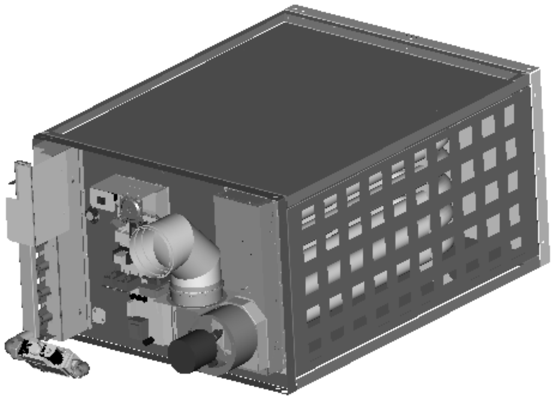
Application instructions

RHC 4000(M) RJL
RHC 4000(M) DJL

Jacket-less, Gas fired, Balanced flue, Power vented, Air heater

This document applies when installing into an air handler or as part of an air handling system



Applies to

Austria,Belarus, Bulgaria, China, Czech Republic, Croatia, Cyprus, Denmark, England, Estonia, Finland, Germany, Greece, Hungary, Iceland, Latvia, Lithuania, Montenegro, New Zealand, Norway, Poland, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey, Ukraine

These appliances meet the following EC Directives
Dir. 2009/142/EC:GAD
Dir. 2004/108/EC:EMC
Dir. 2006/95/EC:LVD
Dir. 2006/42/EC:MD (annex II, sub B)

Please read this document carefully prior to commencing building into an air handler

EC Declaration of incorporation
(Directive 2006/42/EC (*annex ll, Sub B)*

PROHIBITION TO PUT INTO SERVICE

Reznor Europe N.V.
J & M Sabbestraat 130
B 8930 Menen
Belgium

Herewith declares that:

Power vented gas fired heating battery :

- RHC 4000 series RJL and/or DJL series
- Models

4050 06	4100 12	4150M.18
4060 07	4110M.13	4175M.21
4075 09	4125M.15	4200M.24

Are destined to be incorporated in other machines (air-handlers) and are for this reason not (entirely) in compliance with the machinery directive (2006/42/EC).
Proper integration into the air-handling systems is required to comply with the prescribed machinery directive.

Is in conformity with the provisions of the following other EEC directives :

- 2009/142/EC (GAD)
- 2006/95/EC (LVD)
- 2004/108/EC (EMC)

The following harmonised standards have been applied:

- EN 60335-1, EN 50165 & EN 1020

E. Dewitte
Approvals and Certifications

Menen 20th March, 2006

INDEX:

1.0 DEFINITIONS

1.1 **Jacket-less**:
A gas-fired air heater supplied as a skeleton appliance e.g. without case or cover**.**

1.2 **Module:**
The jacket-less gas fired air heater.

1.3 **Constructor:**
The undertaking, which builds a module into another casing. e.g. an air handler.

1.4 **Appliance;**
The end product of the constructor

1.5 **Compartment**:
The section of an appliance into which the module is installed

1.6 **B22 Appliance**:
An appliance where the air for combustion is taken from within the area where the gas burner is operated.

1.7 **C12 Appliance**:
An appliance where the air for combustion is taken from outdoors via a duct terminating horizontally from the appliance.

1.8 **C32 Appliance**
An appliance where the air for combustion is taken from outdoors via a duct terminating from the appliance vertically.

1.9 **Dew point**:
The condition, when the temperature is such that the water vapour in the combustion products condenses out.

Attention
Only recognized air handler manufacturers are authorized to build-in the heater module. Please contact your distributor.

2.0 BASIC INFORMATION

2.1 The instructions contained in this document apply to the models RHC 4000(M) RJL/DJL gas fired fan assisted warm air heaters.

2.2 Models RHC 4000(M) RJL are intended for use in appliances as outdoor (roof top) systems.

Models RHC 4000(M) DJL are intended for use in appliances as indoors and must be used with one of the following flue systems :

B22: vertically (through the roof) or horizontally (through the wall) flue system.

C12: Horizontal (through the wall) vented balanced flue system.

C32: Vertical (through the roof) vented balanced flue system.

2.3 The gas category for use : see table 8)

2.4 All models may only be used when installed within a closed compartment, e.g. an air handler.

2.5 Dimensions: we refer to the figures 1,2 & 3.

All dimensions are in mm (25.4mm= 1 inch)

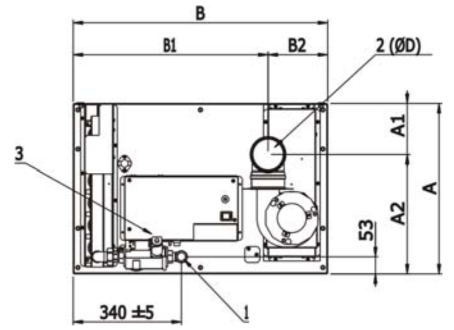
2.6 Installations with C12 & C32 combustion systems need to be installed with an appropriate concentric vent terminal as supplied by your distributor.

☛DANGER :
ANY OTHER APPLICATION IS FORBIDDEN AND DANGEROUS. FAILURE TO COMPLY CAN RESULT IN SEVERE PERSONAL INJURY OR DEATH AND OR PROPERTY DAMAGE.
Note: Manufacturer warranties do not apply in such circumstances.

2.7 Dimensions

RHC 4000 RJL/DJL

Figure 1 : Side view



1.Gas connection ¾"
2.Flue outlet
3.Electrical connection

Figure 2 : Top view

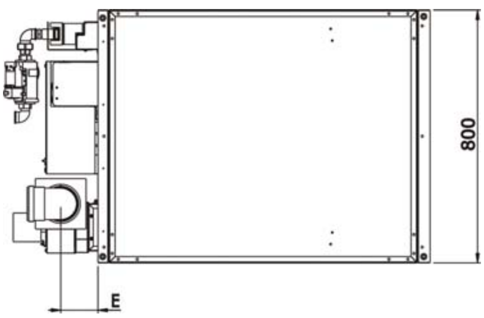
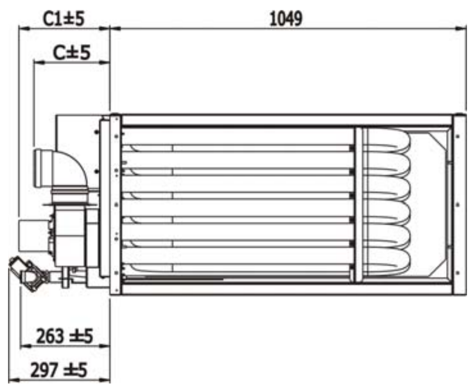
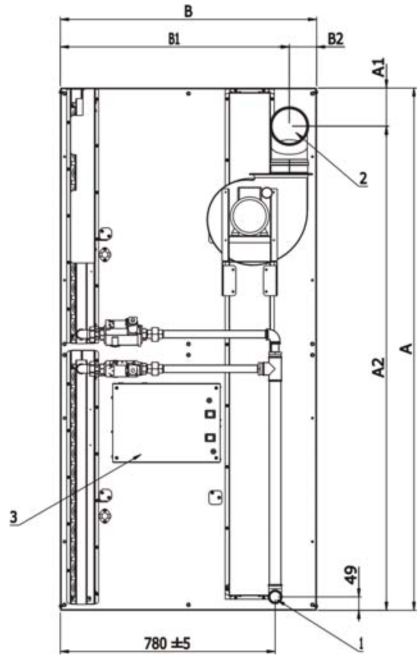
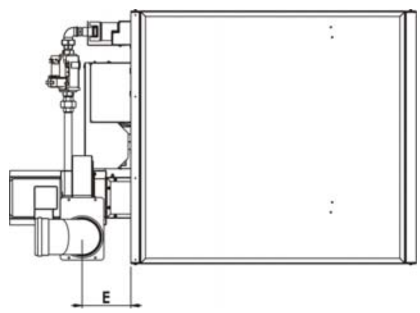


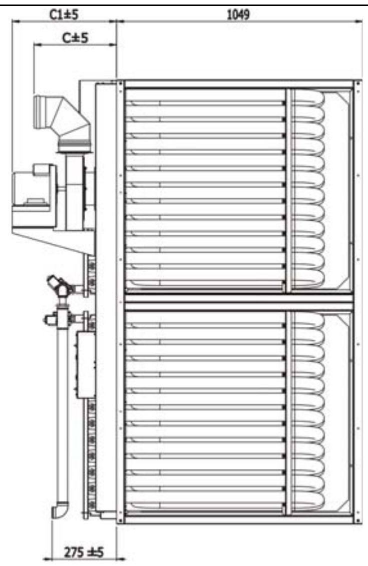
Figure 3 : Front view



RHC 4000(M) RJL/DJL







	DJL/RJL				DJL					RJL				
TYPE	**A**	**B**	**B1**	**B2**	**A1**	**A2**	**C**	**C1**	**E**	**A1**	**A2**	**C**	**C1**	**E**
4050 06	531	800	613	187	85	466	224	268	118	85	446	291	268	118
4060 07	601	800	613	187	160	441	224	268	118	85	516	291	268	118
4075 09	741	800	613	187	160	581	224	268	118	85	656	291	268	118
4100 12	950	800	613	187	160	790	224	268	118	85	865	291	268	118
4110M.13	1132	930	778	152	190	942	361	348	188	190	942	364	351	191
4125M.15	1272	930	778	152	190	1082	361	348	188	190	1082	364	351	191
4150M.18	1481	930	778	152	190	1291	361	348	188	190	1291	364	351	191
4175M.21	1691	930	778	152	190	1501	361	348	188	190	1501	364	351	191
4200M.24	1900	930	831	99	139	1761	352	445	179	139	1761	354	447	181

2.8 Weights

Weights (kg)	4050 06	4060 07	4075 09	4100 12	4110M.13	4125M.15	4150M.18	4175M.21	4200M.24
unit	90	100	120	149	200	220	250	279	313
packaging	29	29	29	29	58	58	58	58	58
total	119	129	149	178	258	278	308	337	371

3.0 PRACTICAL APPLICATION

Heat exchanger compartment size.The duct section or air handler compartment must be sized in accordance with the dimensions given in table 1 with reference to figure 4.

Mounting flanges on the modules RHC 4000(M)RJL & DJL allow easy installation.

The heating module may only be fitted as shown in figure 5.

Alternative orientation is **not** allowed.

Figure 4. : Compartment dimensions

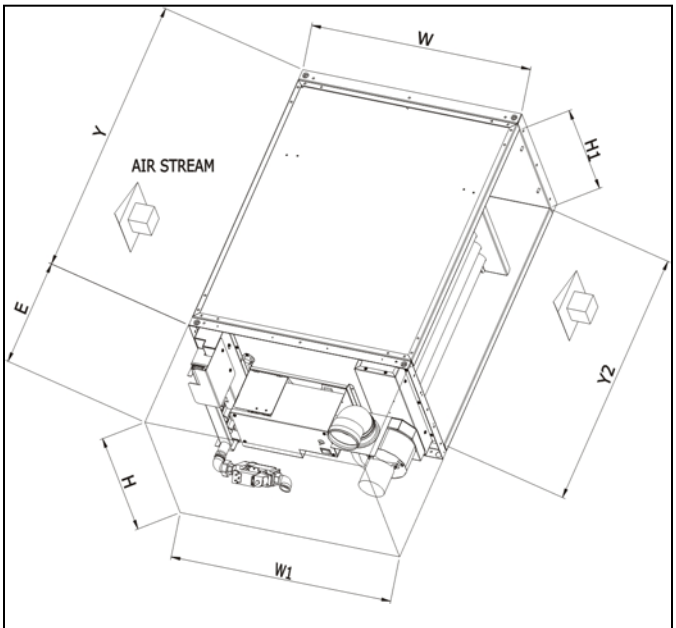
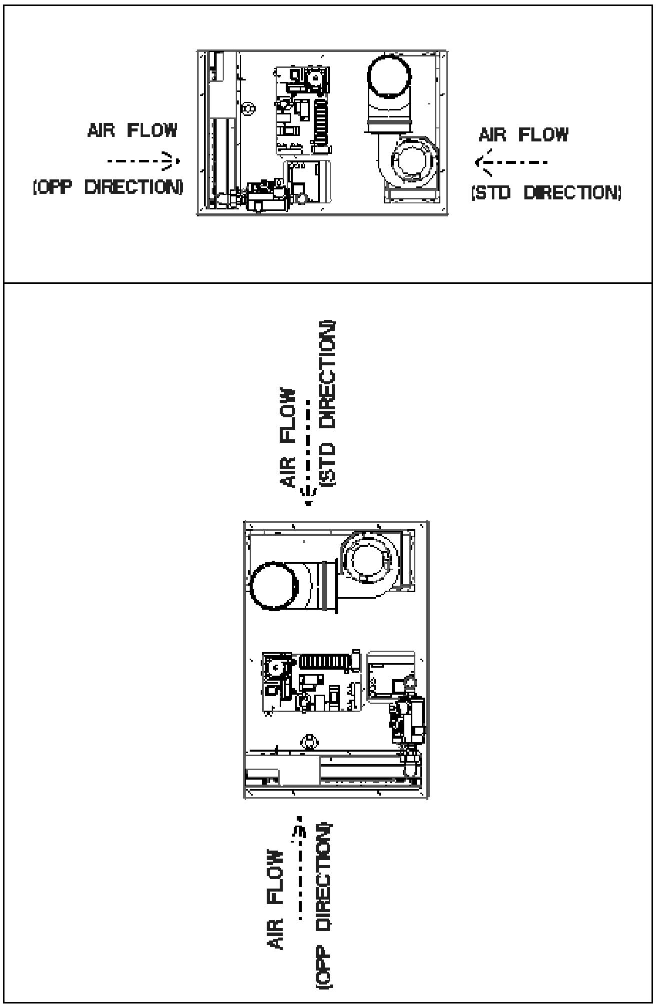


Table 1 : Dimensions

Model	Duct channel & controls compartment						
	H	H1	Y	Y2	W	W1	E
4050 06	531	461	1049	975	800	800	400
4060 07	601	531	1049	975	800	800	400
4075 09	741	671	1049	975	800	800	400
4100 12	950	880	1049	975	800	800	400
4110M.13	1132	1062	1049	975	930	930	420
4125M.15	1272	1202	1049	975	930	930	420
4150M.18	1481	1411	1049	975	930	930	420
4175M.21	1691	1621	1049	975	930	930	420
4200M.24	1900	1830	1049	975	930	930	470

E = min. dimension

Figure 5 : Installation possibilities for RHC 4000 air heater modules



4.0 LIMITATIONS FOR USE

4.1 Heat exchanger compartment

4.1.1 <u>**Minimum airflow requirement through heat exchanger enclosure :**</u>

RHC 4000(M) RJL & DJL air heaters may be used for either push or pull through air heaters. **The minimum airflow duty through the heat exchanger enclosure (see fig. 4 – table 1) must be observed as indicated in table 2.**

Table 2 : Airflow duty

MODEL	V1	Heat output 100% 1 stage (H1) (1)	V2	Heat output 100% 1 stage (H2) (1)	Heat output 50% 2 stage	Minimum modulating output
	m³/h	kW	m³/h	kW	kW	kW
4050 06	3900	50.00	5950	50.80	24.00	24.00
4060 07	4700	60.00	7150	61.20	28.90	28.90
4075 09	5700	73.75	8800	75.00	36.00	36.00
4100 12	7500	97.00	11700	100.00	47.00	47.00
4110M.13	-	-	13600	112.30	51.20	53.80
4125M.15	-	-	15600	126.30	51.00	61.20
4150M.18	-	-	12300	151.30	75.80	72.50
4175M.21	-	-	14100	175.00	99.40	84.70
4200M.24	-	-	16300	198.70	99.40	96.40

(1) =see also table 8
H1 = heat output at airflow V1
H2 = heat output at airflow V2
V1 = min. airflow required through enclosure
V2 = minimum airflow for high heat output H2

4.1.2 **<u>Maximum airflow through heat exchanger enclosure :</u>**

Special attention must be given to ensure that the temperature rise of the air, passing through the enclosure around the heat exchanger tubes, is high enough to avoid condensation forming within the tubes. This condensation forming could occur by super cooling of the products of combustion. Such condensation can be the source of severe corrosion and damage to tubes or part of the tubes.

Figure 6 indicates the probability of condensation forming within the tubes reference :

- the temperature rise of the air through the enclosure around the tubes (see table 1- fig. 4).
- the inlet air temperature passing over the heat exchanger

In function of the expected minimum inlet air temperature, the minimum required temperature rise (to avoid condensation) must be derived from the chart shown in figure 6.

<u>Example</u> :

- expected minimum inlet temperature = -5°C
- minimum required temperature rise shown on the chart = +13°K

Table 2 indicates the heat output (kW) of the different models.

The maximum allowable airflow [through the enclosure (duct channel) around the tubes] can be calculated as follows :

$$V_{max}\,(m^3/h) = \frac{\text{heat output}\,(kW) \times 1000}{\Delta T_{minimum} \times 0.3423}$$

<u>Example</u> :

ΔT_{min} = 13K (with min. inlet temp. = -5°C)

model 4075 09 at 100% heat output : 75,00kW results into $V_{max} \approx$ 16854m³/h

<u>Remark</u> :

For air heaters with the option 2 stage gas valve (50% minimum heat input) or the option modulating gas valve (30% minimum heat input) attention must be given to determine the maximum allowable airflow in function of the appropriate heat input.

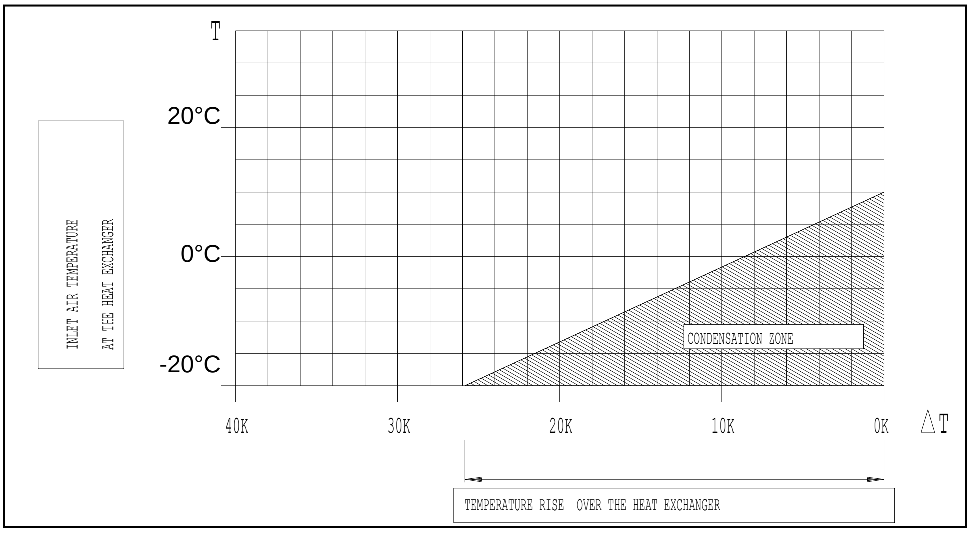
<u>Example</u> :

ΔT_{min} = 13K (with min. inlet temp. = -5°C)

model 4075 09 at 50% modulation (see table 2 'output') : 36kW

results into $$V_{max} = \frac{36(kW) \times 1000}{13 \times 0.3423} = \mathbf{8090\,m^3/h}$$

Figure 6 :
Dew-point occurrence chart (condensation zone)



WARNING :

- **Use of RHC 4000 (M) heating modules for purposes other than those described above <u>could</u> result in severe personal injury or death and cause property damage.**
  The manufacturer warranties are void if departure from the intended use is undertaken.
- **This heating module may not be used where the air handler/heating system in which it is installed will be used where, flammable substances/vapours exist or where the atmosphere contains chlorinated or haloginated hydrocarbons, silicones, aluminium oxides, etc.**
  The manufacturer warranties are void if these restrictions are not observed

4.1.3 **By-pass**

For applications where the air duty exceeds that required to maintain the criteria stated above, a parallel by-pass around the heat exchanger enclosure is required to conduct the excess air.

Such a by-pass should be designed and constructed so that the air flow (m³/h) across the heat exchanger enclosure it-self maintained between the minimum and maximum figures as mentioned in section 4.1.1 & 4.1.2..

The by-pass is shown in figure 13.

We refer also to section 11.0.

4.1.4. **Important remark :**

The air velocity needs to be equal over the total area of the heat exchanger enclosure so that even distribution is achieved over the entire heat exchanger tube assembly.

<u>Attention</u> :

Special attention is necessary in a push through system. Baffles and or an air-stream diverter(s) may be necessary to ensure an even distribution of the air flow.

Part or the whole of the tubes may become damaged or can be the source of poor combustion if the air velocity as recommended above is not applied.

5.0 BURNER & CONTROLS SECTION

WARNING : The control compartment must be 100% sealed and isolated from the other compartments or duct work of the air handler – only combustion air may have access into this compartment

5.1 The following conditions must be observed when applying the heating module with its burner controls.

5.1.1 An enclosure containing RHC 4000 (M) heating modules shall be so constructed that it is fully protected against the rigours of the environment in which it is intended to operate.

5.1.2 When applied as an RJL (roof top/outdoor unit) the enclosure into which it is fitted,must comply with protection grade IP 45.

5.1.3 Access to compartments enclosing the burner and its controls must be provided with panels, doors, etc. that are intended to be opened only by the use of a tool (key). Such panels must be designed to ensure that after repeated removal and replacement their integrity is not jeopardised, i.e. seals and insulation etc. remain serviceable.

5.1.4 Openings in 'RJL' units from the outside of the air handler, e.g. gas and electrical services, shall not be larger than to permit a ball of 16 mm diameter to pass with a pressure of 5N.

5.1.5 Dimensions (mm) of control cabinet with reference to figure 4, the dimensions of the control cabinet must be in accordance with table 1.

Caution :*Alterations to the burner and/or its controls, any other electrical apparatus supplied as part of the heating module or changing of the settings as supplied is strictly forbidden. To do so is in contravention of the E.C. gas appliance directive.*

5.1.6 Thermal insulation used in the construction of a heating module enclosure shall maintain its insulating properties under the influence of heat mechanical stress and ageing, it shall be non- combustible and resistant against vermin. Ensure that any insulation is securely fixed and will not obstruct combustion air pathways.

Asbestos or materials containing asbestos may not be used. All materials used in association with RHC 4000 modules must be in accordance with the combustibility requirements of ISO 1182.

5.1.7 Where appliances containing RHC 4000(M) DJL modules are intended to be suspended at a height of 1,8 m above floor level, doors, panels etc. intended to be removed for servicing shall be provided with hinges, or restraining devices to prevent falling from above during servicing. Access panels must be readily capable of correct and easy removal and assembly, this feature is particularly appropriate to square dimensioned elements.

<u>NOTE:</u>

Provision must be made to view the burner to ensure its operation under normal operating conditions. Viewing ports may be necessary. Ensure no flammable substances are in the immediate environment of the heating module.

6.0 GAS CONNECTION
Rc ¾ or Rc 1 ¼ for M units

6.1.1 National requirements and regulations for the installation of gas must be respected for all countries into which the appliance is delivered. Gas connections may only be carried out by appropriately qualified persons.

6.1.2 Clearances around connections shall be adequate so as to afford access to allow the use of tools to connect and disconnect the gas service connections.

6.1.3 Threads used for gas pipes and fittings shall comply with ISO 7.1.

6.1.4 Copper pipes and fittings may not be used. Solder which has a melting point of less than 450º C neither solder or alloys containing cadmium shall not be used.

6.1.5 All gas services to the heating module shall be equipped with an isolation tap which shall be of the 90º turn type and shall be provided with a positive stop and it should be fitted adjacent to the heating module. Such taps when installed in a vertical position shall be such that in the event of a falling handle the valve will be in the closed condition, the open and closed positing shall be readily distinguishable. The valve shall be easy to operate when required.

Attention :
All passages for gas pipes, etc … to the control department must be completely sealed !

7.0 ELECTRICAL EQUIPMENT

WARNING : **Ensure that when installing electrical wiring or cables no contact is made with the burner, heat exchanger or flue arrangement.**

Cables or wires must be securely fixed so that they cannot move. To protect supply cables as good as possible we recommend to install them at the left side of the control compartment.

7.1.1 The RHC 4000(M) heating module has been fully tested prior to leaving the manufacturer. The constructor shall not make changes to the wiring supplied with the module. Electrical connections may only be made using the terminals provided and strictly in accordance with wiring diagram provided with the module.

7.1.2 RHC 4000(M) electrical controls **are** phase sensitive 230V 1N 50 Hz. The appliance must be **earthed** after the installation has been completed and earth continuity test must be carried out.

7.1.3 The electrical equipment of the module complies with the requirements of: EN 60335-1, EN60730-1 and EN61058-1 or to relevant amendments. The constructor must also comply with these requirements when fitting the module.

7.1.4 The protection of jacketless appliances conforms to protection code IP 20. The constructor must ensure that protection accordingly to at least IP 45 is fulfilled and mark his data/rating plate accordingly.

Note: **IP 45 provides:**

a) Personal protection against contact with electrical components within the construction;

b) Degree of protection within the construction against ingress of water.

7.1.5 The constructor shall test and inspect fully the total appliance prior to supply including the following:

a) Earth continuity (re: CENELEC 289)

b) Di-electric strain (re: CENELEC 289)

c) Function of all electrical components and securities and operational inspection

d) Heat input and test for good and clean combustion

e) Auxiliary equipment to be supplied as part of the appliance

f) Soundness of the total gas circuit

Attention :
All passages for gas pipes, etc to the control compartment must be completely sealed !

8.0 COMBUSTION CIRCUIT
RHC 4000(M) RJL 'OUTDOOR'

8.1.1 Inlets for combustion air and flue outlets shall be so designed so that when an appliance is finally installed their termination shall be at least 500mm above deck/ground level.

8.1.2 The heating modules are delivered with all parts necessary for the construction of the jacket so that combustion can take place safely and in line with the Gas Appliance Directive.

Included with the heating module RHC 4000 :Dia 100 terminal outlet (length 300mm) (PN°60 50712 300)

- 90° elbow with sealing ring (dia 100) (PN 60 50733 100)
- Flue outlet combustion sealing ring (dia 100) (PN 06 22786 104)
- Combustion air inlet protection grill (PN 90 79050)
- Gas tube sealing ring (PN 06 22783 125)

Included with the heating module RHC 4000M:

- Dia 130 terminal outlet (length 282mm) (PN°60 50712 130282)
- 90° elbow with sealing ring (dia 130) (PN 60 50786 134)
- Flue outlet combustion sealing ring (dia 130) (PN 06 22786 104)
- Combustion air inlet protection grill (PN 90 79050)
- Gas tube sealing ring (PN 06 22783 054).

The 90° elbow, sealing ring, terminal and the combustion air inlet protection grill must be installed according to figure 7.

All sealings must be correctly placed in the tubes to avoid flowing back of combustion products to the burner.

As indicated, the combustion air inlet protection grill (PN 90 79050) must be integrated in the side panel of the controls compartment. The dimensions of the required opening in this side panel and its position relative to the mounting flange of the RHC 4000(M) RJL heat exchanger enclosure are indicated in figure 8 & 9.

The air inlet protection grill must be installed in a level plane and horizontally centred.

The minimum and maximum distances between the axis of the flue outlet pipe and the top of the combustion inlet grill are indicated in figure 9.

Ensure the combustion inlet grill at the control door panel is completely sealed to prevent ingress of water.

It is forbidden to use the combustion inlet grill as passage for cables or gas supplies. Ensure the inlet grill openings are not obstructed.

Make sure the installation of the combustion inlet grill is securely fixed.

The outlet combustion sealing ring (dia 100 or 130) (PNs 06 22786 104 or 06 22786 134) must be installed in the fixed outlet panel of the air handler in a hole with dia 112mm for dia 100mm outlet or with hole diat dia 142mm for dia 130mm outlet. This hole must be located in the axis of the 90° flue outlet elbow with a sealing ring of the RHC 4000(M) RJL (see drawing figure 9). The sealing ring provided, fits for 1mm thick panels.

Figure 7. :General arrangement combustion air inlet and flue products outlet for RHC 4000(M) RJL units

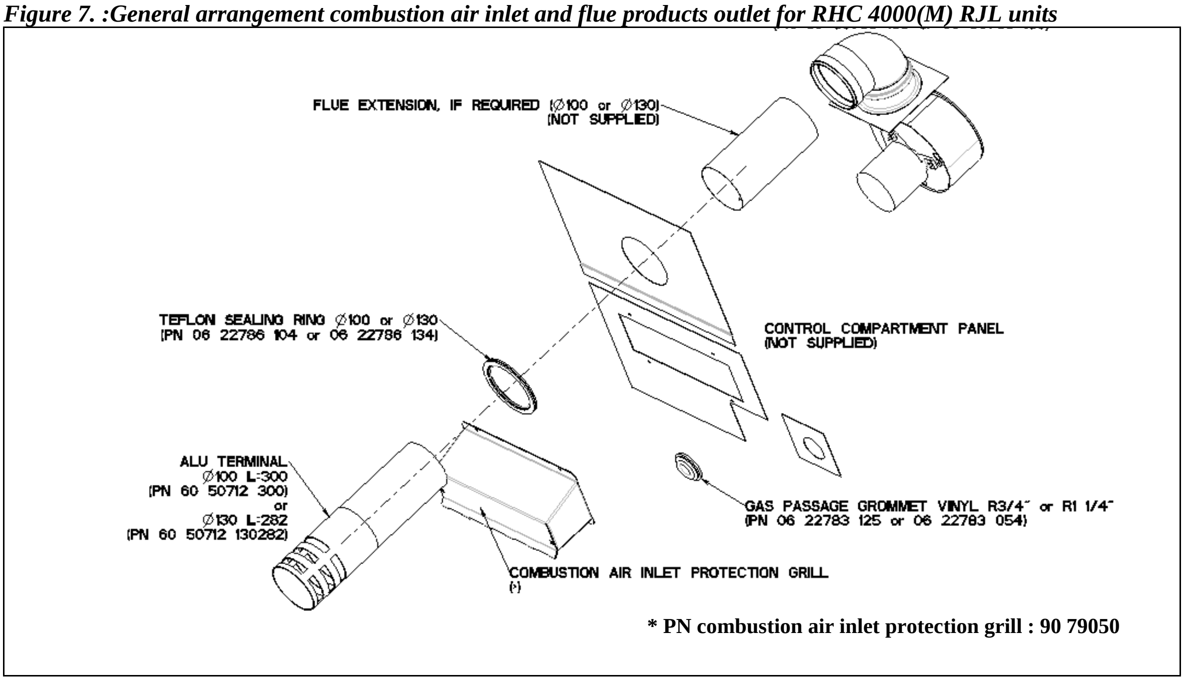


Figure 8

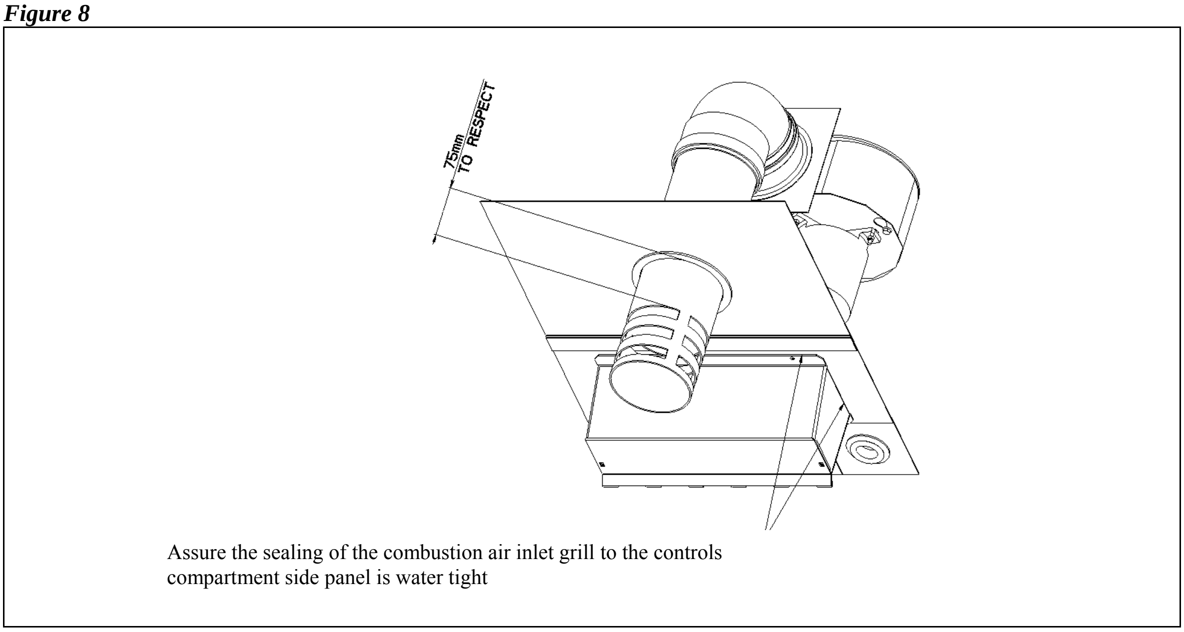
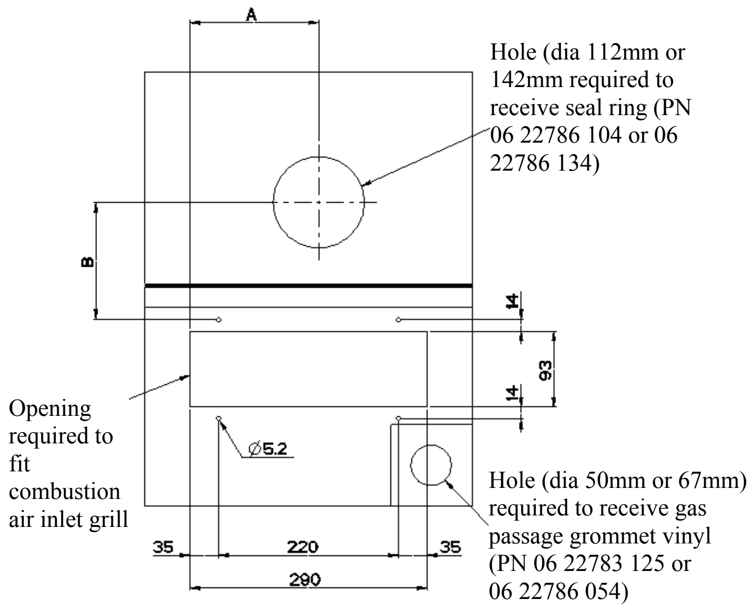


Figure 9: Controls compartment (side) panel for RHC 4000(M) RJL units



Type	A (mm)		B (mm)	
RHC 4000	158 (1)	558 (2)	225 (1)	405 (2)
RHC 4110M.13	610		485	
RHC 4125M.15	610		191	
RHC 4150M.18	610		404	
RHC 4175M.21	610		453	
RHC 4200M.24	663		574	

(1) = minimum (2) = maximum

8.1.3 The terminal outlet (PN 60 50712 300 or 60 50712 130282) of thick wall aluminium pipe supplied must be fitted in a horizontal plane and be placed so as to fit exactly between the elbow on the combustion fan and the outlet terminal hole with sealing ring.

If required this terminal outlet must be cut to length in order to respect the dimension 75.0mm (fig. 8).

However, when the depth of the control compartment exceeds the value E indicated in table 1, a seamless duct ∅100 or ∅130 (for the M range) of thick wall aluminium and a sealing ring are to be used to extend the length of the terminal outlet. The absolute maximum allowable extension to the protection cap (standard length 300mm) is 700mm.

8.1.4. Attention must be given to properly seal the controls compartment from the enclosure for the main air stream (duct channel).

This sealing should be appropriate to avoid any leakage of air from controls compartment into the duct channel and vice versa.

***Note* : Flue arrangements other than those described and supplied with the heating module are not permitted.**

8.1.5 A gas service inlet (PVC) sealing ring is also provided for the appliance for size RC ¾.

The hole size required for the seal ring in the casing is 50 mm diameter. The provided sealing ring fits for 1mm thick panels.

All cables and wires passing through the casing of the burner/controls section should be via strain relief bushings.

It is recommended that sealing is accomplished by the use of the sealed ring type.

Connections between the burner module controls compartment must be effectively sealed from the appliance air-stream so the pressure within the compartment remains neutral.

9.0 COMBUSTION SYSTEM
RHC 4000(M) DJL 'INDOOR'

9.1.1 The DJL Modules are provided with flue outlets sized dia 130mm.:

9.1.2 If the DJL model is to be installed as a room sealed type C12 or C32 appliance, the burner and controls cabinet must be sealed so as to ensure air leakage does not exceed that stated in table 4.

9.1.3 The heating modules are delivered with all parts necessary to properly seal the combustion circuit.

Included with the heating module are:
- 90° elbow with sealing ring (only RJL units) PN 60 50733 130 (dia 130)
- gas tube sealing ring (PN 06 22783 125 or 06 22786 054 (M units)
- 2 'teflon' sealing rings PN 06 22786 134 (dia 130)
- set of restriction rings **(only for 4000M units!)** as per table 3a.

Table 3a

Model	Dia (mm)	Qty
4110M.13	90, 93, 96, 99, 107	5
4125M.15	86, 90, 93, 95, 107	5
4150M.18	90, 93, 95, 99	4
4175M.21	90, 95, 99, 107	4
4200M.24	92, 97, 102, 114	4

9.1.4 **Use of flue restriction rings (only for 4000M models).** To assure the efficieny of the M units eventually a flue restriction ring needs to be fitted in the outlet collar of the venter housing (see fig. 11a). The diameter of the restriction ring will be determined by the flue length as indicated in table 3b.

As shown in figure 11a the sealing rings must be fitted in the outer casing to properly seal around the combustion air inlet pipe and the flue outlet pipe. The centre distance between the pipes must be respected as per table 5 and the flue outlet must always be above the combustion air inlet.

Figure 11b indicates the hole size required (as shown in table 5) in the outer casing and the position of these holes relative to the mounting flange of the RHC 4000(M) DJL heating module.

9.1.5 The combustion air inlet duct must not pass through the cabinet panel by more than 50 mm.

9.1.6 When the DJL model is to be used as a type B22 appliance i.e. combustion air being taken from the space to be heated, a protection grille complying with IP 20 must be installed at the inlet point of the cabinet (see figure 10).

9.1.7 Attention must be given to properly seal the mounting flange of the heating module (see figure 9).

9.1.8 A gas service inlet (PVC) sealing ring is also provided for the appliance for size Rc ¾ or Rc 1 ¼ for the M models. The hole size required for this seal ring in the casing is 50 mm diameter.

All cables and wires passing through the casing of the burner/controls section should be via strain relief bushings. It is recommended that sealing is accomplished by the use of the sealed ring type. Connections between the burner module controls compartment must be effectively

sealed from the appliance air-stream so the pressure within the compartment remains neutral.

9.1.9 A viewing port for the purpose of ascertaining the operation of the burner should be included. The viewing port may be located behind a door or panel provided that when the door or panel is opened the combustion circuit remains in its **"sealed"** condition so that burner operation is not upset.

Table 3b : Diameter flue restrictors for DJL

	Combustion out and inlet application	**4110M.13**	**4125M,15**	**4150M.18**	**4175M.21**	**4200M.24**
C Appliance	2X1m pipe length till 2X3m pipe length	99mm	95mm	93mm	95mm	102mm
	2X4m pipe length till 2X6m pipe length	107mm	107mm	99mm	107mm	114mm
	2X7m pipe length till 2X9m pipe length	open	open	open	open	open
B appliance	1X1m pipe length till 1X3m pipe length	90mm	86mm	90mm	90mm	92mm
	1X4m pipe length till 1X6m pipe length	93mm	90mm	93mm	95mm	97mm
	1X7m pipe length till 1X9m pipe length	96mm	93mm	95mm	99mm	102mm

Table 4 : Maximum cabinet air leakage rates

Model	**Heat input gross kW**	**Allowed leakage m^3/h @ 50Pa**
4050 06	62.00	25.00
4060 07	74.00	25.00
4075 09	92.50	25.00
4100 12	120.00	25.00
4110M.13	136,60	25.00
4125M.15	153,47	25.00
4150M.18	182,91	25.00
4175M.21	211,76	25.00
4200M.24	240,62	25.00

Table 5 : Centre distances combustion air inlet flue outlet

Model	**Connection Ø (mm)**	**Centre distance B (mm)**	**Cabinet hole size required for sealing ring (mm)**
4050 06	130	225	142
4060 07	130	225	142
4075 09	130	225	142
4100 12	130	225	142
4110M.13	130	225	142
4125M.15	130	225	142
4150M.18	130	225	142
4175M.21	130	225	142
4200M.24	130	225	142

Figure 10: Arrangement for class B22 appliance

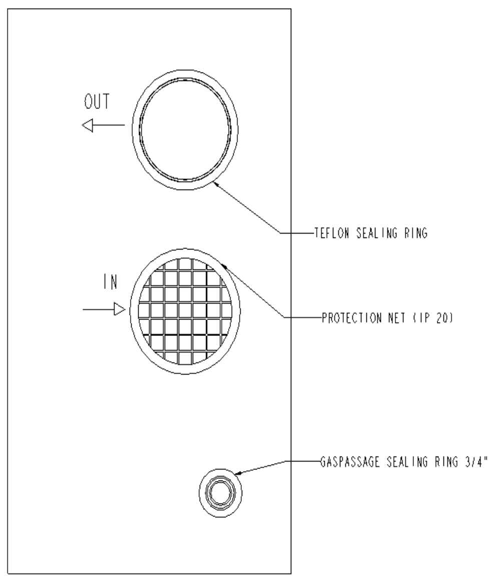
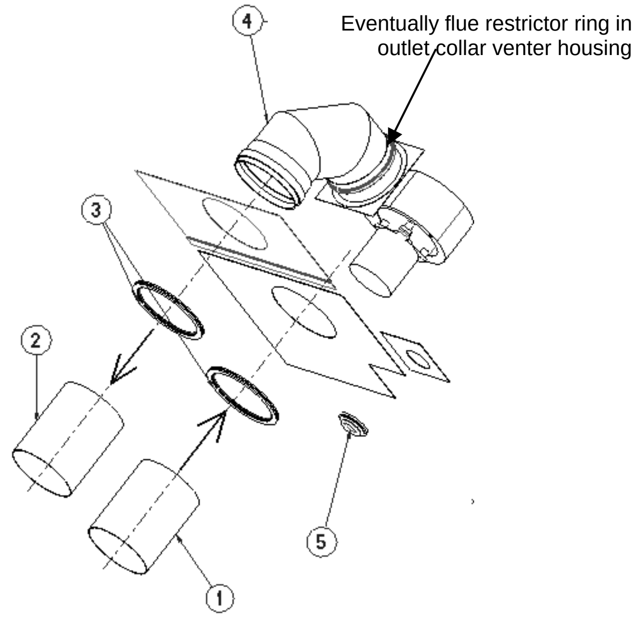
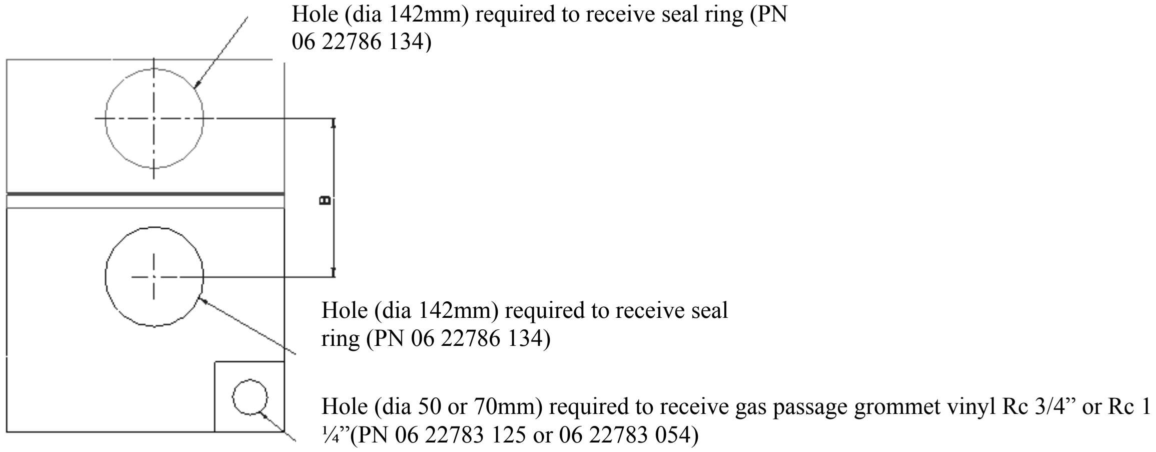


Figure 11a : Combustion air inlet – outlet dimension requirements



1	Combustion air inlet pipe (*)
2	Flue outlet pipe (*)
3	Teflon sealing ring
4	90° bend (only RJL units)
5	Gas passage grommet vinly Rc ¾" or Rc 1 ¼"(PN 06 22783 125 or 06 22783 054)
(*)	Not delivered with the unit

Figure 11b : Combustion air inlet – outlet dimension requirements



Attention :

Poor combustion leading to a hazardous situation can result from either positive or negative pressures within the combustion circuit.

10.0 PRESSURE LOSS THROUGH HEATING MODULE

10.1 The chart below indicates the pressure drop over the heating module versus the air flow volume through the heat exchanger enclosure (see fig. 4 and table 1).

10.2 The temperature rise (∆T) shown is for 100% heat output.

Figure 12a :

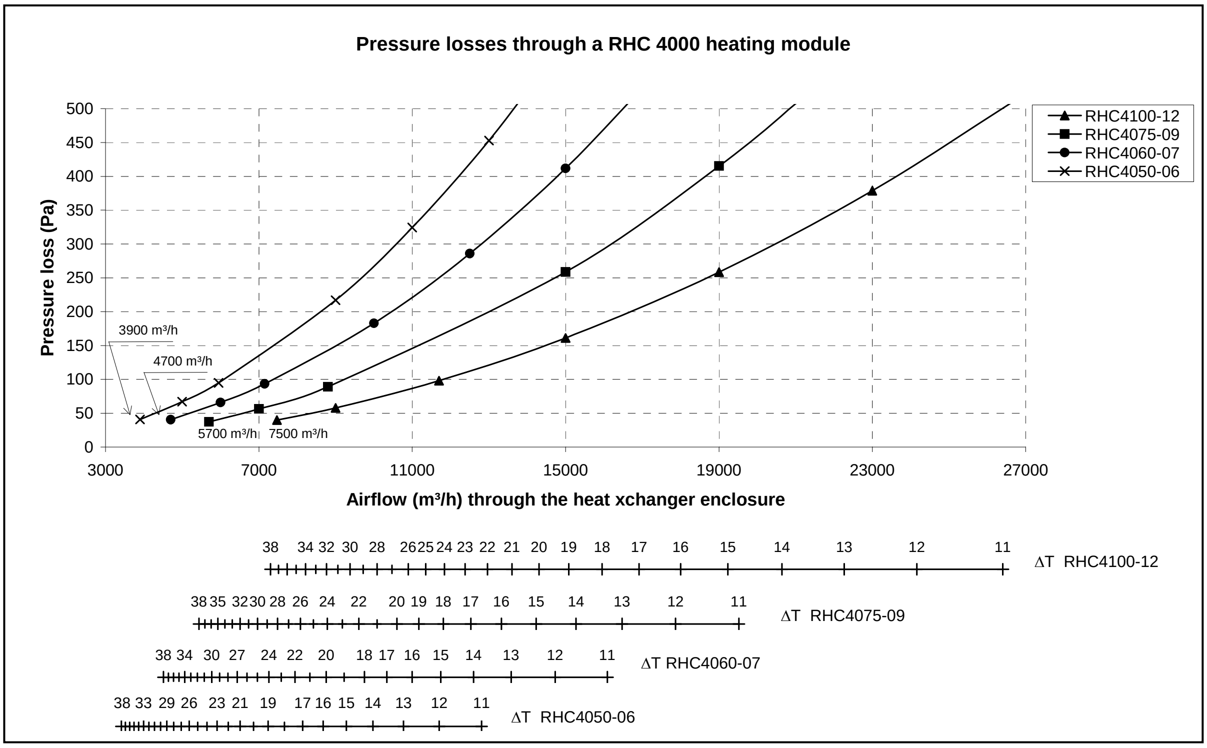


Figure 12b :

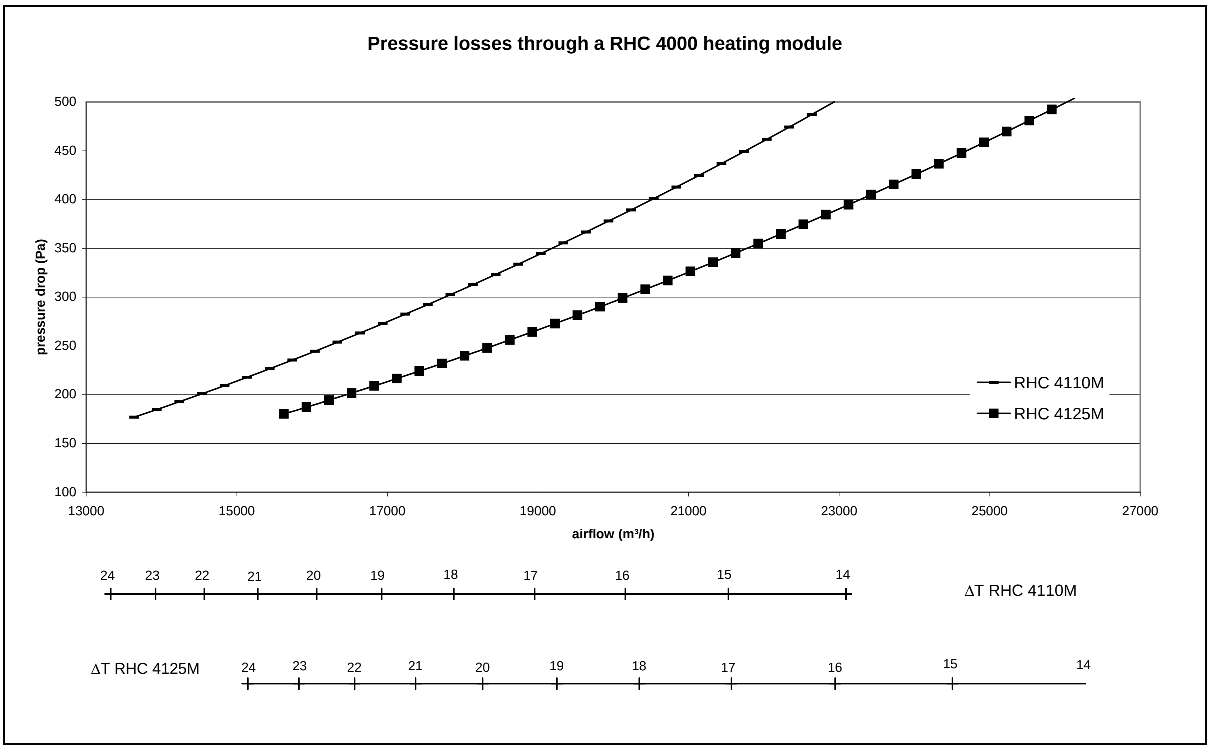
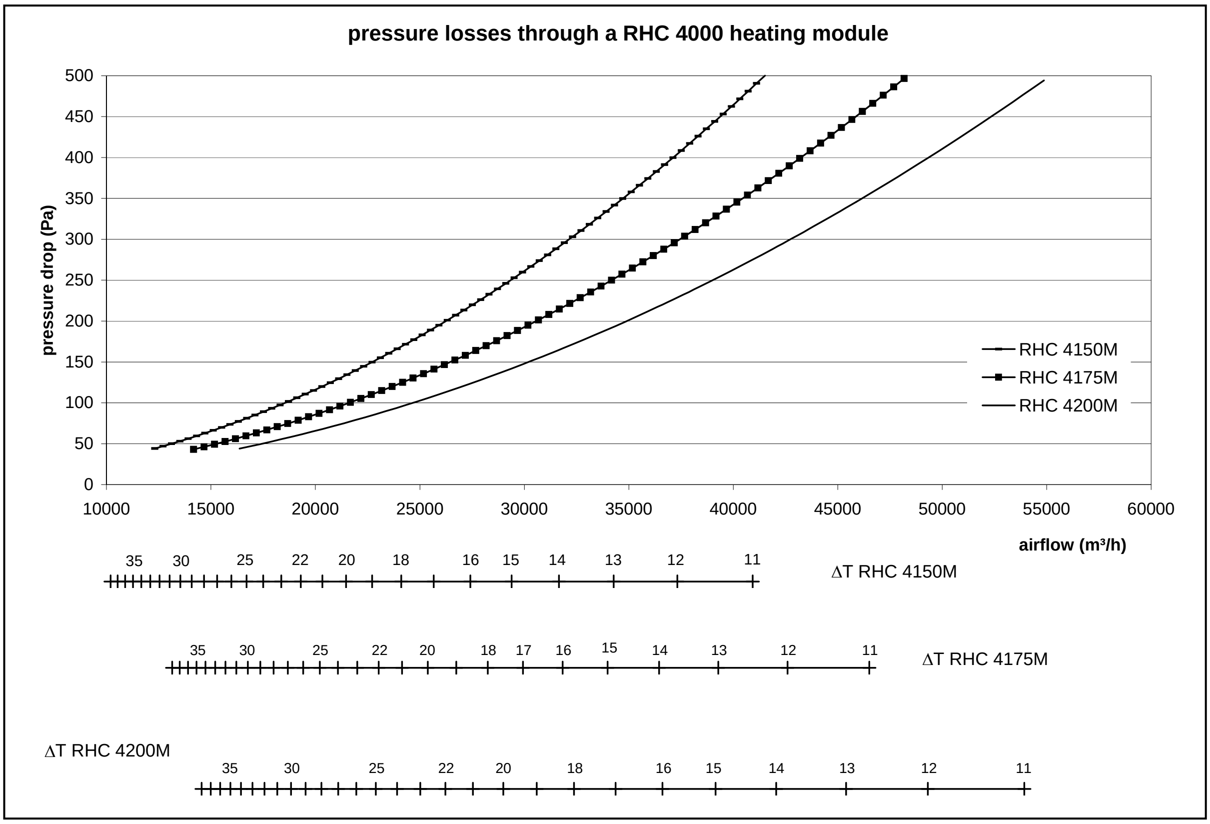


Figure 12c :



11.0 HEATING SECTION WITH BY-PASS CHANNEL

11.1 By-pass requirements

11.1.1 Referring to section 4.1.3, a by-pass duct in parallel with the heat exchanger enclosure might be required.

11.1.2 Such by-pass duct might also be required to reduce the pressure loss over the heating section, particularly at higher airflows.

11.1.3 When a by-pass duct is applied, a portion of the total airflow is guided through the by-pass duct and the remaining airflow is guided through the heat exchanger enclosure.

11.1.4 The by-pass duct dimensions must be properly determined in order to ensure that the airflow through the heat exchanger enclosure always meets the minimum airflow requirements as mentioned in table 6.

Table 6

Model	V1 (m^3/h)	V2 (m^3/h)
4050 06	3900	5950
4060 07	4700	7150
4075 09	5700	8800
4100 12	7500	11700
4110M.13	---	13600
4125M.15	---	15600
4150M.18	---	12300
4175M.21	---	14100
4200M.24	---	16300

V1 = minimum. airflow required through heat exchanger enclosure
V2 = minimum airflow required for high heat output H2

11.2 Calculation of recommended maximum by-pass

The calculation can be made for all airflows above V1, the minimum airflow.

When the high heat output H2 is required, then the calculation should be made reflected on V2. This is only possible for airflow conditions above V2.

The by-pass can either be mounted on top of the heat exchanger or besides the heat exchanger as shown in figure 13.

The recommended maximum by-pass dimensions for a given air flow (Vtot) can be calculated as follows : (Vtot is the air flow expressed in m³/s).

By-pass besides heat exchanger

For heat output H1 (V > V1)			
Model	**dim. B (mm)**	**factor R1**	**factor R2**
4050 06	461.00	289.30	-313.40
4060 07	531.00	250.60	-315.20
4075 09	670.50	206.50	-319.20
4100 12	880.00	150.00	-305.20
4110M.13	-	-	-
4125M.15	-	-	-
4150M.18	-	-	-
4175M.21	-	-	-
4200M.24	-	-	-

For heat output H2 (V > V2)			
Model	**dim. D (mm)**	**factor R1**	**factor R2**
4050 06	461.00	189.70	-313.40
4060 07	531.00	174.40	-336.30
4075 09	670.50	138.20	-334.60
4100 12	880.00	99.70	-321.00
4110M.13	1062.00	58.80	-216.20
4125M.15	1202.00	54.30	-239.10
4150M.18	1412.00	88.20	-291.20
4175M.21	1621.00	80.00	-306.00
4200M.24	1830.00	70.00	-312.00

► **Dimension C (mm) = R1 x V$_{tot}$ + R2**

EXAMPLES :

Example 1 : RHC 4075 09 RJL
with :

- total air flow = 3.^{61}m³/s = 13000 m³/h
- by-pass besides heat exchanger
- calculation for heat output H1

Result :

- dimension B = 670.^{50}mm
- dimension X = 800mm
- R1 = 206.^{50}
- R2 = -319.^{20}
- dimension C = 206.^{50} x 3.^{61} – 319.^{20}

► **C = 426.^{50}mm**

Note : In this case 1.^{58}m³/s (= 5700m³/h) flows through the heat exchanger enclosure. The remaining 2.^{03}m³/s (=7300m³/h) flows through the by-pass duct
(3.^{61}m³/s – 1.^{58}m³/s = 2.^{03}m³/s)

By-pass on top of heat exchanger

For heat output H1 (V > V1)			
Model	**dim. D (mm)**	**factor R1**	**factor R2**
4050 06	975.00	136.80	-148.20
4060 07	975.00	135.70	-169.50
4075 09	975.00	141.80	-219.30
4100 12	975.00	135.40	-275.40
4110M.13	-	-	-
4125M.15	-	-	-
4150M.18	-	-	-
4175M.21	-	-	-
4200M.24	-	-	-

For heat output H2 (V > V2)			
Model	**dim. D (mm)**	**factor R1**	**factor R2**
4050 06	975.00	89.60	-148.20
4060 07	975.00	93.20	-183.10
4075 09	975.00	95.00	-229.90
4100 12	975.00	90.00	-289.70
4110M.13	975.00	62.50	-225.00
4125M.15	975.00	65.20	-279.35
4150M.18	975.00	131.60	-446.00
4175M.21	975.00	137.50	-547.50
4200M.24	975.00	135.40	-620.80

► **Dimension A (mm) = R1 x V$_{tot}$ + R2**

Example 2 : RHC 4075 09 RJL
with :

- total air flow = 3.^{61}m³/s = 13000 m³/h
- by-pass besides heat exchanger
- calculation for heat output H2

Result :

- dimension B = 670.^{50}mm
- dimension X = 800mm
- R1 = 138.^{20}
- R2 = -334.^{60}
- dimension C = 136.^{20} x 3.^{61} – 334.^{60}

► **C = 164.^{30}mm**

Note : In this case 2.^{44}m³/s (= 8800m³/h) flows through the heat exchanger enclosure. The remaining 1.^{17}m³/s (=4200m³/h) flows through the by-pass duct
(3.^{61}m³/s – 2.^{44}m³/s = 1.^{17}m³/s)

Example 3 : RHC 4075 09 RJL
with :

- total air flow = $1.^{94}$m³/s = 7000 m³/h
- by-pass besides heat exchanger
- calculation for heat output H1

Result :

- dimension B	= $670.^{50}$mm
- dimension X	= 800mm (see fig. 13)
- R1	= $206.^{50}$
- R2	= $-319.^{20}$
- dimension C	= $206.^{50}$ x $1.^{94}$ – $319.^{20}$

$$\boxed{C = 81.^{40}mm}$$

Note

In this case $1.^{58}$m³/s (= 5700m³/h) flows through the heat exchanger enclosure. The remaining $0.^{36}$m³/s (=1300m³/h) flows through the by-pass duct
($1.^{94}$m³/s – $1.^{58}$m³/s = $0.^{36}$m³/s)

Example 4 : RHC 4075 09 RJL
with :

- total air flow = $1.^{94}$m³/s = 7000 m³/h
- by-pass besides heat exchanger
- calculation for heat output H2

This is impossible because the total airflow (= 7000m³/h) is less than the minimum required airflow V2 for heat output H2.

Pressure loss :

In this case the total pressure loss over the RHC module with by-pass can be extracted from figures 12a/b/c. The airflow through the heat exchanger enclosure must be applied to determine the total pressure drop.

Example 1 :

- Airflow through the heat exchanger enclosure = $2.^{58}$ m³/s (5700 m³/h)
- Total pressure drop = 40 Pa (approx.)

Example 2 :

- Airflow through the heat exchanger enclosure = $2.^{44}$ m³/s (8800 m³/h)
- Total pressure drop = 90 Pa (approx.)

11.3 Calculation of alternative by-pass dimension

Due to space restrictions it may not be possible to use the above mentioned maximum dimension by-pass.
In this case a smaller by-pass can be applied.
Obviously, this smaller by-pass will result in higher portion of the total air flow through the heat exchanger enclosure and consequently in a higher total pressure drop

To calculate this air flow through the heat exchanger enclosure, following interpolation rule should be applied :

With :

- VR = Recommended air flow (Table 7) (m³/s)
- Vtot = Total air flow (m³/s)
- x1 = Recommended by-pass (dim A or C) (as calculated in section 11.1).
- x2 = Applied by-pass dim. (mm)

Then VHS (air flow through heat exchanger enclosure) can be calculated as :

$$\boxed{V_{HS} = \frac{V_{tot}}{\frac{x_2}{x_1} \times \left(\frac{V_{tot}}{VR} - 1\right) + 1}}$$

As explained, the air flow VHS through the heat exchanger enclosure must be used in figure 12 to extract the correct total pressure drop over the RHC module with by-pass.
The air flow VHS may not exceed the maximum airflow allowed according to section 4.1.2 to avoid supercooling ot the flue gases.

<u>Example</u> .

RHC 4075 09 RJL
with :

- Total air flow : 3.61m³/s (13000m³/h)
- Expected min. inlet temperature : -5°C
- Recommended max. dim C = 426.50mm (see example 1)
- Dimension X = 800mm
- Applied by-pass dim. C = 250mm

Then :

- x1 = 426.50mm
- x2 = 250mm
- Vtot = 3.61m³/s
- VR = 1.58m³/s (5700m³/h)

Result :

$$\boxed{V_{HS} = \frac{3.^{61}}{\frac{250}{426.^{50}} \times \left(\frac{3.^{61}}{1.^{58}} - 1\right) + 1} = 2.^{06}\, m^3/s \;\; (7413 m^3/h)}$$

Consequently, 2.^{06}m^3/s (7413 m^3/h) flows through the heat exchanger enclosure and the remaining 1.^{55}m^3/s (=5587m^3/h) (= 3.^{61}m^3/s – 2.^{06}m^3/s) flows through the by-pass channel.

From section 4.1.2 the maximum allowable airflow through the heating module enclosure is 23979 m^3/h (for this example).

We notice the 7413m^3/h is still below this maximum allowable figure. Consequently there is no probability of condensation forming within the tubes.

Pressure drop :

The total pressure drop can be derived from figure 12. Use the air flow through the heat exhanger enclosure to determine the total pressure drop. (@7413 m^3/h)

Result : 70Pa (approx)

Figure 13a

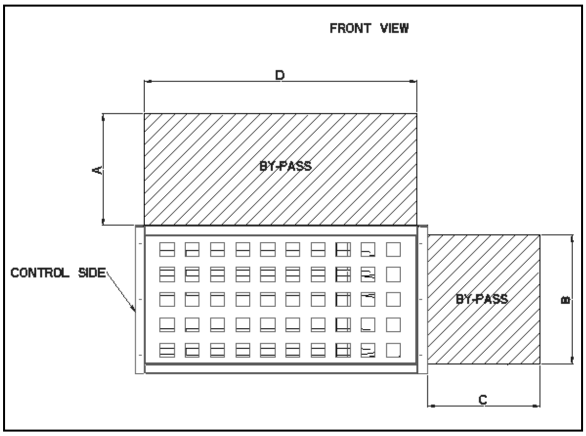
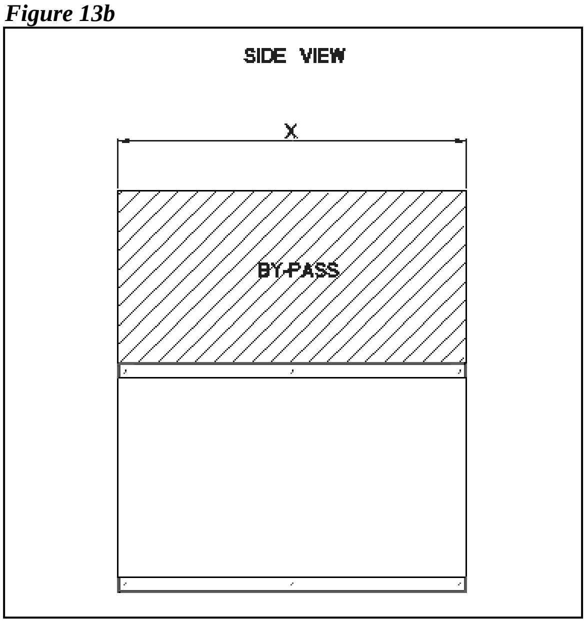


Figure 13b



12.0 Installation of RHC units in series

12.1 General

12.1.1 Two RHC 4000(M) units can be installed in series. Units can be bolted together using the pre-punched holes in the duct flanges (see fig. 3 for dimensions B and C). Apply a sealant between two units in order to avoid air leakage.

12.1.2 Each individual unit requires its own combustion circuit as described in sections 8.0 & 9.0.

12.1.3 Instructions concerning the burner and controls section (see section 5.0) must be followed. The controls sections of the 2 units in series can be combined, resulting in one enclosure.

The recommendations as described in section 4.1.2 are applicable for RHC units when installed in series. Checking the possibility of condensation forming within the tubes must be done (heating section by heating section), taking into account the expected minimum inlet temperature and the heat output conditions for each individual heating section.

12.2 Limitations for use

12.2.1 Minimum airflow requirement through heat exchanger enclosure :
For RHC units, installed in series, the minimum airflow duty through the heat exchanger enclosure (see fig. 4 – table 1) must be observed as indicated in table 7.

12.2.2 Maximum airflow through heat exchanger enclosure :

12.3 Pressure loss through multiple heating modules

The charts below (figures 14) indicates the pressure loss over the heating module versus the total air volume through the heat exchanger enclosure (see figure 4 and table 1). The temperature rise (△T) as shown is for 100% heat output.

Table 7 :Minimum airflow requirements for 2 RHC units in series :

Model	V (m^3/h)	Model	V (m^3/h)
2x 4050-06	5950	2x 4110M,13	13600
2x 4060-07	7150	2x 4125M,15	15600
2x 4075-09	8800	2x 4150M,18	17500
2x 4100-12	11700	2x 4175M,21	20600
		2x4200M,24	23300

V = min. airflow required through heat exchanger enclosure

Pressure drop for 2 units in series

Figure 14a

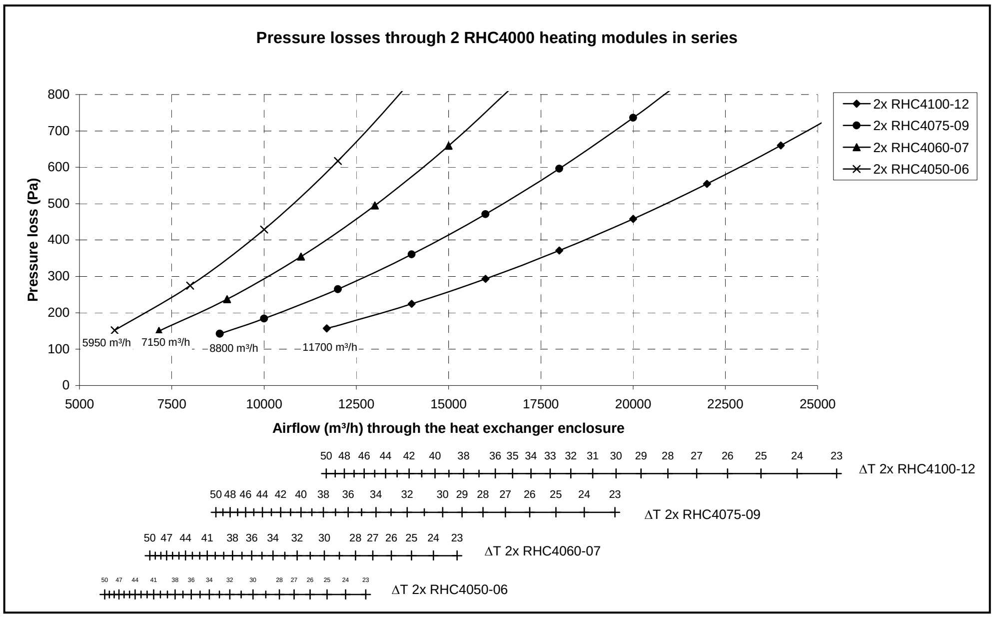


Figure 14b

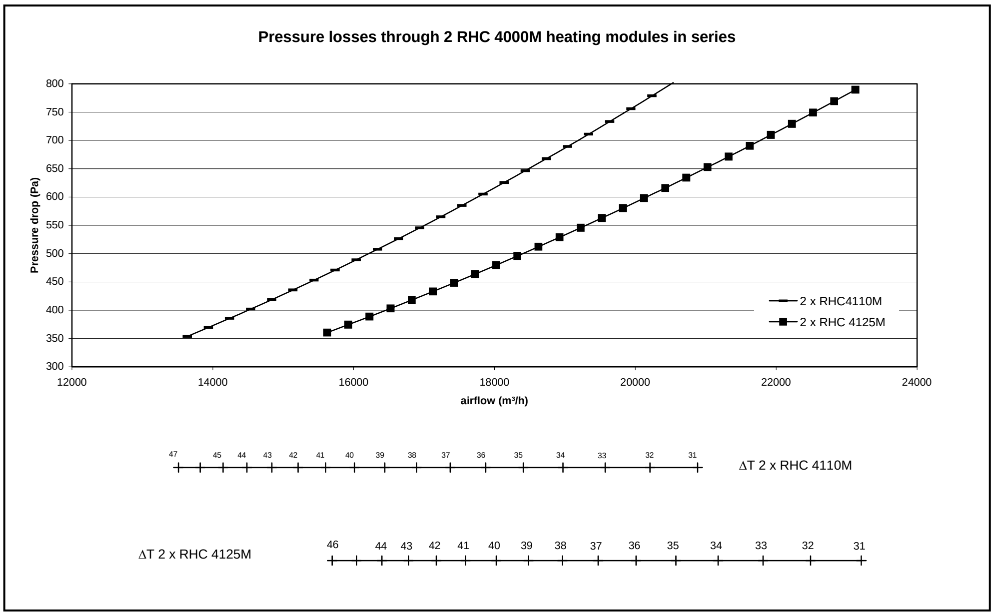
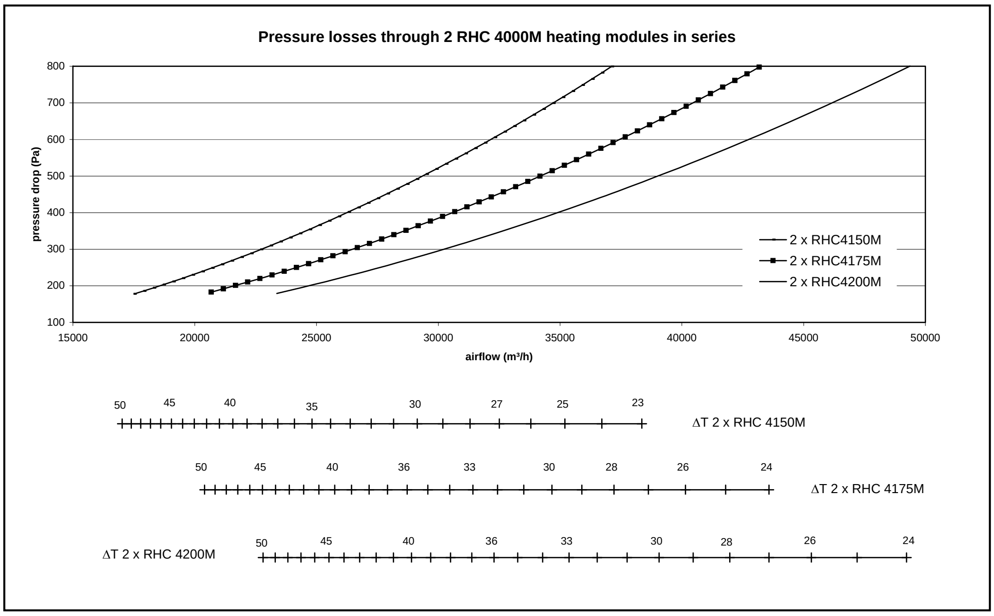


Figure 14c



12.4 Multiple heating sections in series with by-pass channels

12.4.1 By-pass requirements :

* Referring to section 4.1.3, a by-pass duct in parallel with the heat exchanger enclosure might be required.
* Such by-pass duct might also be required to reduce the pressure loss over the heating section, particularly at higher airflows.
* When a by-pass duct is applied, a portion of the total airflow is guided through the by-pass duct and the remaining airflow is guided through the heat exchanger enclosure.
* The by-pass duct dimensions must be properly determined in order to ensure that the airflow through the heat exchanger enclosure always meets the minimum airflow requirements as mentioned in table 7.

12.4.2 Calculation of recommended maximum by-pass for 2 units in series:

This calculation is applicable for total airflow conditions above V (table 7).

The by-pass can either be mounted on top of the heat exchanger or besides the heat exchanger as shown in figure 13.

The recommended maximum by-pass dimensions for a given air flow (Vtot) can be calculated as follows : (Vtot is the air flow expressed in m³/s).

By-pass besides heat exchanger :

Model	dim. B (mm)	factor R1	factor R2
4050 06	461.00	149.80	-247.70
4060 07	530.50	136.80	-268.40
4075 09	670.50	109.80	-265.10
4100 12	880.00	78.80	-253.60
4110M,13	1062	43,5	-164,1
4125M,15	1202	38,5	-167,3
4150M,18	1412	46,3	-224,1
4175M,21	1621	40,0	-231,0
4200M,24	1830	36,8	-235,3

▸ **Dimension C (mm) = R1 x V_{tot} + R2**

By-pass on top of heat exchanger :

Model	dim. D (mm)	factor R1	factor R2
4050 06	975	70.90	-117.10
4060 07	975	74.50	-146.20
4075 09	975	75.60	-182.20
4100 12	975	71.30	-228.90
4110M,13	975	47,6	-182,1
4125M,15	975	47,6	-209,5
4150M,18	975	65,8	-318,4
4175M,21	975	64,5	-366,9
4200M,24	975	69,4	-452,8

▸ **Dimension A (mm) = R1 x V_{tot} + R2**

12.4.3 Calculation of alternative by-pass dimension :

Due to space restrictions it may not be possible to use the above mentioned maximum dimension by-pass.

In this case a smaller by-pass can be applied. Obviously, this smaller by-pass will result in a higher portion of the total airflow through the heat exchanger enclosure and consequently in a higher total pressure drop

To calculate this air flow through the heat exchanger enclosure, following inter-polation rule should be applied :

With :

V = Recommended air flow (Table 7) (m³/s)
V_{tot} = Total air flow (m³/s)
x_1 = Recommended by-pass (dim A or C) (as calculated in section 11.1).
x_2 = Applied by-pass dim. (mm)

Then V_{HS} (air flow through heat exchanger enclosure can be calculated as :

$$V_{HS} = \frac{V_{tot}}{\frac{x_2}{x_1} \times \left(\frac{V_{tot}}{V2} - 1 \right) + 1}$$

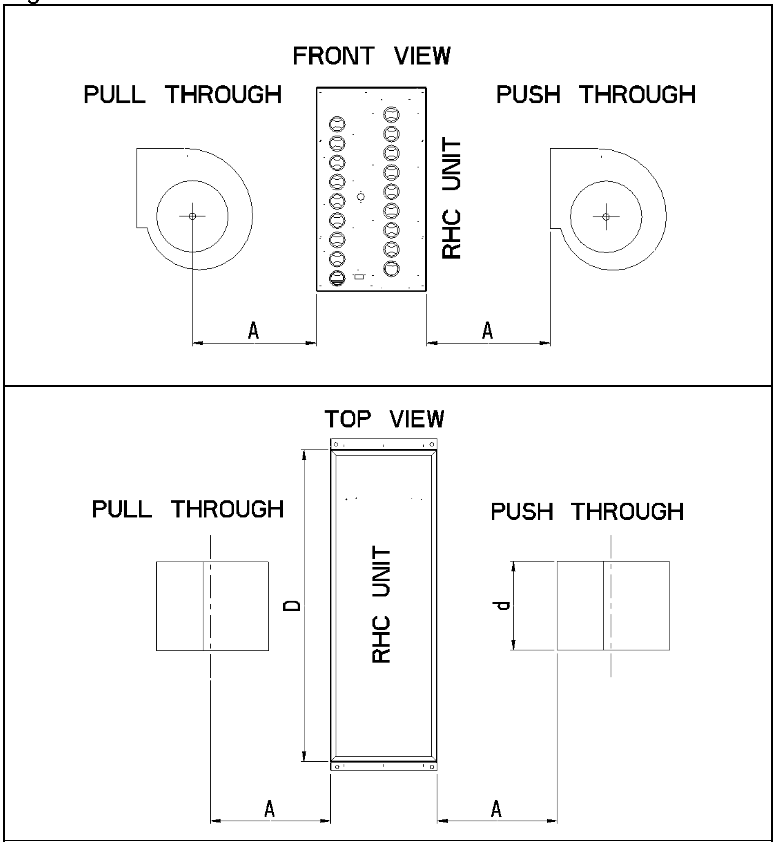
As explained above, the air flow VHS through the heat exchanger enclosure must be used in figure 12 to extract the correct total pressure drop over the RHC module with by-pass.

The air flow VHS may not exceed the maximum airflow allowed according to section 4.1.2 to avoid supercooling ot the flue gases.

13.0 INSTALLATION OF AIR FAN IN RESPECT OF RHC HEATING COIL

To ensure a fluent air distribution over the RHC heating coil, it is stronly recommen-ded to follow the installation method as described in figure 15.

Figure 15 : Installation of air fan



With **:**

A : min. distance fan → heating coil
D : width of duct section (see table 1, fig. 4, dim Y2)
d : width of centrifugal fan

$$A \geq \frac{D - d}{2}$$

Example :

RHC 4100 12
D = 1770 mm
d = 500mm

$$A \geq \frac{1770 - 500}{2} = 635\text{mm}$$

14.0 TECHNICAL DATA

Table 8 – Gas category

Country	Gas category
Austria	222H3P
Belarus	II2H3+
Bulgaria	I2H or I3B/P
China	II2H3+
Czech republic	II2H3+
Croatia	II2H3P
Cyprus	II2H3+
Denmark	II2H3 B/P
England	II2H3+
Estonia	II2H3+
Finland	II2H3 B/P
Greece	II2H3+
Hungary	II2HS3P
Iceland	II2H3+
Latvia	II2H3+
Lithuania	II2H3+

Country	Gas category
Germany	I2ELL or I3P
Montenegro	II2H3+
New Zealand	II2H3+
Norway	II2H3 B/P
Poland	II2E3P
Portugal	II2H3+
Romania	II2H3P
Russian Federation	I2H or I3P
Serbia	II2H3+
Slovakia	II2H3+
Slovenia	II2H3+
Spain	II2H3+
Sweden	II2H3 B/P
Turkey	II2H3+
Ukraine	I2H or I3P

Table 9 - Model RHC 4000 Specifications

Model	Heat input		Heat output H2 100%[3]	Gas rate [4]			Power Consumption	Heat output 50% 2 stage[3]	Minimum modulating output
				G20	G30	G31			
	kW gros[1]	KW net[2]	kW	m³/h	kg/h	kg/h	kW	kW	kW
4050 06	62.00	55.90	50.80	5.90	4.50	4.40	0.15	24.00	24.00
4060 07	74.60	67.20	61.20	7,10	5.40	5,20	0.15	28.60	28.60
4075 09	91.50	82.40	75.00	8,70	6.70	6,60	0.15	36.00	36.00
4100 12	120.00	108.40	100.00	11,40	8.80	8,60	0.15	47.00	47.00
4110M.13	136.60	123.00	112.30	13.00	--	9.60	0.28	51.20	51.20
4125M.15	153.50	138.30	126.30	14.60	--	10.80	0.28	51.00	51.00
4150M.18	182.90	164.80	151.30	17.40	--	12.80	0.28	75.80	75.80
4175M.21	211.80	190.80	175.00	20.20	--	14.90	0.28	99.40	99.40
4200M.24	240.60	216.80	198.70	22.90	--	16.90	0.65	99.40	99.40

Notes to table 1:
1. GCV (Hs)
2. NCV (Hi)
3. Heat output depends on airflow (see table 3a)
4. Natural gas G20 gross calorific value 10.48 kWh/m³ @ 15 °C, 1013.25 mbar
   Butane gas G30 gross calorific value 13.7 kWh/kg
   Propane gas G31 gross calorific value 14.0 kWh/kg

Table 10 : Injector size and burner pressure

Belarus, China Croatia, Czech Republic, Cyprus, England, Estonia, Greece, Iceland, Latvia, Lithuania, Montenegro, New Zealand, Portugal, Serbia, Slovenia, Slovakia, Spain , Turkey

		Model	4050 06	4060 07	4075 09	4100 12	4110M,13	4125M,15	4150M,18	4175M,21	4200M,24
Nat. Gas G20	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
		marking	300	300	300	300	300	300	300	300	300
	Burner pressure (1)	mbar	7,00	7,50	7,50	7,50	7,70	7,40	7,50	7,70	7,70
	Inlet pressure	mbar	20								
Prop. Gas G31	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	1,55	1,55	1,55	1,55	1,55	1,55	1,55	1,55	1,55
		marking	155	155	155	155	155	155	155	155	155
	Burner pressure (1)	mbar	35,50	35,50	33,90	33,60	35,20	34,80	34,90	35,30	34,40
	Inlet pressure	mbar	37								

Romania, Poland

		Model	4050 06	4060 07	4075 09	4100 12	4110M,13	4125M,15	4150M,18	4175M,21	4200M,24
Nat. Gas G20	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
		marking	300	300	300	300	300	300	300	300	300
	Burner pressure (1)	mbar	7,00	7,50	7,50	7,50	7,70	7,40	7,50	7,70	7,70
	Inlet pressure	mbar	20								
Prop. Gas G31	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65	1,65
		marking	165	165	165	165	165	165	165	165	165
	Burner pressure (1)	mbar	28,90	28,44	27,90	26,80	28,20	28,20	27,90	28,40	26,50
	Inlet pressure	mbar	30								

Germany,Hungary, Russian Federation, Ukraine, Austria

		Model	4050 06	4060 07	4075 09	4100 12	4110M,13	4125M,15	4150M,18	4175M,21	4200M,24
Nat. Gas G20	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
		marking	300	300	300	300	300	300	300	300	300
	Burner pressure (1)	mbar	7,00	7,50	7,50	7,50	7,70	7,40	7,50	7,70	7,70
	Inlet pressure	mbar	20(*)								
Prop. Gas G31	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	1,55	1,55	1,55	1,55	1,55	1,55	1,55	1,55	1,55
		marking	155	155	155	155	155	155	155	155	155
	Burner pressure (1)	mbar	35,50	35,50	33,90	33,60	35,20	34,80	34,90	35,30	34,40
	Inlet pressure	mbar	50								

(*): Inlet pressure for Hungary = 25mbar

Bulgaria, Denmark, Finland, Norway, Sweden

		Model	4050 06	4060 07	4075 09	4100 12	4110M,13	4125M,15	4150M,18	4175M,21	4200M,24
Nat. Gas G20	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
		marking	300	300	300	300	300	300	300	300	300
	Burner pressure (1)	mbar	7,00	7,50	7,50	7,50	7,70	7,40	7,50	7,70	7,70
	Inlet pressure	mbar	20								
Prop. Gas G31	Injector	quantity	6	7	9	12	13	15	18	21	24
	Injector size	mm	1,55	1,55	1,55	1,55	1,55	1,55	1,55	1,55	1,55
		marking	155	155	155	155	155	155	155	155	155
	Burner pressure (1)	mbar	27,60	27,50	25,40	27,30	27,69	27,28	27,35	27,67	29,96
	Inlet pressure	mbar	30								

(1) : with open service door

Subject to modifications

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