each module in °C.
AIR FLOW IS OPEN	No air flow is detected in the duct. Humidifier is stopped.
DRAIN CYCLE	Drain cycle in process.
END OF SEASON DELAY IS OVER	72 hours without humidity demand. Evaporation chamber(s) of the humidifier has been flushed of the remaining water in order to prevent growth of bacteria. Upon new humidity demand, evaporation chamber(s) will fill up with fresh water and produce steam.
!!! INPUT SUPPLY TOO LOW	Voltage supply is below the minimum value. Humidifier is stopped.
!!! HI-LIMIT CUT OUT	High limit RH% is above Hi limit set point. Humidifier is stopped.
!!! INTERLOCK OPEN	Interlock safety is open. Humidifier is stopped.
!!! CLEANING REQUIRED CALL SERVICE PEOPLE	Number of hours to service will be reached within 50 hours. Humidifier continues to operate but will stop for service soon.
!!! SERVICE UNIT NOW	Number of hours to service has been reached. Humidifier is stopped. It is time to service the humidifier.
!!! CRITICAL ALARM PRESENT SEE MENU	Abnormal critical situation has been detected. Humidifier is stopped. Go to Alarm menu for details.
!!! NON-CRITICAL ALARM PRESENT SEE MENU	Abnormal non-critical situation has been detected. Humidifier may continue to operate. Go to Alarm menu for details.

Status Menu

<i>Display</i>	<i>Description</i>
STATUS 101 Room Rel. Humidity 64%RH	Room Relative Humidity: Displays the room relative humidity if a room humidistat is connected to the humidifier.
STATUS 104 System Demand 64,3%	System Demand: Displays the humidity demand from the system. 100% represent a full demand.
STATUS 105 System Output H1: 45,5% H2: 43,0% H3: 42,5% H4: 41,0%	System Output: Displays the output for each module. Value is indicated in %. (50% of a 300kg/hr module would represent 150kg of steam per hour output.)
STATUS 106 Hours before drain H1: 4H H2: 2H H3: 3H H4: 1H	Hours before drain: Displays the remaining time before the next automatic flush for each module. The automatic flush of the evaporation chamber is fully programmable. Please refer to display # 301 for more details. <i>Note: If Drain has been disabled by an authorized service engineer, this display will be disabled as well.</i>
STATUS 107 Running Hours H1: 2H H2: 2H H3: 3H H4: 1H	Running Hours: Displays the number of hours of operation since the last servicing for each module. Value is indicated in hours. This counter can be reset after each servicing.
STATUS 108 Total Running Hours H1: 40H H2: 25H H3: 22H H4: 20H	Total Running Hours: Displays the total number of hours of operation for each module since the original start-up. This counter cannot be reset.
STATUS 109 Water level H1: 98% H2: 99% H3: 101% H4: 98%	Water level: Displays the reading of water level electronic probe for each module. Value is indicated in %, 100% indicate that the evaporation chamber is full of water. During normal operation, the value can fluctuate between 95% and 105%.
STATUS 110 Water Temperature H1: 32°C H2: 35°C H3: 31°C H4: 29°C	Water Temperature: Displays the water temperature inside the evaporation chamber for each module. Value is indicated in °C. During normal operation, this temperature must be around 100°C.
STATUS 111 Chimney Temperature H1: 41°C H2: 45°C H3: 60°C H4: 51°C	Chimney Temperature: Displays the Flue gases temperature for each module. Value is indicated °C. During normal operation, this temperature must be lower than 210°C.
STATUS 112 Unit Size H1: 100 kg/Hr H2: 105 kg/Hr H3: 103 kg/Hr H4: 72 kg/Hr	Unit Size: Displays the total capacity of each module. Value is indicated in kg/hr.

Note: Displays shown in these instructions are representing a display for a 4 module SKGE3 Steam humidifier. If your SKGE3 Steam humidifier is equipped with 1, 2 or 3 modules, only H1, H1 and H2, or H1, H2 and H3 will appear on the LCD display.



Control Set-up Menu

Display	Description	Values
<div>CONTROL SETUP 200</div> <div>Control Mode</div> <div>INTERNAL</div>	Control Mode: Selection of control mode. <i>If External is selected, the control demand will be received by the analog input. If Com Port is selected, the control demand will be received by the communication port (BACnet option).</i>	External Internal Com Port
<div>CONTROL SETUP 201</div> <div>Control Input Setup</div> <div>Volt/Amp: Voltage</div> <div>Vin Min.: 2.00V</div> <div>Vin Max.: 10.00V</div>	Control Input Setup: Selection of input control settings. <i>Allows you to select voltage or current signal and range of the signal.</i>	Voltage or Amp. From 0 to 10 V or 2 to 10 V Or 4 to 20 mA
<div>CONTROL SETUP 202</div> <div>Room SP Source</div> <div>INTERNAL</div>	Room SP Source: Selection of source for room humidity setpoint.	External Internal Com Port
<div>CONTROL SETUP 203</div> <div>Room Set Point</div> <div>40 %</div>	Room Set Point: Selection of room relative humidity value.	Percentage From 10 to 90 %
<div>CONTROL SETUP 204</div> <div>Room Humidity SetPoint</div> <div>Volt/mA: Voltage</div> <div>Vin Min.: 2.00V</div> <div>Vin Max.: 10.00V</div>	Room Humidity SetPoint: Selection of room humidity setpoint settings. <i>Allows you to select voltage or current signal and range of the signal.</i>	Voltage or Amp. From 0 to 10 V or 2 to 10 V Or 4 to 20 mA
<div>CONTROL SETUP 205</div> <div>Room RH Source</div> <div>EXTERNAL</div>	Room RH Source: Selection of room relative humidity source.	External Com Port
<div>CONTROL SETUP 206</div> <div>Humidity Input Setup</div> <div>Volt/Amp: Voltage</div> <div>Vin Min.: 2.00V</div> <div>Vin Max.: 10.00V</div>	Humidity Input Setup: Selection of humidity input.	Voltage or Amp. From 0 to 10 V or 2 to 10 V Or 4 to 20 mA
<div>CONTROL SETUP 207</div> <div>Humidity Input Offset</div> <div>45.5%RH</div> <div>Off: 0.00%</div>	Humidity Input Offset: Selection of room humidity input offset.	Offset in % From -5.0% to +5.0%
<div>CONTROL SETUP 208</div> <div>Hi Limit Ctrl Mode</div> <div>Disable</div>	Hi Limit Ctrl Mode: Selection of high limit control Mode	Disable External Com Port
<div>CONTROL SETUP 209</div> <div>Hi Limit SP Adjust.</div> <div>80%</div>	Hi Limit Set Point Adjustment: Selection of high limit relative humidity value.	Percentage From 50 to 90 %

Control Set-up Menu

CONTROL SETUP 210 Hi Limit SetPoint Volt/mA: Voltage Vin Min.: 2.00V Vin Max.: 10.00V	Hi Limit SetPoint: Selection of high limit setpoint settings. <i>Allows you to select voltage or current signal and range of the signal.</i>	Voltage or Amp. From 0 to 10 V or 2 to 10 V Or 4 to 20 mA
CONTROL SETUP 211 Hi Limit Offset 45.5%RH Off: 0.00%	Hi Limit Offset: Selection of duct relative humidity input offset.	Offset in % From -5.0% to +5.0%
CONTROL SETUP 212 PID Control Band 5.0 %	PID Control Band Selection of PID control band value	Percentage From 1 to 20 %
CONTROL SETUP 213 PID Control Gain KP = 20 KI = 0 KD = 0	PID Control Gain Selection of PID control gain values	KP from 0 to 100 KI from 0 to 100 KD from 0 to 100
CONTROL SETUP 214 Tank Operation SEQUENTIAL	Tank Operation: Selection of tank operation, when SKGE3 humidifier is built with more than one module. For optimum humidity control, it is recommended to use sequential operation.	Sequential Parallel
CONTROL SETUP 215 Lock On Capacity 100 %	Lock On Capacity: Selection of humidifier capacity reduction	Percentage From 20 to 100 %




System Set-up Menu



Display	Description	Values
SYSTEM SETUP 300 Service Timer 1000 Hrs	Service Timer: Selection of delay between service alarms. Value is indicated in Hours.	From 400 to 3000 Hrs Increment: 100 Hrs Default: 1000 Hrs
SYSTEM SETUP 301 Auto Drain Delay 4 Hrs	Auto Drain Delay: Selection of delay between automatic drain cycles. Value is indicated in Hours. <i>Note: If Auto-Drain has been disabled by an authorized service engineer, this display will indicate "Drain Disabled".</i>	From 1 to 24 Hrs Increment: 1 Hr Default: 4 Hrs
SYSTEM SETUP 302 No Demand Delay 72 Hrs	No Demand Delay: Selection of delay when there is no demand. Value is indicated in Hours. <i>Note: If Auto-Drain has been disabled by an authorized service engineer, this display will indicate "EOS Disabled".</i>	From 1 to 250 Hrs Increment: 1 Hrs Default: 72 Hrs
SYSTEM SETUP 303 Fan ON Delay 10 Min	Fan ON Delay: Selection of delay to keep fan ON when there is no humidity demand. If the fan is connected to the Operation volt free contact, refer to stage 9. Value is indicated in Minutes.	From 3 to 30 Min. Increment: 1 Min. Default: 10 Min.
SYSTEM SETUP 304 Holding Temperature OFF	Holding Temperature: Selection of evaporation chamber temperature between humidity demands. If enabled, combustion will be ordered to maintain a specific water temperature. Value is indicated in °C, when setting is enabled.	From 50 to 90°C or OFF Increment: 5°C Default: OFF
SYSTEM SETUP 305 Anti Freeze Temper. OFF	Anti Freeze Temperature: Selection of evaporation chamber anti-freeze temperature. If enabled, combustion will be ordered to maintain water temperature between 7 and 12°C. This feature must be enabled when using direct outside combustion air in a freezing environment. <i>This screen is not available for humidifiers with the weather proof enclosure option.</i> Value is indicated in °C, when setting is enabled.	From 7 to 12°C or OFF Increment: 1°C Default: OFF
SYSTEM SETUP 306 Water Temp. Offset H1: 0°C H2: 0°C H3: 1°C H4: -1°C	Water Temperature Offset: Selection of evaporation chamber temperature offset for each module, in order to adjust reading of the water temperature probe to proper temperature. When producing water temperature, probe must indicate 100°C. Value is indicated in °C.	From -10 to 10°C Increment: 1°C Default: 0°C
SYSTEM SETUP 307 Water Level Offset H1: 0% H2: -1% H3: 2% H4: 0%	Water Level Offset: Selection of evaporation chamber water level offset for each module, in order to adjust reading of the water level probe to the proper level. Value is indicated in %.	From -10 to 10% Increment: 1% Default: 0%

System Set-up Menu

<i>Display</i>	<i>Description</i>	<i>Values</i>
SYSTEM SETUP 308 Chimney Temp. Offset H1: 0°C H2: 1°C H3: -1°C H4: 0°C	Chimney Temperature Offset: Selection of chimney temperature offset for each module, in order to adjust reading of the chimney temperature probe to proper temperature. Value is indicated in °C.	From -10 to 10°C Increment: 1°C Default: 0°C
SYSTEM SETUP 309 Lcd Contrast 160	LCD Contrast: Selection of the LCD display contrast. Value is indicated in relative number.	From 140 to 180 Increment: 1 Default: 160
SYSTEM SETUP 310 Language Selection English	Language Selection: Selection of the language displayed by interactive menus.	English or Français Default: English
SYSTEM SETUP 311 Time/Date Set N/A	Time/Date Setup: Reset of the internal clock.	Not programmable in this firmware version Default: N/A
SYSTEM SETUP 312 Set Alarm Beep ON Sound ON	Set Alarm Beep ON: Select whether to enable the beep sound in case of an alarm.	ON or OFF Default: ON

Alarms Menu

Display	Description
<div> ALARMS 400 Operation Period H1: 1000Hr H2: 800Hr H3: 550Hr H4: 550Hr +/- to Reset Timer </div>	<p>Operation Period:</p> <p>Displays the <u>running hours countdown</u>, it displays the reverse number of hours of Display # 107.</p> <p>IMPORTANT:</p> <p>This countdown must be reset after servicing in order to remove the alarm for call of service.</p> <p>To reset the running hours <u>press first on the</u>  button to select which module you wish to reset, then press and hold the  &  buttons simultaneously for 10 seconds.</p> <p>Value indicated is in Hours.</p>
<div> ALARMS 401 Alarms for Unit 1 No Alarm </div>	<p>Alarms for Unit 1:</p> <p>Displays alarm(s) message(s) for module 1, whenever necessary.</p>
<div> ALARMS 402 Alarms for Unit 2 No Alarm </div>	<p>Alarms for Unit 2:</p> <p>Displays alarm(s) message(s) for module 2, whenever necessary.</p>
<div> ALARMS 403 Alarms for Unit 3 No Alarm </div>	<p>Alarms for Unit 3:</p> <p>Displays alarm(s) message(s) for module 3, whenever necessary.</p>
<div> ALARMS 404 Alarms for Unit 4 No Alarm </div>	<p>Alarms for Unit 4:</p> <p>Displays alarm(s) message(s) for module 4, whenever necessary.</p>

Note: To manually reset alarm, press and hold the  &  buttons simultaneously for 3 seconds.



List of Alarms



No alarm must be reset prior to identifying and rectifying the cause of fault.

Please refer to the troubleshooting guide for help on identifying and resolving potential problems.

When an alarm is indicated by the LCD display, the red LED Alarm will flash. Normal operation of the humidifier is altered.

To manually reset alarm, press and hold the  &  buttons simultaneously for 3 seconds.

Message Displayed	Description
Power Fuse Open	The power fuse located on the Slave PCB is open. Replacing this fuse will automatically reset this alarm.
Input Volt. Too low	Power supply voltage is too low for proper operation of the humidifier. Verify power supply voltage level and take necessary actions. Proper voltage level will automatically reset this alarm.
No Water T. Sensor	Humidifier is not receiving signal from the water temperature sensor. The alarm will have to be manually reset after communication is re-established.
No Chimney T. Sensor	Humidifier is not receiving signal from the flue gases venting temperature sensor. The alarm will have to be manually reset after communication is re-established.
Water level error	Humidifier is not receiving signal from the water level sensor. The alarm will have to be manually reset after communication is re-established.
Foaming in the tank	Humidifier is detecting foam in the tank and has performed a de-foaming cycle. This alarm will automatically reset when foaming conditions are eliminated.
Water Temp. too low	Water holding temperature is below the pre-set minimum value; humidifier will fire-up the burner to heat-up the water. This alarm will reset automatically when the water temperature reaches the proper value.
Water Temp. too high	Water holding temperature is above the pre-set maximum value; humidifier will shut-off and cool down until water temperature reaches a proper value. This alarm will reset automatically when the water temperature reaches the proper value.
Chim. Temp. too high	Flue gases temperature is above the pre-set maximum value; humidifier will shut-off and cool down until flue gases temperature reaches a proper level, at which time the alarm will reset automatically.
Tank cannot fill	Water filling of the evaporation chamber is taking more than predetermined maximum time. Humidifier will not fire-up until proper water level is reached. This alarm will reset automatically once water reaches the proper level.
Tank cannot refill	The time period between two refills of the evaporation chamber is longer than expected. Investigation to define the cause of this fault is necessary. This alarm will reset automatically. For more details, please refer to the Service and Troubleshooting guide .
Tank cannot drain	Water draining of the evaporation chamber is taking more time than predetermined. This alarm will reset automatically once water has been totally evacuated.
Burner Fan Defect	Burner fan is not synchronized with the humidity output. This alarm will have to be reset manually. For more details, please refer to the Service and Troubleshooting guide .
Burner Locked	Gas burner did not light-up after 3 retries. Gas burner must be verified. This alarm will automatically reset once after 30 minutes. If the gas burner is still not light up, the alarm will then have to be reset manually. For more details, please refer to the Service and Troubleshooting guide .

For information on troubleshooting please refer to the **Service and Troubleshooting guide** supplied.

Diagnostics Menu

Display

Description

```

DIAGNOSTICS    500
Input Voltage
  Input #1: 7.15V
  Input #2: 7.13V
  Input #3: 7.14V
  
```

Input Voltage:

Displays the analog inputs:

Input #1: Control setpoint input voltage
 Input #2: Room humidity input voltage
 Input #3: Duct humidity input voltage

Value indicated is in Volts.

If input signal is 4-20mA, the humidifier will convert it into voltage.

```

DIAGNOSTICS    501
Digital input
  Input #1: ON
  Input #2: ON
  Input #3: ON
  
```

Digital Input:

Displays the digital inputs:

Input #1: High Limit Humidistat
 Input #2: Pressure differential switch (fan proof)
 Input #3: Interlock

Value indicated is On or Off.

```

DIAGNOSTICS    502
Water Level Sensor
  H1: 17598Hz
  H2: 17550Hz
  H3: 17585Hz
  H4: 17601Hz
  
```

Water Level Sensor:

Displays water level reading from electronic water level sensor for each module.

Value is indicated in Hz.

```

DIAGNOSTICS    503
Burner Fan Speed
  H1: 0Hz
  H2: 0Hz
  H3: 0Hz
  H4: 0Hz
  
```

Burner Fan Speed:

Displays burner fan speed reading from electronic burner fan speed sensor for each module.

Value is indicated in Hz.

```

DIAGNOSTICS    504
Burner Gas Valve
  H1: OFF
  H2: OFF
  H3: OFF
  H4: OFF
  
```

Burner Gas Valve:

Displays the state of the burner gas valve.

Value indicated is On or Off.

```

DIAGNOSTICS    505
Foaming Probe
  H1: 128
  H2: 132
  H3: 140
  H4: 135
  
```

Foaming Probe:

Displays conductivity value of the foaming probe. The lower the value, the more conductive the probe.

Value indicated is a relative number from the minimum of 128.

```

DIAGNOSTICS    506
Firmware Revision
  SKG3000
  Rev.: 1.8
  August 2009
  
```

Firmware Revision:

Displays the revision level of the program.

*For information on troubleshooting please refer to the **Service and Troubleshooting guide** supplied.*

Com Port Set-up Menu

<i>Display</i>	<i>Description</i>	<i>Values</i>
<div> COM PORT SET UP 600 Com Port Speed N/A Baud </div>	Com Port Speed: N/A Baud Not Applicable, communication speed unit is not a variable. The communication speed is expressed in Baud.	Default: N/A
MS/TP MAC Address		
<div> COM PORT SET UP 601 MS/TP MAC Address 255 Value is locked ! </div>	Selection of MS/TP MAC address This value is locked, in order to avoid incorrect set-up of the MAC Address. To unlock the setting, put the BACnet® interface dip switch No1 at the ON position (Configuration mode), <i>see the "Stage 9 – BACnet® Interface Set-up" section of the manual.</i>	From 0 to 255 Increment: 1 Default: 0
Device Instance		
<div> COM PORT SET UP 602 Device Instance 01530000 Value is locked ! </div>	Selection of device instance value. This value is locked, in order to avoid incorrect set-up of the device instance. To unlock the setting, put the BACnet® interface dip switch No1 at the ON position (Configuration mode), <i>see the "Stage 9 – BACnet® Interface Set-up" section of the manual.</i>	From 0 to 4194303 Increment: 1 Default: 01530000

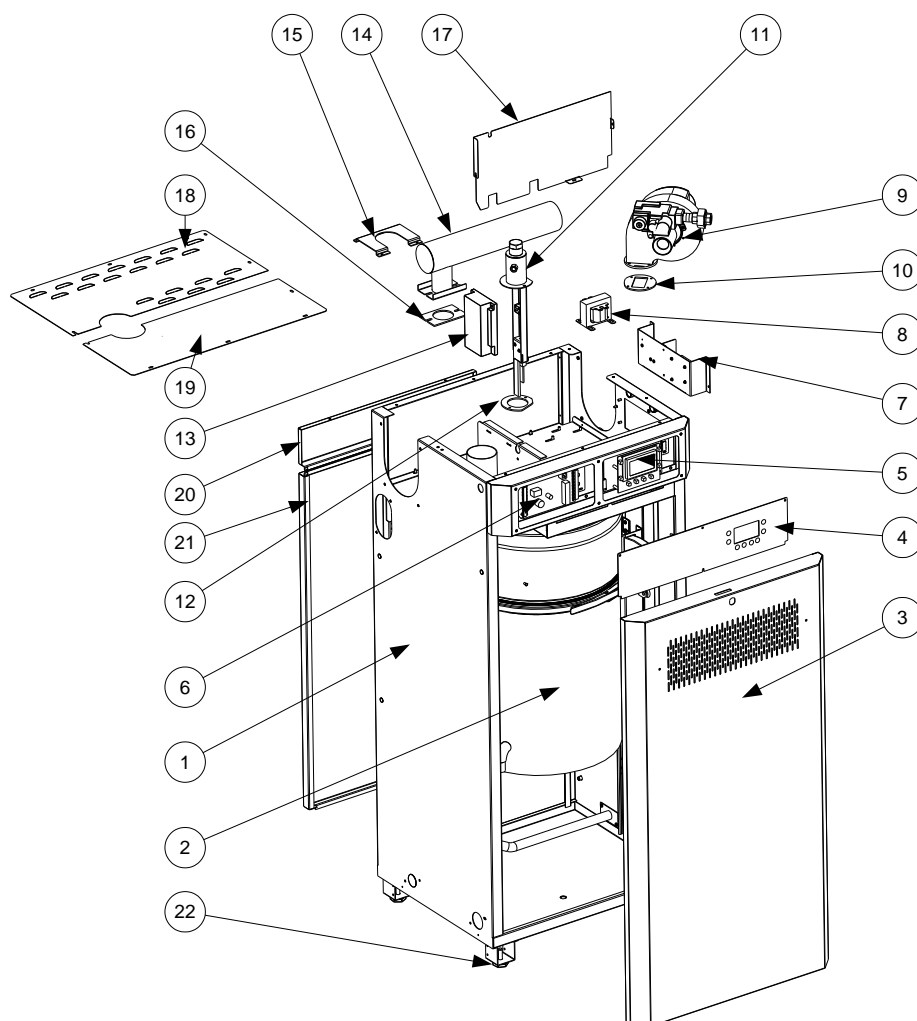


Personal Notes



Exploded Views & Parts List

General

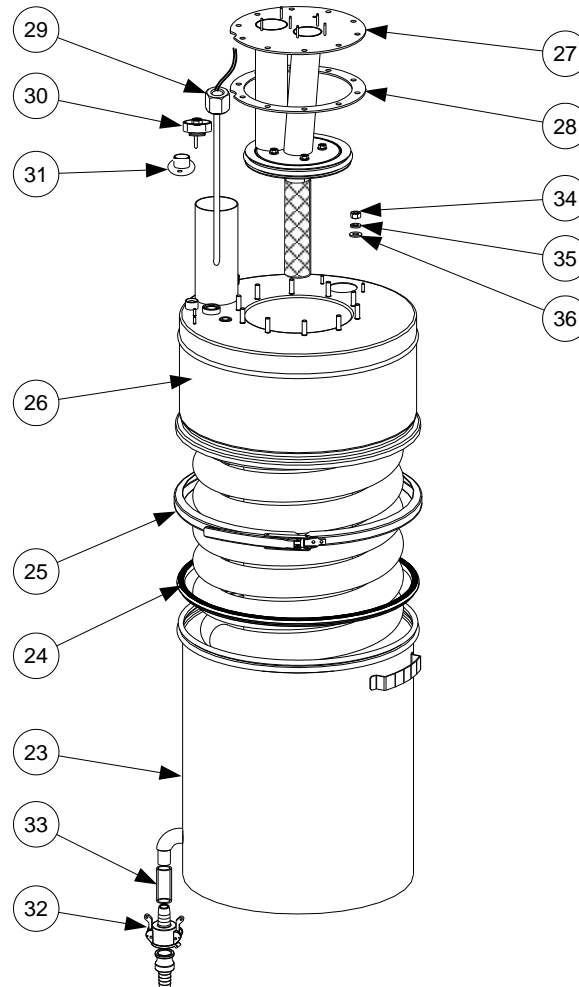


General exploded view - Fig. 53

Item	Description	Model	Part number
1	SKG Cabinet	All models	SW G1012
2	Evaporation chamber assembly		See detail
3	Front door assembly		See detail
4	Front Panel	Master (1 st) module	SP G1002-21
		Slave module	SP G1002-24
5a	Master control PCB (with LCD display)	All models	NW SKGAZMAINSS
5b	BACnet communication PCB	All models	NW SKGAZBACNET-SS
6	Slave control PCB	All models	NW SKGAZSLAVESS
7	Interconnection panel	All models	SW GELECT-ASSY
8	Transformer 230/24Vac – 100VA	All models	SP 3365
9	Combustion blower & gas valve assembly		See detail
10	Combustion blower gasket	All models	SP G2104
11	Igniter holder assembly		See detail
12	Igniter holder gasket	All models	SP G2103
13	Combustion controller	All models	SP G2001
14	Internal flue pipe	SKGE3-0501 to 1001	SP G4211
		SKGE3-1202 to 2002	SP G4222
		SKGE3-2503 to 4004	See detail
15	Flue pipe holder	SKGE3-0501 to 2002	SPG 1002-1
		SKGE3-2503 to 4004	SWG WATFIT1-ASSY
16	Flue pipe gasket	All models	SP G2107
17	Heat shield panel	All models	SP G1012-18
18	Top back cover	All models	SP G1012-9
19	Top front cover	All models	SP G1012-8
20	Back gas pipe panel	All models	SP G1012-7
21	Back door	All models	SP G1012-6
22	Leg	All models	SP G3401

Exploded Views & Parts List

Item 2 – Evaporation chamber assembly detail

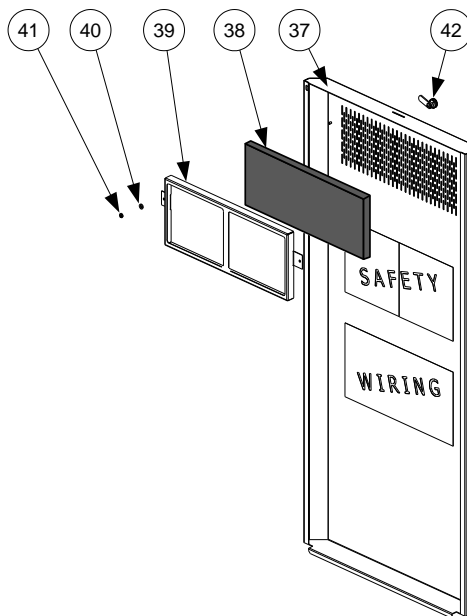


Evaporation chamber exploded view - Fig. 54

Item	Description	Model	Part number
23	Water tank	All models	SW G3208
24	Water tank gasket	All models	SW G2101
25	Band clamp	All models	SWGCLAMP-ASSY
26	Heat exchanger		See combustion component detail table
27	Burner assembly		See combustion component detail table
28	Burner assembly gasket	All models	SP G2111
29	Water temperature sensor	All models	SW GWATTEMP-ASSY
30	AFEC probe	All models	SW GAFECPROBE-ASSY
31	High temperature limit switch	All models	SP 3035
32	Quick release drain connector	All models	SWG3210-ASSY
33	3/4in silicone hose	All models	SP1023B
34	S/S 1/4-20 Nut	All models	SP G9212
35	Lock washer 1/4	All models	SP G9232
36	Flat washer 1/4	All models	SP G1008

Exploded Views & Parts List

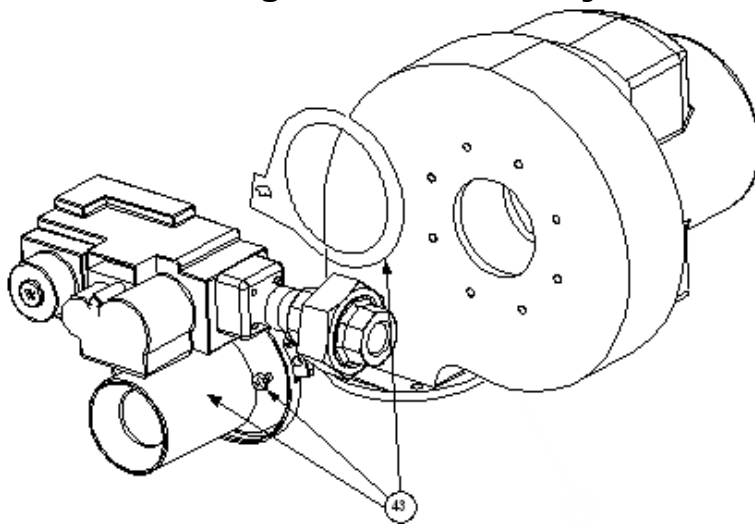
Item 3 - Door assembly detail



Door assembly detail - Fig. 55

Item	Description	Model	Part number
37	Front door	All models	SP G1012-5
38	Air filter	All models	SP G4202
39	Air filter holder	All models	SP G1012-27
40	Spring washer	All models	SP 2112
41	Nut M5	All models	NP NEP188
42	Key lock	All models	SP 6854

Item 9 – Combustion blower & gas valve assembly



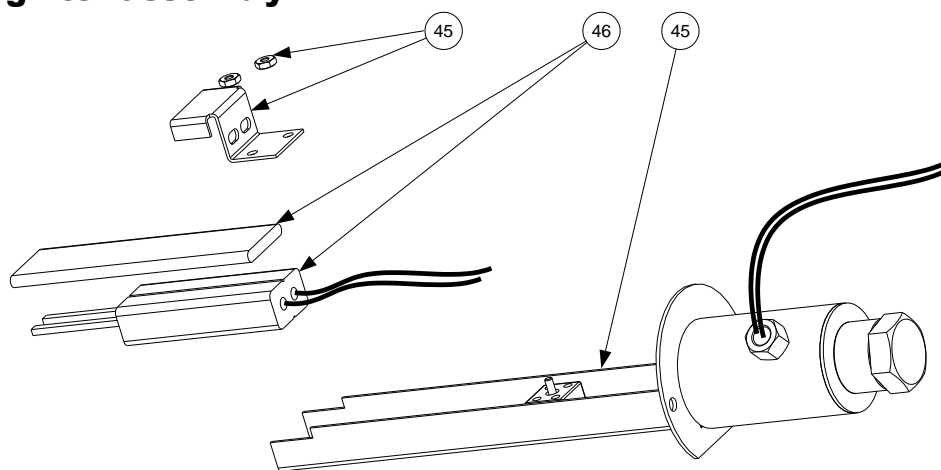
Combustion blower and gas valve assembly - Fig. 56

Combustion component detail table

Item	Description	Part number by Module type			
		Module SKG 100	Module SKG 150	Module SKG 180	Module SKG 200
26	Heat Exchanger	SW GTANKCOVER175	SW GTANKCOVER175	SW GTANKCOVER200	SW GTANKCOVER200
27	Burner assembly	SW GBURN100-ASSY	SW GBURN150-ASSY	SW GBURN150-ASSY	SW GBURN200-ASSY
43	Gas valve & Venturi assembly	SWG GASVENT53-ASSY	SWG GASVENT01-ASSY	SWG GASVENT01-ASSY	SWG GASVENT51-ASSY
55	Orifice for propane	All models: SP G2114			

Exploded Views & Parts List

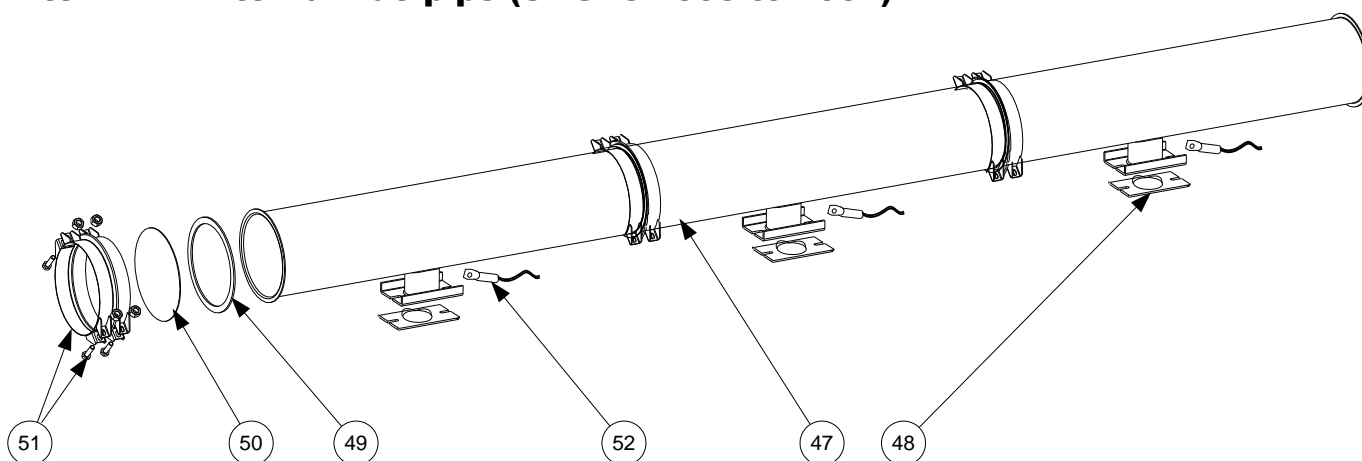
Item 11 – Igniter assembly



Igniter assembly - Fig. 57

Item	Description	Model	Part number
45	Igniter holder assembly	All models	SWGIGNHOLD-H
46	Igniter	All models	SWGIGNITER-120

Item 14 – Internal flue pipe (SKGE3-2503 to 4004)

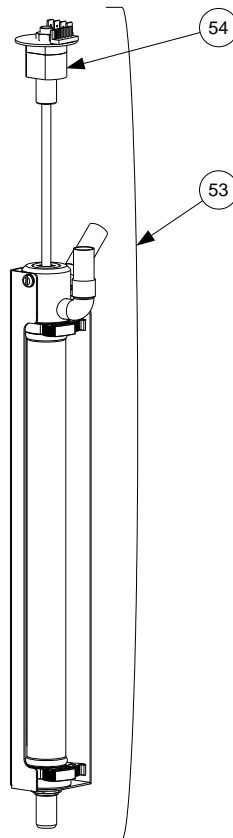


Flue pipe assembly - Fig. 58

Item	Description	Model	Part number
47	Flue section	SKGE3-2503 to 4004	SP G2201
48	Flue breech pipe gasket	All models	SP G2107
49	Flue joint fiber gasket	SKGE3-2503 to 4004	SP G2108
50	Flue section blind flange	SKGE3-2503 to 4004	SP G2206
51	Flue connection clamp assembly	SKGE3-2503 to 4004	SP G2203
52	Flue temperature sensor	All models	SW GCHIMPROBE-ASSY

Exploded Views & Parts List

Water level sensor assembly

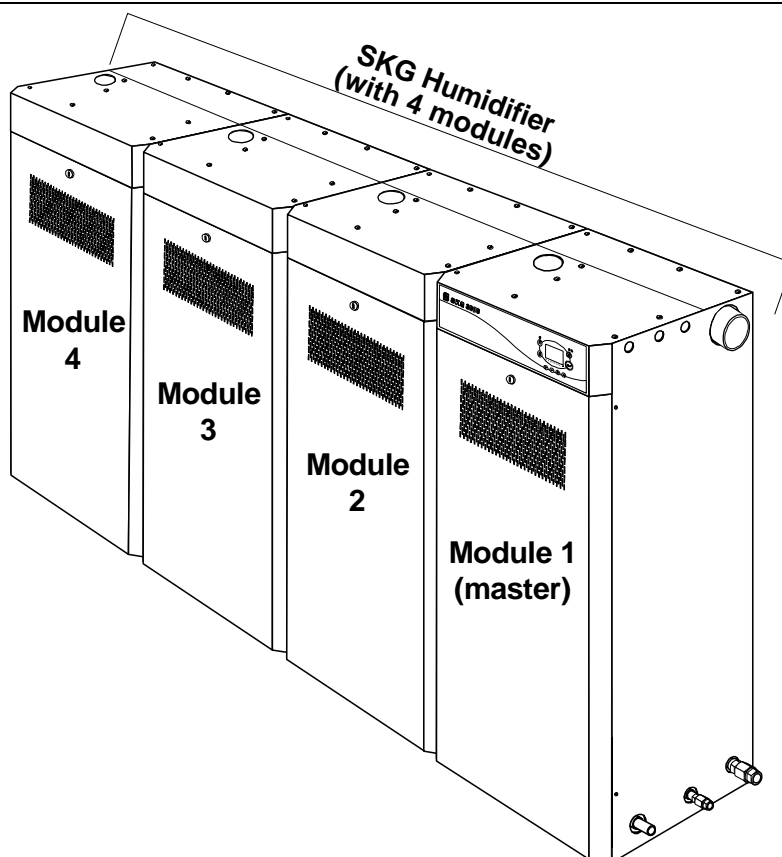


Water level sensor assembly - Fig. 59

Item	Description	Model	Part number
53	Water level sensor assembly	All models	SW GWATLEV-ASSY
54	Water level sensor	All models	SW GWATLEV-SUB



Multiple Modules Composition Table



(fig.60)

Humidifier Model	No of Modules	Module model number & quantity			
		<i>SKG100</i>	<i>SKG150</i>	<i>SKG180</i>	<i>SKG200</i>
SKGE3-0501 N/P	1	x1			
SKGE3-0701 N/P	1		x1		
SKGE3-0801 N/P	1			x1	
SKGE3-1001 N/P	1				x1
SKGE3-1202 N/P	2	x1	x1		
SKGE3-1502 N/P	2		x2		
SKGE3-1702 N/P	2		x1		x1
SKGE3-2002 N/P	2				x2
SKGE3-2503 N/P	3		x1	x1	x1
SKGE3-2703 N/P	3		x1		x2
SKGE3-3003 N/P	3				x3
SKGE3 3504 N/P	4		x1	x1	x2
SKGE3-3704 N/P	4		x1		x3
SKGE3-4004 N/P	4				x4



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