

HURAY®

MERCHANDISING, SUPPLYING
AND MANUFACTURING LTD.

HANDLING, INSTALLATION AND SERVICE MANUAL

HI-DELTA 302ACE-2342ACE SERIES

hot water boilers for central heating/
water heaters for domestic hot water and
technological hot water supply
with fan assisted premix burners
to be installed indoor or outdoor

**THE FIRST OPERATION OF THE APPLIANCE MUST BE
CARRIED OUT BY AN AUTHORIZED SERVICE.
CALL A SERVICE LISTED IN THE WARRANTY!**



Hungary



06/1-2-36-07-27



06/1-2-36-07-26



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**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

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4. Version. Closed on 28. 05. 2008

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1. GENERAL DESCRIPTION OF THE GAS APPLIANCE

1.1. PARTS LIST AND PRODUCT IDENTIFICATION

The gas appliance contains the following parts:

- gas train
- burner system
- blower(s)
- water pressure relief valve
- temperature and pressure measuring gauge
- complete burner sequence and safety control

The following accessories are shipped separately:

- air intake and flue exhaust system pipes and parts
- air intake cover for outdoor use

Further accessories:

- Warranty documents, Installation Handling and Service Manual
- Two pieces of NPT thread pipe adapters.
- External stage controllers, thermostats (optional)

! Upon the receipt of the appliance please check the data on the data plate, particularly the codes of the factory number, and make sure that you received the product you had ordered, undamaged and with every accessory included.

1.1.1. Factory number

HDXXXX	XXXXXXXXXXXXXXXXXX	H	B	4	E8	A1	A3	A6
Model Size	Manufacturing code number	Application	Venting system	Opening pressure of the water relief valve	Efficiency option	Material of the water headers	Material of the heat exchanger tubes	Side of the water connections

Application

- H: hot water boiler for central heating systems,
- W: direct water heating for domestic hot water and technological systems
- P: direct water heating for swimming pools.

Venting system

- O: outdoor unit with factory supplied outdoor vent cap.
- B: outdoor or indoor unit with open burner chamber connected to a flue pipe system.
- C: indoor unit with closed burner chamber connected to a sealed vent system.

Opening pressure of water relief valve

- 4 bar,
- 6 bar,
- 8 bar,
- 10 bars.

Efficiency option

- -: standard efficiency model,
- E8: increased efficiency model.

Material of the water headers

- -: standard, glass lined cast iron
- A1: bronze.

Side of the water connections when facing the front of the unit

- -: standard, left sided
- A6: right sided.

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1.2. SAFETY INSTRUCTIONS



Natural gas and PB gas contain an odorant to make the detection of an eventual gas leakage easier. Some people are unable to identify this smell. Ask for a qualified service person if you were unsure about the origin of the smell.

For your own safety never use or store diesel oil, gasoline, solvents or other flammable liquid or gas next to the gas appliance because it carries the risk of fire and explosion.

Detecting the presence of LPG gas is more difficult because it is heavier than air and tends to accumulate at low areas instead of head height. Pay more attention when the gas appliance is operated on LPG gas.

The type of the operating gas is indicated by the manufacturer on the data plate of the gas appliance.

If you suspect gas leakage :

- Do not touch any electrical switch; do not use any phone in the gas leakage area!
- Do not cause any open flame or spark!
- Close the gas supply and leave the gas leakage area!
- Immediately contact a qualified service and inform the gas supplier in case of need!
- Contact the fire department if you neither reach the service nor the gas supplier!
- Follow their instructions!



Gas appliances that run on LPG or natural gas are different. PB gas type models cannot be operated on natural gas without the readjustment of the appliance! Never attempt to do so otherwise it is life-threatening! Readjustment of the appliance for a different gas type must be performed by a qualified service unit, listed in the warranty.

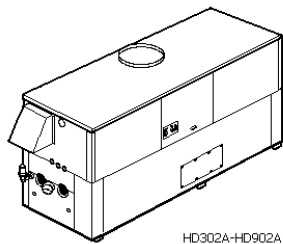


The gas appliance must not be located in air streams containing the following chemicals: Freon, calcium-chloride, potassium-chloride, carbon-tetra-chloride, chlorine, halogens refrigerants, per chlorine-ethylene, trichlorine-ethylene, hydrochloric-acid, ethylene-dichloride, and photo chemicals. Such air is breathable but the chemicals in it create corrosive substances, which shorten the lifetime of any gas appliance.

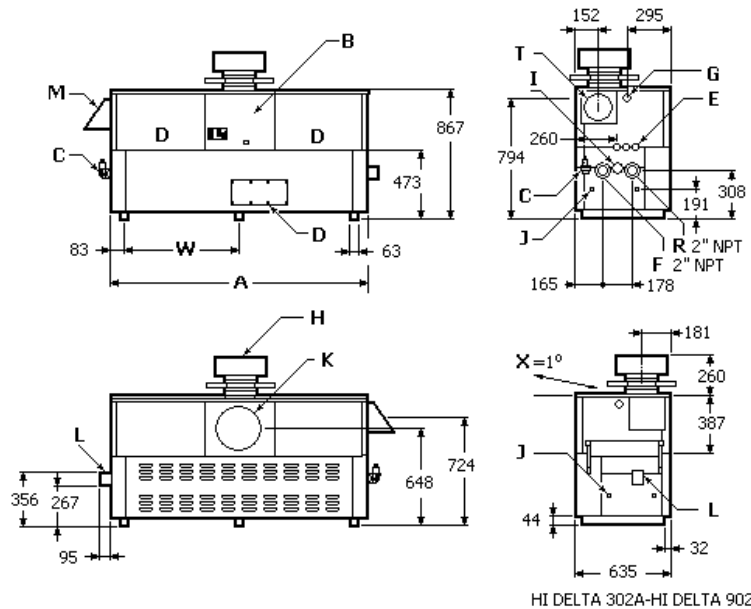
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1.3. TECHNICAL DATA

Model	Number of stages	Nominal net input (kW)		Gas consumption		Flue gas volume (m ³ /h)	Weight (kg)
		Natural gas	LPG gas	Natural gas (Nm ³ /h)	LPG gas (kg/h)		
302ACE	1	80	80	8,016	6,2	160	171
402ACE	1	110	110	11,022	8,5	220	200
502ACE	2	140	140	14,028	10,9	280	245
652ACE	2	180	180	18,036	14,0	360	266
752ACE	2	200	200	20,040	15,5	400	304
902ACE	2	250	250	25,050	19,4	500	333



HD302A-HD902A

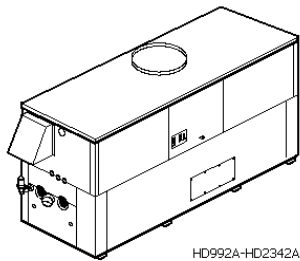


HI DELTA 302A-HI DELTA 902A

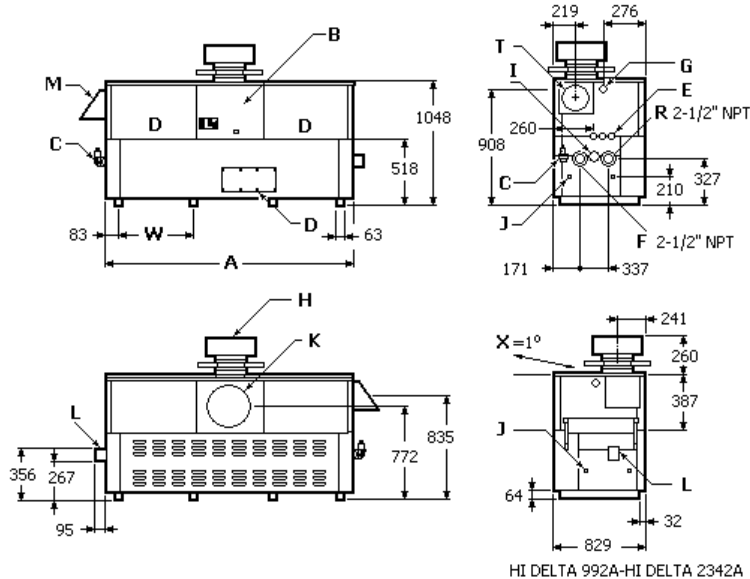
Model	HD 302ACE	HD 402ACE	HD 502 ACE	HD 652ACE	HD 752ACE	HD 902ACE
A	Width (mm)					
	914	1092	1270	1537	1715	1981
B	Operational centre control panel on the front of the boiler					
C	Water pressure relief valve					
D	Mounting cover for ignition parts					
E	Electrical connections					
F	Water outlet (reversible), female thread 2"(NPT)					
G	Gas supply connection, (reversible) male thread (GAS)					
	3/4	3/4	5/4	5/4	5/4	5/4
H	Outdoor cap (optional)					
I	Temperature and pressure gauge					
J	Viewing window to burners					
K	Flue exhaust (reversible option) (mm)					
	130	150	150	200	200	200
L	Flow switch					
M	Combustion air inlet filter (with protective cover for outdoor boilers)					
R	Water inlet (reversible) female thread 2"(NPT)					
T	Combustion air connection for sealed chamber (mm)					
	150	150	150	150	150	150
W	Distance between the supports (mm)					
	457	470	559	692	781	914
X	1 degree sloop on jacket top toward the back of the unit					

**RAYPAK HI DELTA BOILERS/WATER HEATERS
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Model	Number of stages	Nominal net input (kW)		Gas consumption		Flue gas volume (m ³ /h)	Weight (kg)
		Natural gas	LPG gas	Natural gas (Nm ³ /h)	LPG gas (kg/h)		
992ACE	2	270	270	27,054	20,9	540	405
1262ACE	3	340	340	34,068	26,3	680	455
1532ACE	4	420	420	42,084	32,5	840	551
1802ACE	4	490	490	49,098	38,0	980	608
2002ACE	4	550	550	55,110	42,6	1100	653
2072ACE	4	570	570	57,114	44,2	1140	653
2342ACE	4	640	640	64,128	49,6	1280	684



HD992A-HD2342A



HI DELTA 992A-HI DELTA 2342A

Model	HD 992 ACE	HD 1262 ACE	HD 1532 ACE	HD 1802 ACE	HD 2002 ACE	HD 2072 ACE	HD 2342 ACE
A	Width (mm)						
	1451	1740	2029	2315	2604	2604	2893
B	Operational centre control panel on the front of the boiler						
C	Water pressure relief valve						
D	Mounting cover for ignition parts						
E	Electrical connections						
F	Water outlet (reversible), female thread 2 1/2"(NPT)						
G	Gas supply connection, (reversible) male thread 2" (GAS)						
H	Outdoor cap (optional)						
I	Temperature and pressure gauge						
J	Viewing window to burners						
K	Flue exhaust (reversible option) (mm)						
	250	300	300	350	350	350	400
L	Flow switch						
M	Combustion air inlet filter (with protective cover for outdoor boilers)						
R	Water inlet (reversible) female thread 2 1/2"(NPT)						
T	Combustion air connection for sealed chamber (mm)						
	250	250	250	250	250	250	250
W	Distance between the supports (mm)						
	427	522	619	714	811	811	907
X	1 degree sloop on jacket top toward the back of the unit						

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Combustion efficiency (without E8 option)	93,2 %	→ Minimal allowed inlet water temperature:	40 °C
Combustion efficiency (with E8 option)	96,6 %	→ Minimal allowed inlet temperature:	49 °C
Nominal gas supply pressure (natural gas):	20/25 mbar	Flue gas temperature:	121-138 °C
Nominal gas supply pressure(LPG gas):	50 mbar	Maximal allowed outlet water temperature:	105 °C
Maximal allowed gas pressure upstream of valve:	200 mbar	Water pressure relief valve opening:	Max. 10 bar
Flue gas NO _x emission (natural gas):	26 mg/m ³	Electric supply	230V / 50Hz
Flue gas CO emission (natural gas):	43 mg/m ³	Total electric input demand:	VA + P _{pump}
Flue gas NO _x emission (LPG gas):	44 mg/m ³	Protection :	IP X4
Flue gas CO emission (LPG gas):	80 mg/m ³	Category:	II _{2H3B/P}
Flue gas CO ₂ emission (natural gas):	7,8 – 8,2 %	Burner pressure (LPG gas)	24,5±0,5 mbar
Burner pressure (natural gas)	8,9±0,2 mbar		

Model	Quantity of burner tubes	Quantity of gas valves	Quantity of blowers	Maximal electric input under continuous load Without pump
	Pieces.	Pieces.	Pieces.	Watts
302 ACE	6	1	1	525
402 ACE	8	1	1	525
502 ACE	10	2	1	595
652 ACE	13	2	1	595
752 ACE	15	2	1	595
902 ACE	18	3	1	620
992 ACE	11	2	2	955
1262 ACE	14	3	2	985
1532 ACE	17	4	2	1055
1802 ACE	20	4	2	1055
2002 ACE	23	5	3	1510
2072 ACE	23	5	3	1510
2342 ACE	26	5	3	1510

Model	Number of burner tubes per each gas valve					Number of burner stages				% of nominal input at stage			
	1	1A	2	3	4	1	2	3	4	1	2	3	4
302 ACE	6	-	-	-	-	1	-	-	-	100	-	-	-
402 ACE	8	-	-	-	-	1	-	-	-	100	-	-	-
502 ACE	5	-	5	-	-	1	1,2	-	-	50	100	-	-
652 ACE	7	-	6	-	-	1	1,2	-	-	54	100	-	-
752 ACE	8	-	7	-	-	1	1,2	-	-	53	100	-	-
902 ACE	6	-	6	6	-	1,2	1,2,3	-	-	66	100	-	-
992 ACE	6		5			1	1, 2	-	-	55	100	-	-
1262 ACE	5		3	6		1	1,2	1, 2, 3	-	36	57	100	-
1532 ACE	6		4	4	3	1	1,2	1, 2, 3	1, 2, 3, 4	35	59	82	100
1802 ACE	6		4	5	5	1	1,2	1, 2, 3	1, 2, 3, 4	30	50	75	100
2002 ACE	5	4	5	4	5	1, 1A	1, 1A, 2	1, 1A, 2, 3	1, 1A, 2, 3, 4	39	61	78	100
2072 ACE	5	4	5	4	5	1, 1A	1, 1A, 2	1, 1A, 2, 3	1, 1A, 2, 3, 4	39	61	78	100
2342 ACE	5	5	5	5	6	1, 1A	1, 1A, 2	1, 1A, 2, 3	1, 1A, 2, 3, 4	39	58	77	100

**RAYPAK HI DELTA BOILERS/WATER HEATERS
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1.4. GENERAL LAYOUT AND DESCRIPTION OF OPERATION

The Hi-Delta 302ACE-2342ACE series gas appliances can be used as heating boilers of central heating systems circulating liquid medium.

They can be installed

- indoors (in a conventional boiler room),
- outdoors (without any structure around them),

or instead they can be used as a water heater for the direct heating of:

- domestic hot water,
- hot water for technological purposes,
- swimming pools.

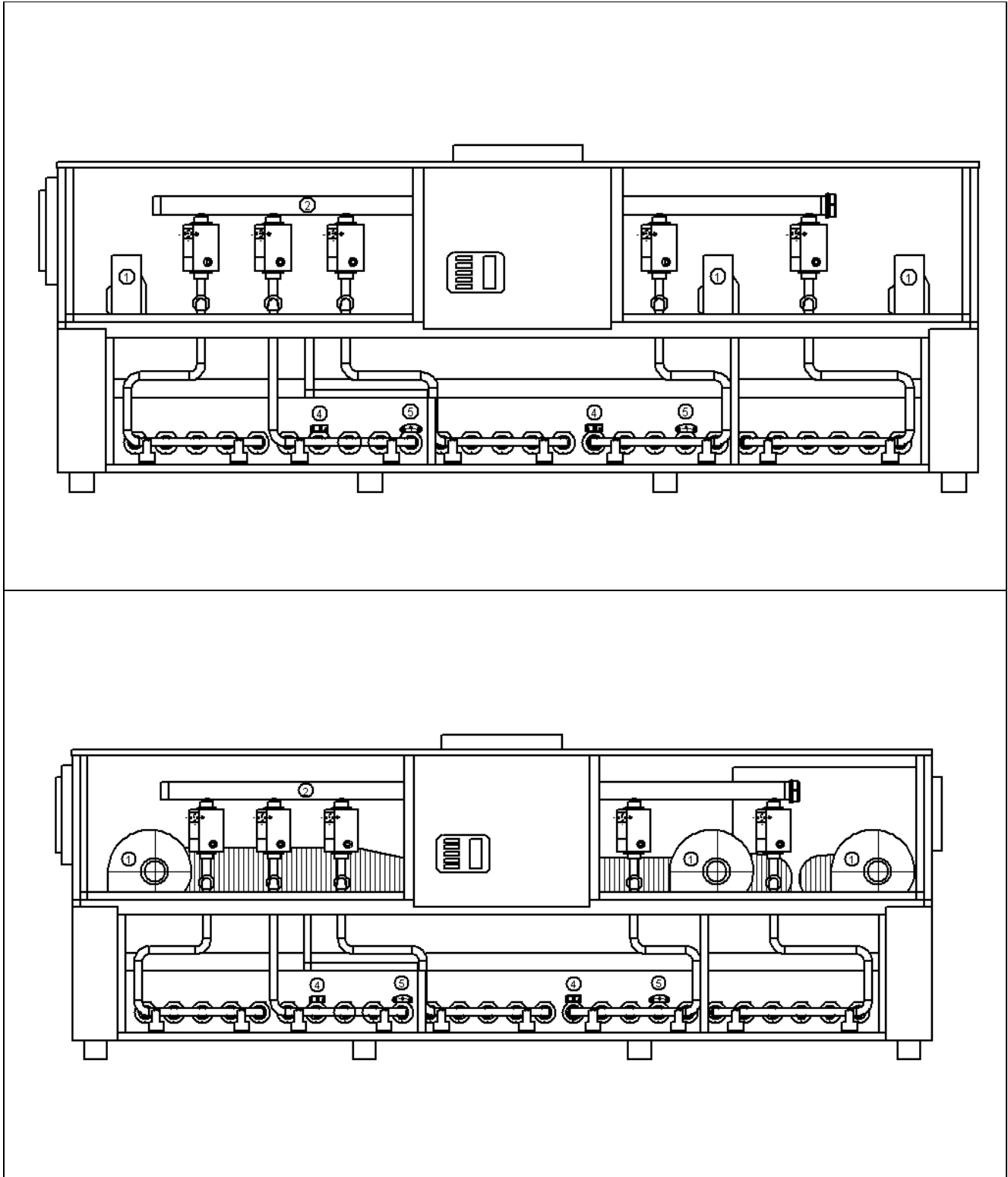
As a water heater they can be installed

- indoors (in a conventional boiler room),
- outdoors (without any structure around them), if there is no risk of freezing.

The combustion air is being drawn by two or three blowers direct from the adjacent area of the gas appliance or through air intake pipes. The burnt gas can be discharged through small diameter horizontal or vertical vent systems which are typical for gas appliances operating under positive pressure. Outdoor installations are self-venting when installed with the optional factory supplied outdoor vent kit and do not require additional vent piping. The gas is burnt in 100% primer air premix stainless steel burner tubes enclosed with the heavily heat insulated combustion chamber, minimizing the emission of harmful materials. The heat generated in the low mass and low volume die-rolled copper fin tubes which are resistible to 12 bars can be removed by the intensive flow of the heating substance.

This is why whenever the burners are on a properly sized circulation pump must always be operated as well. The appliance with the help of a built in relay switches on and off the pump on time. (The pump is not included in the kit). The burners are divided into groups on the basis of burner stages. Each burner group receives the gas through one or more parallel built gas valves. Only the burner groups needed for the given heat demand are switched on in order to minimize the number of switches. In stand by mode no gas is consumed, due to the intermittent, direct burner ignition system. Although the appliance has its own built in thermostat it is advised to connect the appliance to external thermostat(s) or other stage controllers. The appliances are capable to supply collected alarm signal and operation signal to building surveillance systems. They are able to receive low water level signal. They can control external flue gas extractors or fresh air supply blowers.

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All Hi-Deltas from 302ACE up to 2342ACE are wired similarly, up to safe limits, but the quantity of gas valves, blowers and igniters differ from model to model. Information can be obtained about the actual status of the operation and faults through the control lights of the outer and inner panels and time relays.

Whenever the "SAFETY" light of the outer diagnostic panel is on 24V AC signal is generated on the "ALARM" output terminal of the inner panel, which can be carried as a collected error signal.

The two-way main power switch can be found on the C rail located on the front right upper part in the electric box. The 230V main circuit and the inlet terminal of the 24V control circuit are energized and the "POWER" light of the outer diagnostic panel is on when the main switch is switched on. The safety components are instantly supplied by energy:

At this stage, on condition the preventive safety switches are closed, the "SAFETY ERROR" light goes out and the appliance is ready for operation.

In case of an error "SAFETY ERROR" light would stay on and the appliance will not start its operation.

In case of demand for heat of any outer source the "HEAT DEMAND" light goes on. The pump control relay starts the pump connected to the gas appliance.

The contacts of the flow switch close if the pump is able to supply at least the minimal demanded flow through the heat exchanger. The "FLOW" light goes on and all blowers start to operate. The contacts of the air pressure switches close and the appropriate ordinal number of "BLOWER" lights up. The thermostat input of the ignition controller is supplied and a 15 second long pre-purge period is followed by the glowing up of the hot surface igniter. The heating up period lasts for about 30 seconds then an attempt for the igniting begins.

The appropriate gas valve is supplied during the four second long ignition attempt. "STAGE 1" control light goes on. The gas valve only stays open if the remote sensor is able to sense flame during these four seconds. Stage 1 begins to operate and its control light stays on.

Gas valve 2 will be supplied and "STAGE 2" light goes on in case of further heat demand, following the necessary time delay.

At the 1262ACE model gas valve #3 will be supplied and "STAGE 2" light goes on in case of further heat demand, following the necessary time delay.

The ignition systems of models 1532ACE through-2342ACE are duplicated. At these models upon heat demand for stage 3 the ignition controller #2 is supplied and the 15 seconds pre-purge period followed by the glowing up of the hot surface igniter #2 is started. The heating up period lasts for about 30 seconds than an ignition attempt begins.

Gas valve #3 is supplied during the successful igniting attempt for four seconds. "STAGE 3" control light goes on. The gas valve only stays open if the remote sensor #2 is able to sense flame within these four seconds. Stage 3 begins to operate and its control light stays on.

Gas valve #4 will be supplied and "STAGE 4" light goes on in case of further heat demand, following the necessary time delay.

In case of a failure of one ignition system the other will take over the load automatically, this way the appliance is able to operate at about 50% performance.

The contacts of the flow switch stay open if the pump is unable to supply at least the minimal demanded flow through the heat exchanger. The "FLOW" light does not go on. The appliance does not start even in case of heat demand, or it stops operation. Only "POWER" and "HEAT DEMAND" lights stay on.

The ignition controller attempts ignition 5 times in sequence before locking out in case of an ignition failure. "SAFETY" light goes on.

The appliance purges for 15 seconds before locking out whenever the "BLOCKED VENT" light is on. "SAFETY" light goes on.

The appropriate ordinal number "BLOWER" light goes out if any of the blowers is unable to create the minimal pressure difference that is needed for the operation. The appliance purges for 15 seconds before locking out. "SAFETY" light goes on.

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1.5. FIELDS OF APPLICATION

- Heating systems for buildings
- Direct heating of domestic hot water

- Direct heating of the water of swimming pools
- Direct water heating for technological processes

1.5.1. General points

Please consider thoroughly during the design and installation of the complete system that even the tiniest built-in part is able to withstand the overpressures, temperatures, and chemical actions which could apply during operation!

Appropriate heating substance flow must be assured through the heat exchanger of the Hi-Delta during the operation of the burners. The appliance is able to start/stop the operation of a single phase pump or control the magnetic switch of a three phase pump by its built in relay. The output voltage is 230VAC/50 Hz. (Pump is not included in the appliance)

1.5.2. 105 °C systems

The great mechanical strength and thermal-shock resistance of the die-rolled copper finned tubes heat exchanger and temperature range of the operating built thermostat makes Hi-Deltas able to operate with 105 °C outlet-temperature continuously. Proper overpressure must be secured in such systems to prevent the boiling of the heating substance. The rubber membrane of the closed expansion tank, which is often used in such systems, is usually unable to endure such high temperatures therefore proper volume connector must be inserted to avoid direct contact with the hot heating substance liquid.

The residual heat must be removed from the heat exchanger after the burners stop. Either should the pump run continuously or intermittently so that it only starts when there is a heat demand and stops after all burner stages, overrunning for a time that can be adjusted on the pump relay between 1-10 minutes.

The built-in flow switch prevents the operation for the burners of the Hi-Delta effectively if there is too little flow through the heat exchanger.

!	<p>Hot liquid can egress the water pressure relief valve. Discharge piping must be piped near the floor and close to a drain to avoid the possibility of any personal injury or property damage. The piping must be routed so that no discharged liquid could freeze in it.</p>
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The built in flow switch prevents the operation for the burners of the Hi-Delta effectively if there is too little flow through the heat exchanger. It might happen during the operation that a valve is left closed or half-closed in the system by accident. A formation of steam and a reduction of flow might result. The operation of the built in flow switch and the thermal shock resistance of the heat exchanger together ensure that no breakdown could occur even in such situation.

The manual high limit must be adjusted to its highest setting.

The adjusted value on the auto high limit must not exceed 105 °C to avoid in locked position lockout of the appliance.

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1.5.3. Systems below 105 °C down to 40 °C

The great mechanical strength and thermal-shock resistance of the die-rolled copper finned tubes heat exchanger makes Hi-Deltas ideal to operate in high temperature systems.

Please consider thoroughly during the design and installation of the complete system that even the tiniest built-in part is able to withstand the overpressures, temperatures, and chemical actions which could apply during operation!

The residual heat must be removed from the heat exchanger after the burners stop. Either could the pump run continuously or intermittently so that it only starts when there is a heat demand and stops after all burner stages, overrunning for a time that can be adjusted on the pump relay between 1-10 minutes.

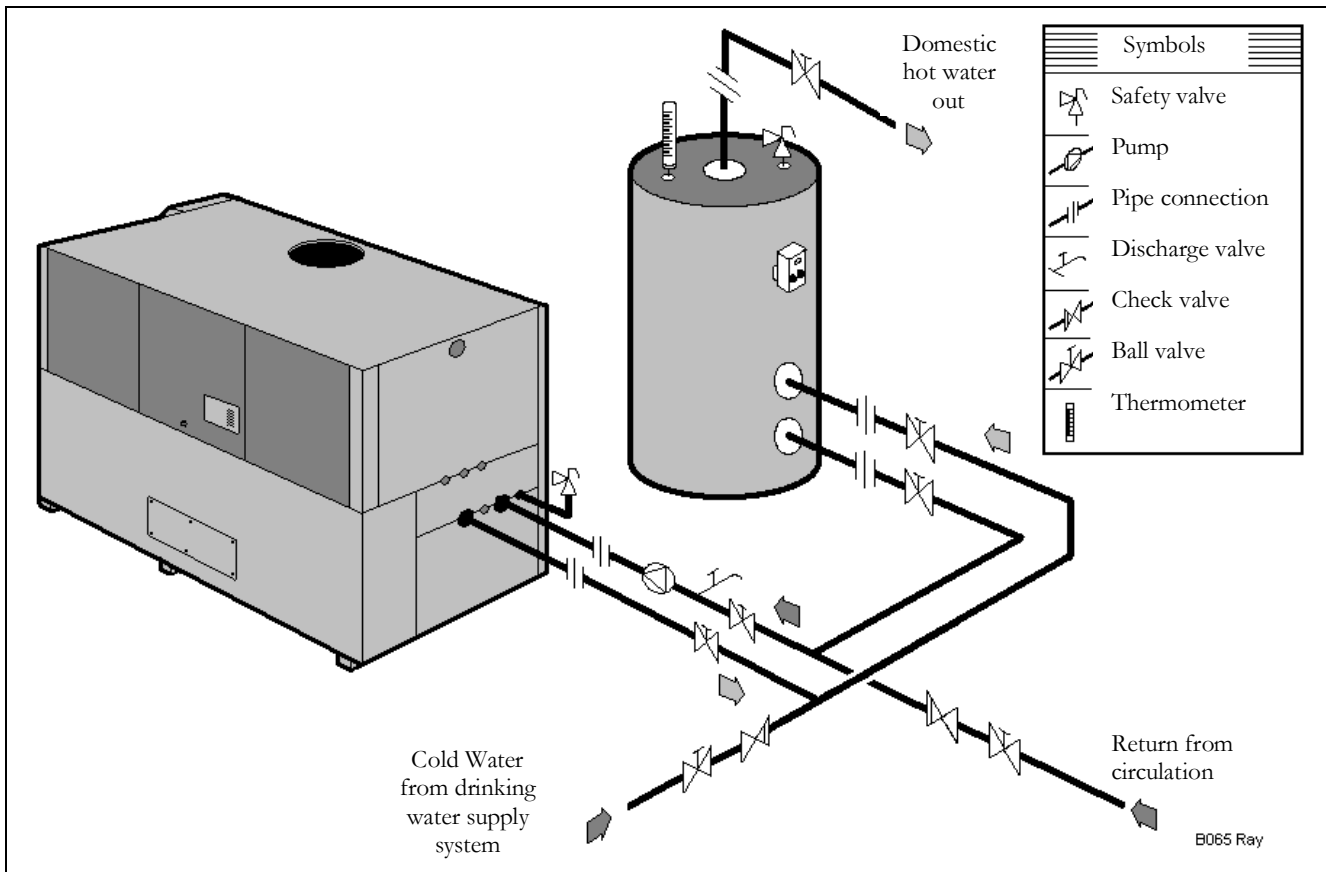
The built in flow switch prevents the operation for the burners of the Hi-Delta effectively if there is too little flow through the heat exchanger.

The return temperature of the Hi-Delta ACE appliances is not allowed to stay below 40 C during continuous operation.

The return temperature of the Hi-Delta ACE appliances with E8 option is not allowed to stay below 49 C during continuous operation.

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1.5.4. Direct heating of domestic hot water



Every Hi-Delta is ideal for heating domestic hot water due to its glass lined cast iron headers, small volume copper or cupro-nickel heat exchanger tubes, easy access for cleaning the waterways, up to 10 bar opening pressure relief valve. It can be operated even at 80 °C supply temperatures continuously.

The supply water that comes from the drinking water system is heated directly in the very own heat exchanger of the Hi-Delta.

The water heater is to be connected to a proper sized domestic hot water storage tank (without inside heat exchanger). The water to be heated is circulated between the tank and the water heater by a pump built into the return water line upstream of the heater.

The thermostat of the storage tank starts the water heater when the temperature drops in the tank.

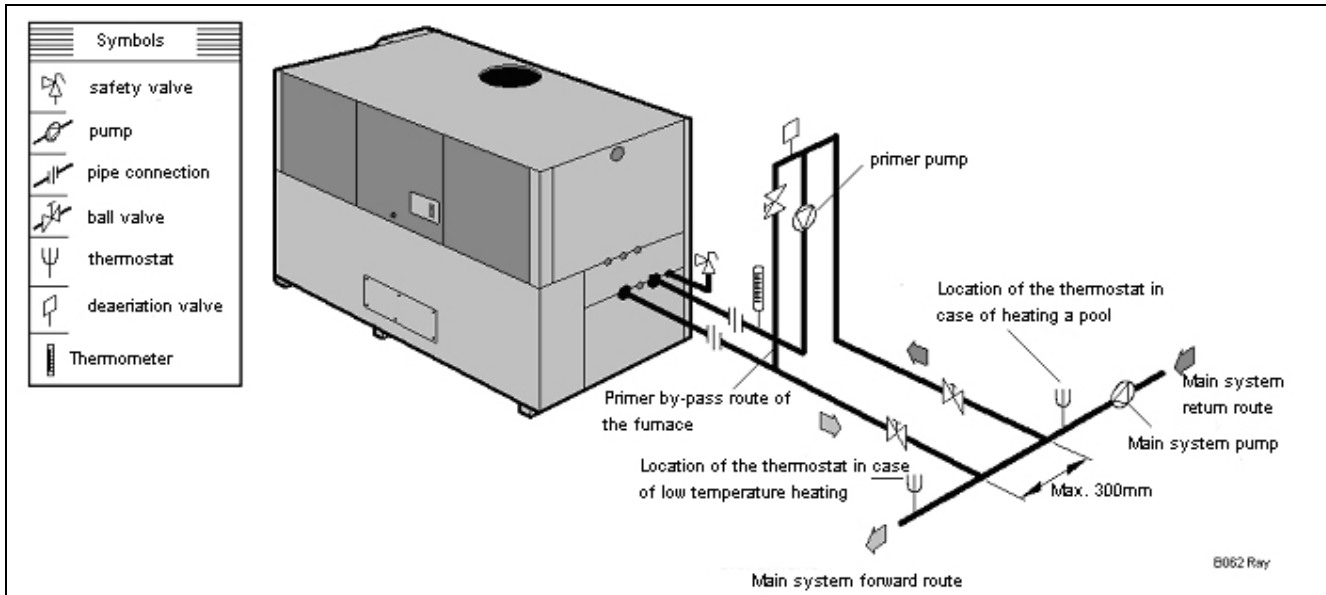
The operation of the pump is controlled by the Hi-Delta itself with the built-in 230/24 V relay.

The tank thermostat stops the water heater when the desired water temperature is reached.

The residual heat must be removed from the heat exchanger after the burners stop. The pump stops after overrunning for a time that can be adjusted on the pump relay between 1-10 minutes.

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1.5.5. Systems below 40 °C



Little temperature rise on the heat exchanger during operation, high insensitivity to condensation and wide operation range of the built in thermostats make Hi-Deltas suitable for operating in low temperature systems. Outlet temperatures below 40 °C are needed for swimming pool heating and some technological processes.

A main system pump must be built in. The operation of this pump must be a precondition for the operation of the appliance. A thermostat or a sensor must be built into the outgoing or return line of the main system to control the temperature of the heating substance. It secures that the appliance begins to operate on the right time.

The greatest allowed flow must be assured through the heat exchanger of the appliance during the operation of the burners to ensure that the temperature rise through the heat exchanger would be as little as possible. (See chapter 3.6.) The appliance must operate a primer pump by itself with its built in relay.

Either could the pump run continuously or intermittently so that it only starts when there is a heat demand and stops after all burner stages, overrunning for a time that can be adjusted on the pump relay between 1-10 minutes.

The residual heat will be utilized in the system not causing temporary temperature rise during the next restart.

The primer pump serves to take out a part of the colder heating substance from the main system to circulate it through the heat exchanger of the appliance then pouring it back into the main system mixed up with its flow to reach the desired outlet temperature that is less than 40 °C.

! The return temperature of the Hi-Deltas is allowed to be decreased to 40 °C only. Lower return temperature than this must be avoided because the water content of the flue gas begins to condensate on the heat exchanger. Soot begins to form on the heat exchanger that blocks the fins which is flammable. Operating the appliance in flue gas condensing mode continuously is not a normal operating condition therefore any fault that results from it is excluded from the warranty.

The simplest way to overcome this technical problem is to build a bypass line into the primer loop which mixes some portion of the heated liquid coming from the appliance to the colder flow arriving from the main system. The temperature of the heating substance will be increased this way. Proper adjustment of the valve in the bypass is important for the correct operation of the appliance. The valve must be opened until the inlet temperature of the appliance reaches minimum 40 °C. The adjustment can be done manually or by some automatic equipment. The built in flow switch prevents the operation for the burners of the Hi-Delta effectively if there is too little flow through the heat exchanger. Further flow switch can be used for proving the operation of the main system pump.

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1.5.6. Direct heating of swimming pools

Direct heating of the water for swimming pools is a typical example of low temperature applications. Below 40 °C Proper adjustment of the bypass valve is very important for the correct operation of the heater. The return water temperature entering the Hi-Delta must be minimum 40 °C.

The valve must be adjusted while

- the water in the swimming pool is cold,
- The water reaches its desired temperature.

The sensor must measure the inlet temperature of the heater when an automatic bypass valve is used. Continuous monitoring is not needed in this case. The water temperature of the swimming pool must be controlled by a thermostat built into the main system return line upstream of the heater. It secures that the heater begins operation at the right time. Chemical imbalance can cause serious damage to the heater and connecting equipment. The pH value of the water to be kept between 7,2 and 7,8 , the total alkalinity to be kept between 100 and 150 ppm.

Lime and scale will form on the inner surface of the heat exchanger and the efficiency of the appliance decreases if the mineral content of the water and the quantity of the dissolved solids becomes too high. All chemicals must be introduced and completely diluted into the pool water before being circulated through the heater. The use of automatic chlorinators and chemical feeders significantly increases the safety of operation. Chlorinators must feed downstream of the heater and have an anti-siphoning device to prevent chemical back-up into the heater when the pump is shut off. This problem of course does not occur if there is a separate line built for the heater only.

!	Hi-Deltas used for direct heating of swimming pools must be fitted with bronze headers flow-turning chambers and water connections to eliminate electrolytic corrosion.
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**RAYPAK HI DELTA BOILERS/WATER HEATERS
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2. TO THE ATTENTION OF THE USER

2.1. THINGS TO ARRANGE BEFORE THE FIRST OPERATION OF THE APPLIANCE

The installation of the Hi-Deltas must be executed by a qualified person only. The procedure must be permitted by the local gas supplier prior to the installation. The applying standards and local regulation must be respected. The installer has to notify the local gas supplier of the finish of the work. The gas supplier tests the pressure tightness of new gas pipes then connects them to the existing gas network. One of the authorized services must be called for the first operation of the appliance. The service person will check out the proficiency of the installation, connects electricity, starts up and tunes the appliance.

! First operation of the appliance is allowed to be executed by an authorized service only. The warranty period starts as of the date of the first operation. The service will charge you for first starting the appliance.

2.2. HOW TO OPERATE THE APPLIANCE

Before starting up the Hi-Delta:

- Make sure that the appliance and the whole hydraulic system is filled up with the proper heating substance!
- Check out and stop drippings on the hydraulic system!
- Purge out air from the hydraulic system! Air being strapped in the system may impede circulation.
- Purge out air from gas pipes!
- Check in the warranty leaflet if the first start up of the appliance was carried out by an authorized service. Check out that the appliance is adjusted to the same gas type being supplied!
- Have you looked over the operation instructions in this handling manual, which was supplied together with the appliance? Have you read the **"SAFETY INSTRUCTIONS 1.2."**? In case of any abnormality please call that service, which did the first start up of the appliance!

For turning on the appliance:

- Switch off every electric supply that leads to the appliance! Watch out for several electric supply sources might be! Take off the side panel of the electric control box!
- First turn the auto high limit to its lowest temperature setting! Push in the red button on the manual high limit to check out if it is not in locked position lockout! Turn the auto high limit to its desired operating temperature setting than turn the manual high limit to a temperature setting at least 5 °C higher to the auto high limit!
- Check out and the pump overrun time on the TD ECONO time delay relay! The value can be adjusted between 1-10 minutes.

- Switch on every electric supply leading to the appliance and power it by switching on the two poles rocker switch on the C rail! The "UNDER POWER" light goes on. Watch out for 230 V AC equipments operating in the control box from now!
- Turn the rocker switch located on the side of the appliance to "ON" position!
- Pushing the reset button of the ignition controller(s) located on the C rail can be released any ignition failure that could rise earlier. (It is also indicated by the "SAFETY" light.)
- Open the gas cock leading to the appliance!
- Wait five minutes allowing any eventual gas residue escaping! Check for smell of gas especially around the floor! Follow the procedures given at the **"SAFETY INSTRUCTIONS 1.2."** if you smell gas!
- Continue turning on the appliance if there is no smell of gas!
- Achieve heat demand by the proper setting of thermostats and stage controllers! The „HEAT DEMAND" light goes on.

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Do not attempt to ignite the burners with a match! The burners will be ignited automatically by the appliance when needed. The red colour "SAFETY" light on the side panel goes on in case of an ignition failure.

- The appliance begins the ignition sequence. The "FLOW" light goes on indicating that the pump is operating and there is a required amount of heating substance flow. The proper operation of the blowers is indicated by the appropriate "BLOWER" light turning on. All of the blowers in a given model must operate simultaneously. The number of the blowers differs model by model. The ignition glows up after the pre-purge time (in 15 seconds) the gas valve of the appropriate stage opens after the igniter reaches the necessary temperature. (in about 45 seconds) The green light of the appropriate "STAGE" indicates that a given stage is in operation. The appliance is ready for operation now and it will operate when there is a heat demand.
- Mount back the side cover of the electric control box! Check the following things if the appliance does not start or stops during the operation!
 - Burnt out fuses, cut-outs and switched off circuit breakers in the electric network leading to the appliance.
 - If any of the blowers is unable to produce the necessary pressure difference its "BLOWER" light goes off, the appliance stops in about 15 seconds and the "SAFETY" light goes on. Check and clean the air filter when needed! Check if the air system is blocked! Mount back the side cover of the electric control box and try again if the appliance is ready to operate!
 - The blowers are unable to forward any air when the flue system is blocked in 100%. The occurring error is the same as it was at the previous point. The "BLOCKED VENT" light is not lit.
 - The "BLOCKED VENT" light goes on when the flue system is blocked partially.

- If necessary the ignition sequence is repeated five times, then the appliance locks out in locked position if remote sensing is not established. The "SAFETY" light goes on. The ignition error can be reset by pushing the reset button located on the C rail. The appliance tries to start again in case of a heat demand.
- The manual high limit locks out the appliance in locked position if the temperature setting of it is lower than the setting of the auto high limit. (It is also indicted by red the "SAFETY" light.) Wait until the heating substance cools back then adjust the manual high limit to a temperature at least 5 °C higher than the value on the automatic high limit. Restart the appliance by pushing the red button on the manual high limit!
- The automatic high limit stopped the appliance because it is adjusted to a lower temperature than any external thermostat or stage controller connected. It is a general rule that the temperature setting of the automatic high limit must always be higher than the highest possible temperature allowed by an external thermostat or stage controller Adjust the Automatic high limit to a higher temperature value, as appropriate!
 - There is no gas!
 - The flow through the heat exchanger is not proper. The appliance does not start despite "POWER" and "HEAT DEMAND" lights are on. "FLOW" light is off. Check if the pump connected to the appliance is working and the position of the closing fittings in hydraulic system!
 - Call an authorized service if the appliance is still not working!
 - Follow the instructions at the „**HOW TO TURN OFF THE APPLIANCE 2.5,**” part and call an authorized service if the burners do not stay on after several attempts!

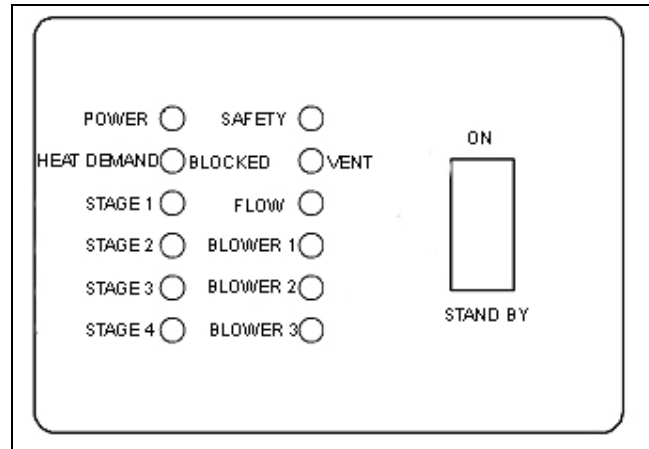


Repair and maintenance works during the warranty period are allowed to be carried out by an authorized service only. The list of the authorized services is included in the warranty card.

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WITH FAN ASSISTED PREMIX BURNERS**

2.3. OPERATION STATUS INDICATION

The actual operation status of the Hi-Delta 302ACE-2342ACE appliances is indicated through led panels on site. The Hi-Delta is an integrated system that controls its safe operation thoroughly. Forwarding the 24V AC collected error signal that applies on the ALARM output of the inner panel whenever the “SAFETY” light is on is an expedient compromise for building management systems. Each signal that is indicated on the outer panel can be forwarded to a building management system but it increases the costs significantly, while not giving any significant advantage in most cases. Knowing the meaning of the inner panel lights is unnecessary for the user. Detailed information about them can be found at 4.2.10.



Outer Panel Lights		
Light	Colour	Meaning
POWER	blue	Main power is on
HEAT DEMAND	yellow	External thermostat contacts are closed
BLOCKED VENT	red	Vent system is blocked
SAFETY	red	The appliance was stopped by one or more safety reason(s)
FLOW	green	Heating substance flow through the heat exchanger is present
BLOWER1	green	Blower 1. is on and pressure difference is present
BLOWER2	green	Blower 2. is on and pressure difference is present
BLOWER3	green	Blower 3. is on and pressure difference is present
STAGE1	green	1. stage is on
STAGE2	green	2. stage is on
STAGE3	green	3. stage is on
STAGE4	green	4. stage is on

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2.4. TEMPERATURE ADJUSTMENT

The selected outlet temperature is indicated on the circular scales of the automatic high limit and the manual high limit.

The temperatures can be adjusted by turning the knob.

The highest allowed outlet temperature in technological and heating systems is 105 °C, if all necessary technical conditions are given.

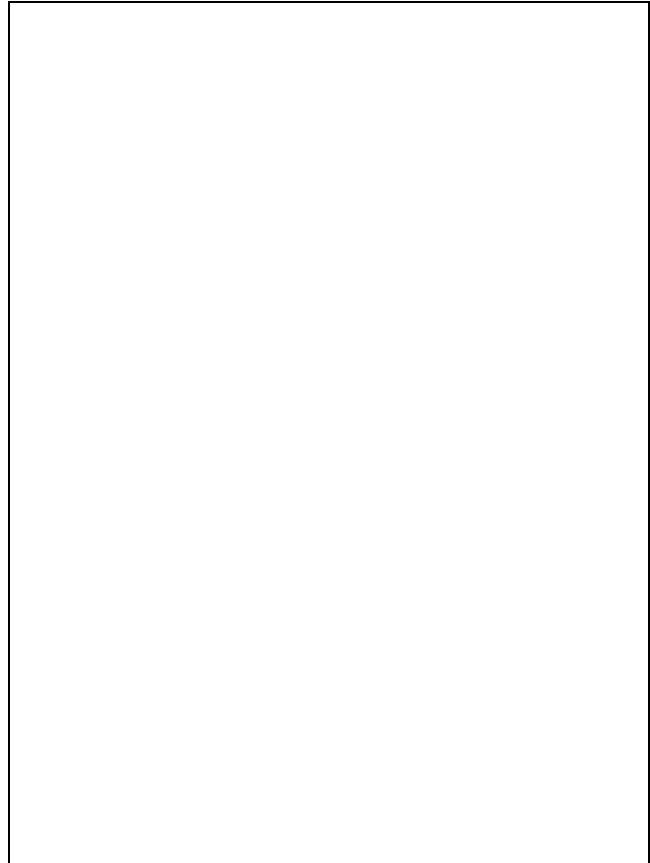
The highest allowed outlet temperature for commercial domestic hot water applications is 80 °C .

The highest allowed outlet temperature for direct heating of swimming pools is less than 60 °C .

Turn the knob of the automatic high limit to the desired value to select the outlet temperature!

The selected temperature of the automatic high limit shall be higher than the highest required temperature on any external thermostat or stage controller connected to the appliance otherwise the desired operating temperature will never be achieved!

The selected temperature of the manual high limit shall be at least 5 °C higher than the highest required temperature on the automatic high limit and any external thermostat or stage controller connected otherwise the appliance will lock out in locked position! Restarting the appliance is possible only by manual intervention. Wait until the heating substance cools back then adjust the manual high limit to a temperature at least 5 °C higher to the value on the automatic high limit. Restart the appliance by pushing the red button on the manual high limit!



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2.5. HOW TO TURN OFF THE APPLIANCE

1. Turn the rocker switch located on the side of the electric control box to "STANDBY" position. The burners stop immediately. The pump also stops after overrunning. Only the "POWER" light of the outer panel stays on. Caution! Some equipment is supplied with 230 V AC in the electric control box. It is worth leaving the appliance in this state because it is ready for immediate start after the rocker switch is being turned to "ON".
2. Wait before maintaining or repairing until the pump overruns then switch off every electric supply leading to the appliance. Take care that the appliance can be supplied from several electric sources!
3. Take off the side panel of the electric control box!
4. Adjust the automatic high limit to its lowest setting! Switch off the two pole switch located on the C rail!
5. Close the gas cock leading to the appliance!
6. Mount back the side panel of the electric control box! The appliance is turned off and power is cut off now.

! Danger of electric shock! Turning off more than one electric switch might be needed for cutting off power to the appliance.

2.6. UNUSUAL OCCURANCES

2.6.1. WATER VAPOUR PRECIPITATION, CONDENSATION

Water vapour precipitation only occurs if the appliance operates on abnormally low temperatures. Permanent condensation is harmful to the appliance. The return inlet temperature of Hi-Delta ACE models is not allowed to be less than 40 °C, or less than 49 °C at models with E8 efficiency option.

2.6.2. SMOKE AND SMELL

Experiencing a small amount of smoke and smell at the first start-up of the appliance is not extraordinary. This is a result of burning oil residues from the metal parts and it ends soon.

2.6.3. STRANGE NOISES

Noises due to thermal expansion during the warming or cooling phase, and the contact of given metal parts do not signal harmful or dangerous condition.

2.6.4. MANUAL HIGH LIMIT

This safety equipment cuts off gas supply to the burners if the outlet temperature exceeds the adjusted limit. Restarting the appliance is possible only by manual intervention. Wait until the heating substance cools back or adjust the manual high limit to a higher temperature and push the red button on the manual high limit! Call the service if the appliance cannot be started again!

! In case of overheating cut off all power supplies and also close the gas cock leading to the appliance!

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2.7. PERIODIC MAINTENANCES TO BE CARRIED OUT BY THE USER

- Check the air filter periodically! Clean it when needed! Remove obstacles, snow and ice from the way of the combustion air and flue gases!
- Keep the environment of the appliance clean and tidy!
- Keep away from flammable substances!
- Check the airtight proper level of heating substance in the hydraulic system! Check and identify the concentration and quality of the antifreeze in appliances installed outdoor in freezing environment! Take care of refilling when needed!
- Before starting up the gas appliance check if its pump is turning into the right direction, there is enough flow, there is not any dripping at pumps, safety relief valves and other fittings in the system!
- The heating substance shall be drained when the appliance is turned off in a freezing environment and the concentration of the antifreeze is not enough. Leave the drain valve open!
- The safety relief valve shall be operated at least once in a year manually!
- Visually inspect the area of the flue outlet for soot! Call the service to clean if needed! Small scale sediment is normal!
- Visually inspect the venting system for normal operation, deterioration or leakage!
- Suspect for periodic flue gas condensation if there is an erratic occurrence of ignition lock-outs! Eliminate the error by adjusting thermostats and controllers! Call the service to adjust the hydraulics when needed!

!	<p>Call an authorized service to execute the annual maintenance! Call an authorized service regularly to check and clean the heat exchanger tubes of domestic hot water/technological water heaters. The required frequency of the inspection depends on the quality of the water! The tubes can be cleaned mechanically or with descaler chemicals. Inspection and cleaning is possible by removing the header only opposite to the water connections. It is better anyway to remove both headers to see through the tubes and to avoid that removed scale could get into the hydraulic system. The use of releasable hydraulic connectors is reasonable.</p>
!	<p>Hot liquid can egress the water pressure relief valve. Discharge piping must be piped near the floor and close to a drain to avoid the possibility of any personal injury or property damage. The piping must be routed so that no discharged liquid could freeze in it.</p>

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3. TO THE ATTENTION OF THE INSTALLER

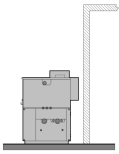
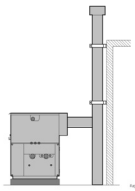
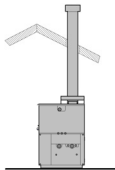
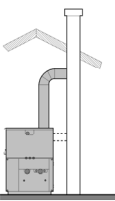
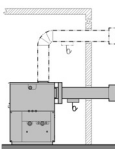
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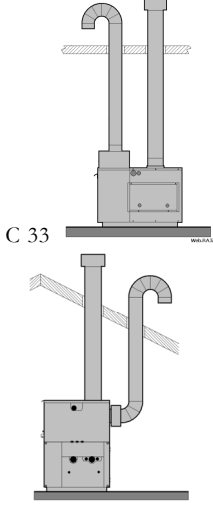

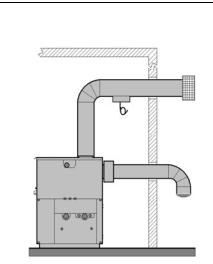
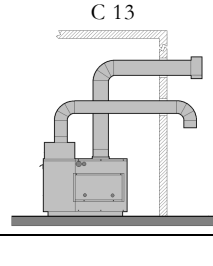
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3.1. VENTING SYSTEMS

EN 1443-2001	APPLIED STANDARD
T160	TEMPERATURE CLASS
N1	PRESSURE CLASS
O	RESISTANCE CLASS AGAINST SOOT FIRE
D	RESISTANCE CLASS AGAINST CONDENSATION
1	RESISTANCE CLASS AGAINST CORROSION
RXX	RESISTANCE AGAINST HEAT CONDUCTION
C60	REQUIRED DISTANCE FROM INFLAMMABLE MATERIALS

Combustion air supply/Flue gas exhaust method	General Layout for of the venting system	Vent type	Combustion Air intake material quality minimum requirements	Venting category material quality minimum requirements for EN 1443-2001
Air supply from outdoor, Flue gas exit to outdoor	Vertical vent with natural draft, negative pressure without flue baffle/deflector	Outdoor 	-	Factory supplied outdoor vent kit only
	Vertical vent (chimney stack) with natural draft, negative pressure without flue baffle/deflector	Outdoor 	-	EN1443-T160-N1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-N1-O-W-1-RXX-C60
Air supply from indoor, Flue gas exit to outdoor	Vertical vent with natural draft, negative pressure without flue baffle/deflector	 B 53	-	EN1443-T160-N1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-N1-O-W-1-RXX-C60
	Vertical vent (chimney stack) with natural draft, negative pressure without flue baffle/deflector	 B 23	-	EN1443-T160-N1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-N1-O-W-1-RXX-C60
	Horizontal through-the-wall venting with positive pressure	 B 53	-	EN1443-T160-P1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-P1-O-W-1-RXX-C60

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Air supply from outdoor, Flue gas exit to outdoor	Vertical vent with natural draft, negative pressure without flue baffle/deflector. Vertical combustion air supply from outdoor	 <p>C 33</p>	Galvanized steel, PVC, ABS, CPVC	EN1443-T160-N1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-N1-O-W-1-RXX-C60
	Vertical vent with natural draft, negative pressure without flue baffle/deflector. Horizontal combustion air supply from outdoor	 <p>C 53</p>	Galvanized steel, PVC, ABS, CPVC	EN1443-T160-N1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-N1-O-W-1-RXX-C60
	Horizontal through-the-wall venting with positive pressure. horizontal combustion air supply from outdoor	 <p>C 13</p>	Galvanized steel, PVC, ABS, CPVC	EN1443-T160-P1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-P1-O-W-1-RXX-C60
	Horizontal through-the-wall venting with positive pressure. vertical combustion air supply from outdoor	 <p>C 53</p>	Galvanized steel, PVC, ABS, CPVC	EN1443-T160-P1-O-D-1-RXX-C60 With E8 efficiency option: EN1443-T140-P1-O-W-1-RXX-C60

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3.1.1. Changing the flue outlet on site of the installation

Follow these instructions to change the flue connection from the standard top location to the rear of the appliance (when the optional vent tee is ordered).

- Turn off every electric supply leading to the appliance!
- Close the gas cock leading to the appliance!
- Remove the screws, gaskets and round dustcover from the rear of the heater!
- Remove the screws, stainless steel flue cover and gasket from the branch side of the tee located in the flue box at the rear of the appliance!
- Remove the screws, retaining ring and rain gasket from the top of the appliance!
- Remove the screws, flue collar and gasket from the run side of the tee located in the flue box on the top of the appliance!
- Reverse the components and reattach them so that the flue outlet would be on the rear of the appliance and the stainless steel flue cover would close the top of the tee! Make sure that the gaskets are perfectly sealed to avoid any flue gas spillage! The silicone vent gaskets must be faultless. Replace any torn or worn vent gaskets!
- Mount the retaining ring, rain gasket and screws to the rear of the appliance! Mount the gaskets, round dustcover and screws to the top of the appliance!

3.1.2. Reversing the air filter on site of the installation

The air filter, located on the left end of the appliance by the manufacturer, can be changed to the other end on the site of the installation.

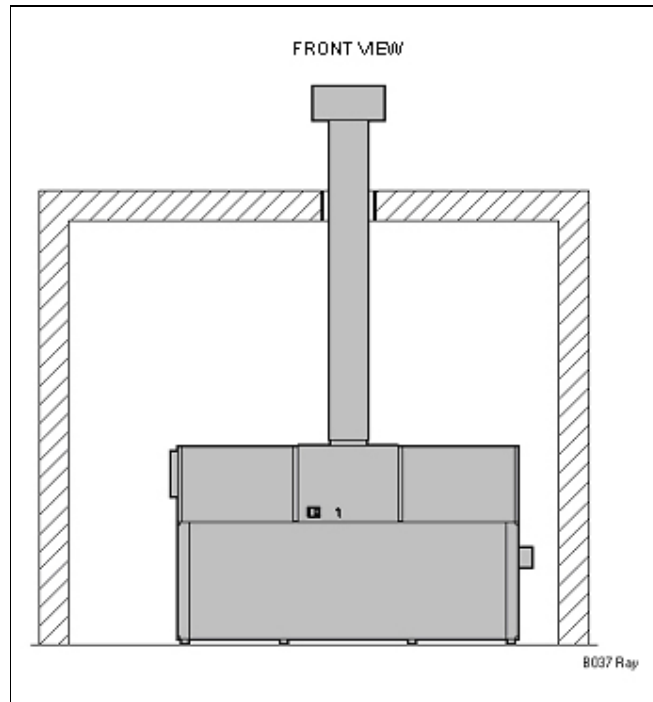
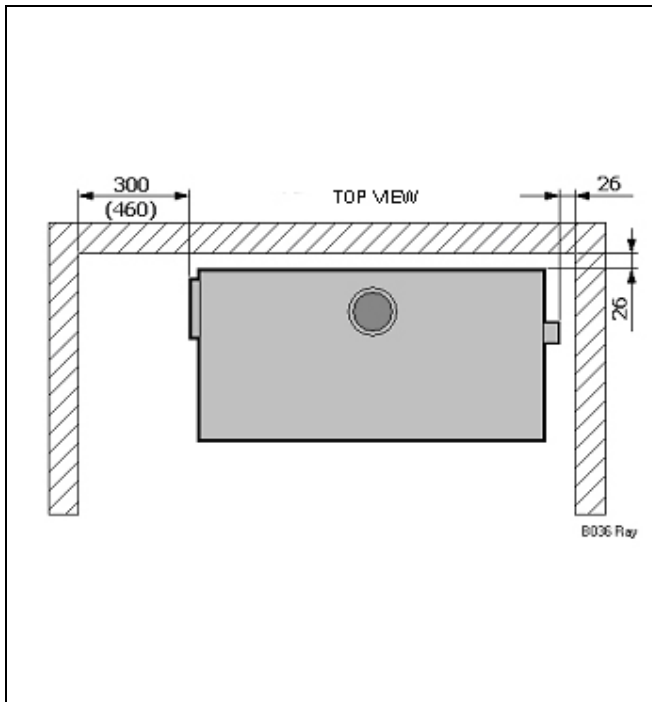
- Remove the four screws and the dust cover from the right hand side of the appliance!
- Remove the four screws and the air filter bracket from the left-hand side of the appliance!
- Reverse the components and reattach in the new location, making sure that the yellow cadmium-plated screw on the air filter locking bracket is on the bottom! (The air filter locking bracket is reversible.)

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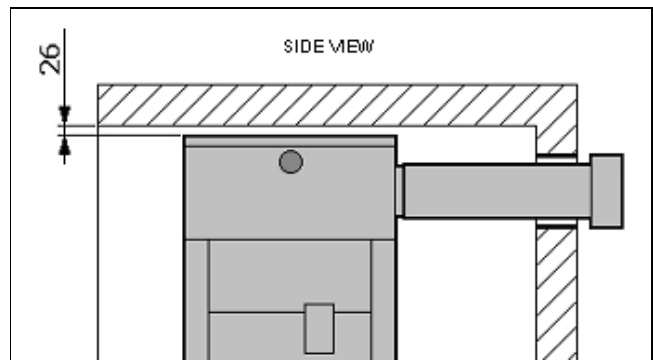
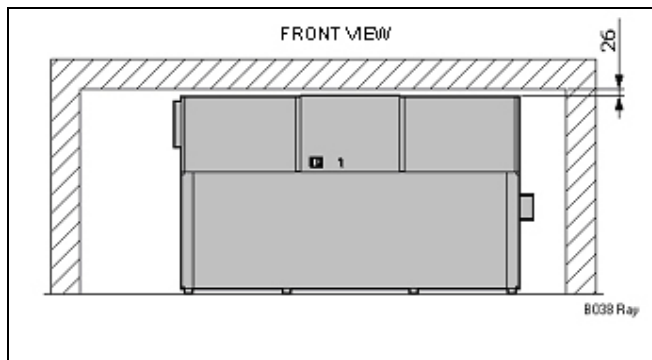
3.2. INDOOR INSTALLATION

- The appliance(s) can be installed in „D” fire hazard category boiler room, mounted on a level, structurally sound surface, in respect to the clearance requirements of the manufacturer and the applying standards and codes.
- When installed according to the minimum safety clearances in the following lists these appliances can still be serviced without removing permanent structural construction around them. However, for ease of servicing, it is recommended to keep a

- clearance of 700 mm in front and at least 460 mm on the water connection side. This will allow the appliance to be serviced in its installed location without movement or removal of it.
- Service clearances less than the minimums may require removal of the appliance to service either the heat exchanger or the burner tray. In either case, it must be installed in a manner that will enable servicing without removing any permanent structure around.



Minimum Clearance from Combustible Surfaces (mm)	
Floor	Not to be installed on combustible surfaces!
Rear	26
Water connections end	300 (460 recommended)
Opposite end	26
Top	26
Flue pipe	60



**RAYPAK HI DELTA BOILERS/WATER HEATERS
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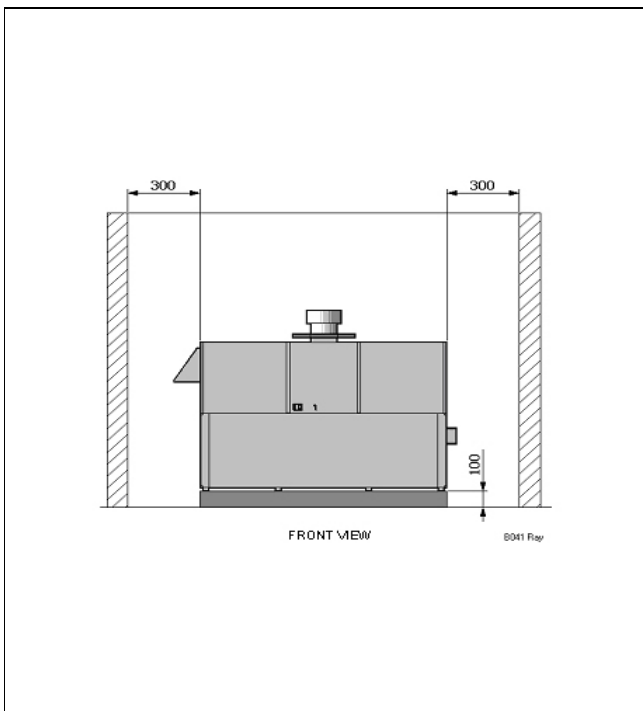
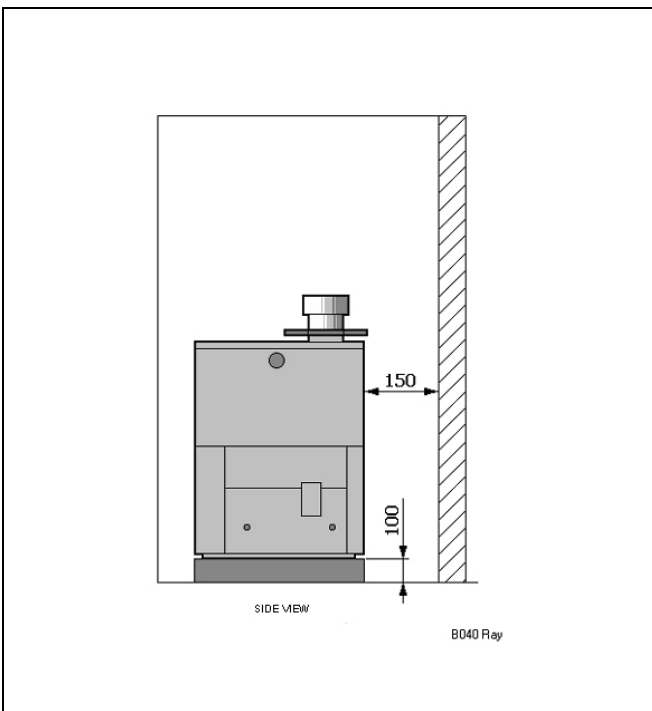
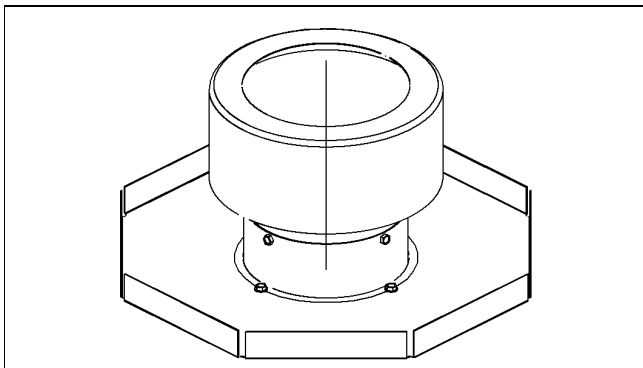
3.3. OUTDOOR INSTALLATION

! The factory supplied air filter must always be used on appliances installed outdoors.

The Hi-Delta appliances are designed for many years of trouble-free and economic outdoor operation. (Water protection: IP X4)

3.3.1. Outdoor installation without chimney

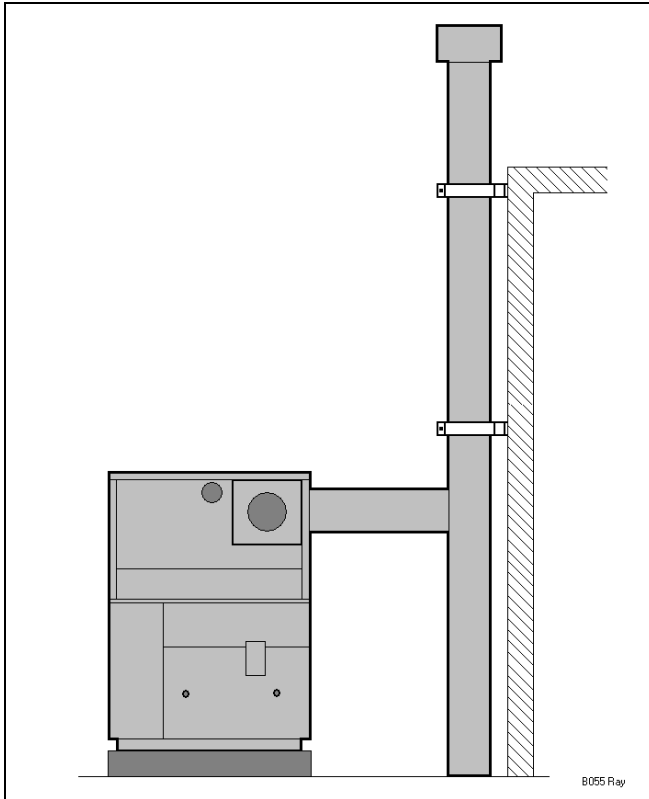
! Appliances installed outdoors do not need any chimney basically but the factory supplied outdoor vent kit must always be installed on the top of the appliance in such case. The factory supplied air filter must always be used on appliances installed outdoors. The factory supplied air filter outdoor cover must always be mounted over the air filter on appliances installed outdoors. Neglecting it might result the blockage of the air filter and stopping of the appliance while in operation!



Minimum Clearance from Combustible Surfaces (mm)	
Rear	300
Water connections end	300
Opposite end	150
Top	Unobstructed!
Flue pipe	Not applicable!

**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

3.3.2. Outdoor installation with chimney



Minimum Clearance from Combustible Surfaces (mm)	
Rear	26
Water connections end	300
Opposite end	26
Top	26
Flue pipe	60

reach over, care must be taken that it cants toward the sides to divert rainwater from the appliance. The use of frost-proof concrete is recommended or a structural steel construction is advised when the weight matters.

7., Outdoor running pipes are advised to be heat insulated and their length to be minimized. (Heat insulating the pipes alone is not enough protection against freezing.)

Further considerations regarding outdoor installations:

- 1., The appliances must not be installed in the reach of inflammable or explosive gases.
- 2., They must not be located in air streams containing any of the gases of the following chemicals: Freon, calcium-chloride, potassium-chloride, carbon-tetra-chloride, chlorine, halogens refrigerants, per chlorine-ethylene, trichlorine-ethylene, hydrochloric-acid, ethylene-dichloride, and photo chemicals. Such air is not harmful for humans but the chemicals in it react with the gas flame creating corrosive materials, which shorten the lifetime of any gas appliance.
- 3., They must be saved from mechanical injury or other damages due to illegal entering. (Low brick wall, safety post, fence, etc.)
- 4., They must be located so that they could not cause any damage to the environment in case the pressure relief valve opens.
- 5., Employ a proper gutter-overhang to avoid that the roof water could flow on the appliance! If you want to raise a roof over the appliance for any reason (falling ice, etc.) it must have at least three sides open and the lower edge of the roof must be at least 1 m higher to the top of the outdoor vent kit.
- 6., Appliances installed outdoors must be mounted on a level, structurally sound surface that is not combustible and at least 100 mm higher to its environment to prevent that precipitation could gather under the appliance. It is not reasonable or advised that the base would reach over the ground-space of the appliance. In case the base would

8., The rest of the heat engineering equipment is advised to be installed inside the building except some proper IP protected pumps, flow switches, level switches, thermostats, sensors for stage controllers, air purging valves, etc.

**RAYPAK HI DELTA BOILERS/WATER HEATERS
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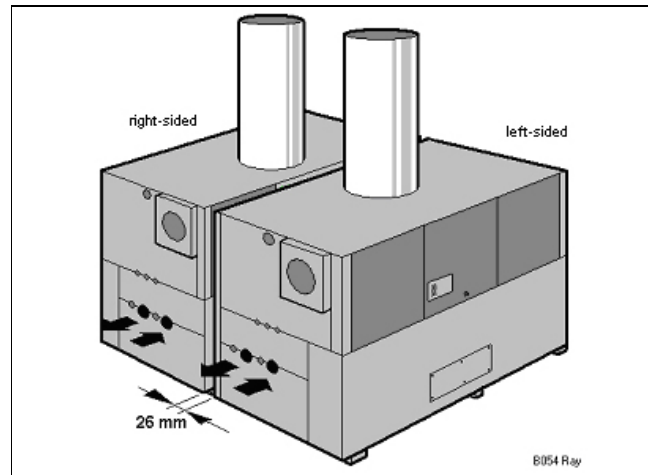
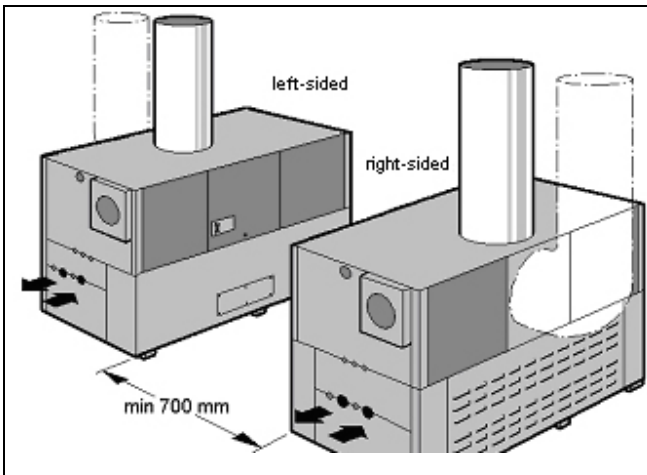
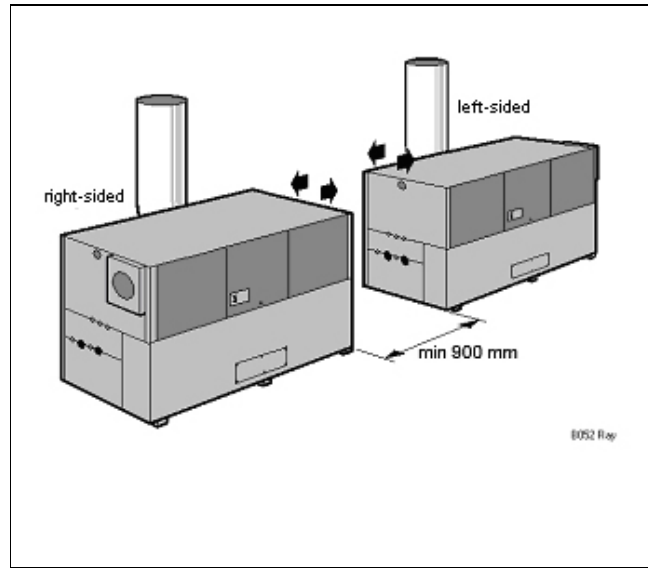
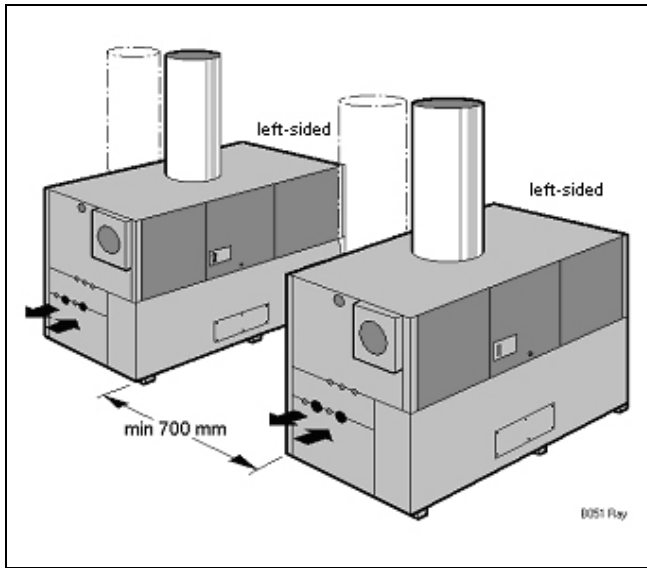
3.4. INSTALLING A GROUP OF APPLIANCES

Bronze or glass lined cast iron headers close the ends of the heat exchangers, which might be interchanged on the site of the installation easily after being removed by unscrewing some octagonal nuts. Many installation arrangements can be realized simply by changing the headers. Reversing the water connection side during the warranty period is allowed by an authorized service only.

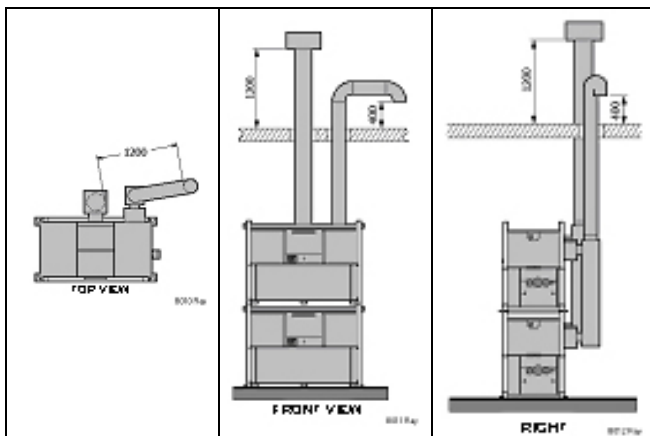
The appliance is called to be left-handed if the water connections are to your left when facing the front of the unit. This is the standard arrangement the manufacturer supplies. Right-handed appliances are the opposite naturally. The following clearances are recommended for servicing and proper air supply.

**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

3.4.1. Group of appliances located next to each other, connected to flue pipes



3.4.2. Two appliances located over each other in a boiler room



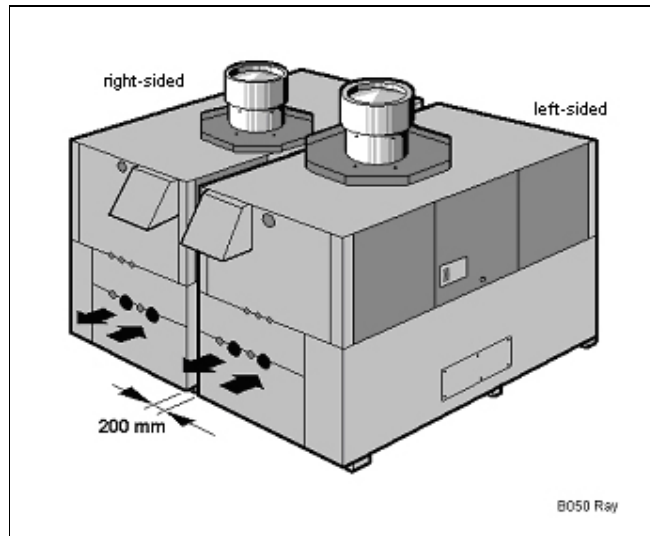
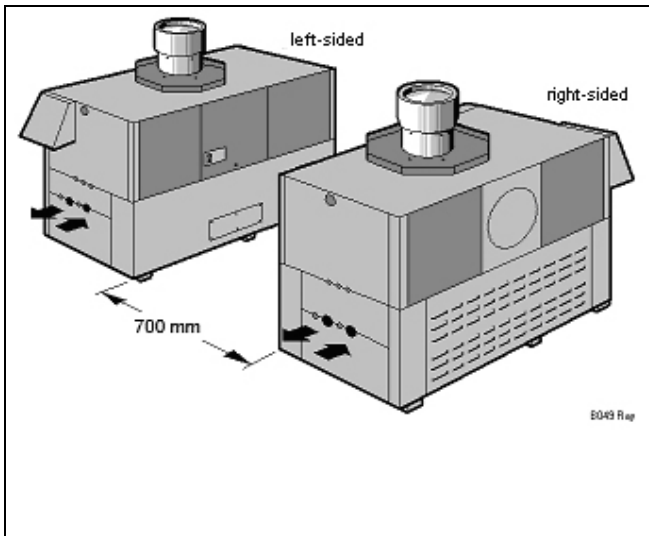
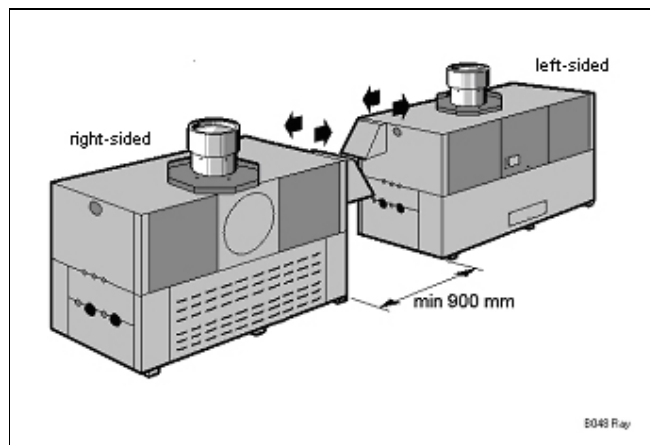
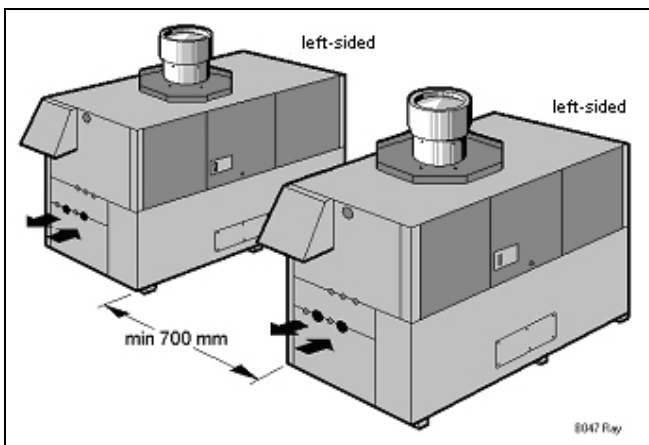
Two appliances can be stacked over each other in the boiler room on a rack.

**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

3.4.3. Group of appliances located next to each other, connected to the factory supplied outdoor vent kit

! Appliances installed outdoors do not need any chimney basically but the factory supplied outdoor vent kit must always be installed on the top of the appliance in such case. The factory supplied air filter must always be used on appliances installed outdoors. The factory supplied air filter outdoor cover must always be mounted over the air filter on appliances installed outdoors. Neglecting it might result the blockage of the air filter and stopping of the appliance while in operation!

Outdoor installed appliances can be connected to a properly heat insulated flue system when it is needed. For further information refer to 3.1. and 3.3.2. For minimum clearance requirements see 3.4.1.



**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

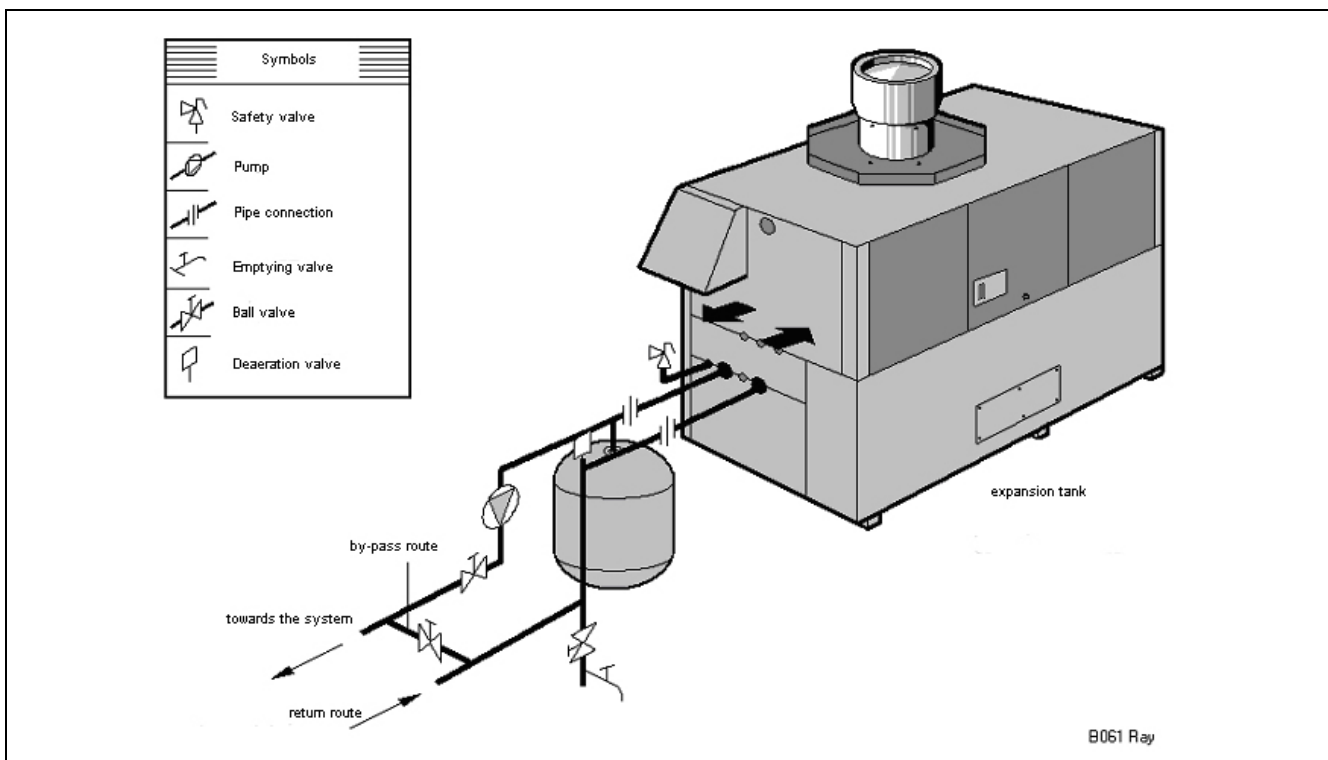
3.5. WATER PIPING

Thanks to the excellent heat conductivity of their copper heat exchanger, the Hi-Deltas contain very little amount of water and have low mass therefore their standby loss is negligible, which is a very great advantage when they are used as an outdoor boiler.

! Appropriate heating substance flow must be assured through the heat exchanger of the Hi-Delta during the operation of the burners.

Flow rates are recommended to be kept between „**Minimum Flow**” and „**Maximum Flow**” values as indicated in the tables below.

The design flow rate must be increased in systems with antifreeze as necessary. Install a bypass with a manual ball-valve, as it is shown on the following drawing, if the designed temperature difference (ΔT) between the fore and the return of the heating system is bigger as it is recommended for the Hi-Delta! The proper ΔT of the appliance can be adjusted during the first start-up by this means.



Between the Hi-Delta and the bypass:

- Do not decrease the pipe size below the outlet/inlet diameter except at the connections of the primer pump if it is reasoned by the flange of the pump!
- Minimize the pipe length!
- Do not install check-valve into this section!

The bypass line and the further sections of the heating system can be sized to the usual pressure drop of 5-20 mmH₂O/m and the pipe diameters can be decreased accordingly. Check-valves shall be installed also into these sections if they were needed for the application!

! Slow operating mixing valve must not be installed between the Hi-Delta and the primer pump because it decreases the flow rate through the heat exchanger temporarily.

The flow rate through the heat exchanger shall not exceed the “Maximum Flow” in any operating mode!

The corrected design flow rate shall not exceed the “Maximum Flow” at outdoor applications using antifreeze! This correction is needed because antifreeze/water mixture transfers heat worse than pure water.

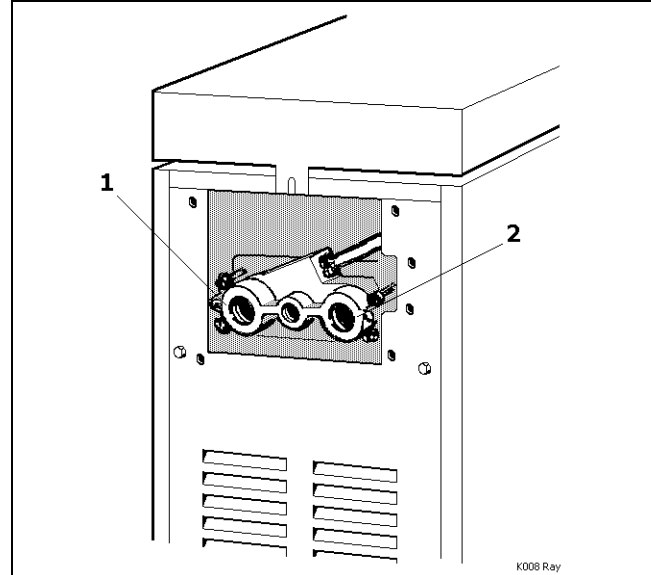
**RAYPAK HI DELTA BOILERS/WATER HEATERS
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Water hardness must be considered when selecting design flow rate for a Hi-Delta installed for direct heating of domestic hot water.

The water connections must be installed in a way that they could be disconnected from the heater easily for servicing the heat exchanger. The use of releasable pipe connections is recommended at the outlet and the inlet of the appliance.

The water outlet is marked with the word „OUT” the inlet is marked with the word „IN” on the cast of the header. The left side connector is for the outlet **(1)** the right side connector is for the inlet **(2)** when facing the water connection header. The side of the water connection can be reversed on the site of the installation as written at point 4.5. Reversing the water connection side during the warranty period is allowed by an authorized service only.



The water connectors of the Hi-Deltas have NPT threads, which can be confused with GAS thread. Although they look similar they are different therefore they must not be replaced. Please use the NPT adapter supplied with the appliance. Contact the dealer or an authorized service when you are in doubt!

Install manual closing valves into the outlet- and inlet-line of the appliance that it could be disconnected when servicing!

The safety relief valve is located on the water connection header. The axis of it must be vertical. The combined temperature/pressure gauge is located on the header too.



Plugging the outlet of the pressure relief safety valve IS FORBIDDEN.

Installing a safety valve with an opening pressure over 10 bars IS FORBIDDEN because it might cause damage to the appliance. Discharge piping must be piped near the floor and close to a drain to avoid the possibility of any personal injury or property damage. The piping must be routed so that no discharged liquid could freeze in it.

PAY ATTENTION! Hot liquid can egress the water pressure relief valve.

**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

3.6. FLOW RATE DEMANDS FOR HEATING APPLICATIONS

The data in the tables refer to pure water.

Flow rate: m³/h

Pressure drop through the appliance: kPa

Outlet/inlet temperature difference, ΔT : °C

The flow switch will not operate if flow rate is less than 4,6 m³/h.

N/A – Not applicable

Model	ΔT 11 °C		ΔT 17 °C		ΔT 22 °C		Minimum Flow			Maximum Flow		
	m ³ /h	kPa	m ³ /h	kPa	m ³ /h	kPa	m ³ /h	kPa	ΔT °C	m ³ /h	kPa	ΔT °C
302 ACE	5,7	2,4	N/A	N/A	N/A	N/A	4,6	1,5	14	20,5	29,4	3
402 ACE	7,8	4,2	5,0	1,8	N/A	N/A	4,6	1,5	19	20,5	30,0	4
502 ACE	9,6	6,9	6,4	3,3	4,8	1,8	4,8	1,8	22	20,5	31,2	5
652 ACE	12,5	12,3	8,2	5,4	6,2	3,3	6,2	3,3	22	20,5	32,4	7
752 ACE	14,4	17,1	9,6	7,8	7,3	4,5	7,3	4,5	22	20,5	33,9	8
902 ACE	17,3	24,9	11,4	11,4	8,7	6,6	8,7	6,6	22	20,5	35,1	9
992 ACE	18,9	15,6	12,5	6,9	9,6	3,9	9,6	3,9	22	30,1	39,3	7
1262 ACE	24,2	28,8	16,2	12,9	12,1	7,2	12,1	7,2	22	30,1	44,4	9
1532 ACE	29,4	47,1	19,6	21,3	14,6	12,0	14,6	12,0	22	30,1	49,5	11
1802 ACE	N/A	N/A	23,0	32,1	17,3	18,0	17,3	18,0	22	30,1	54,9	13
2002 ACE	N/A	N/A	25,5	41,4	19,2	23,7	19,2	23,7	22	30,1	57,0	14
2072 ACE	N/A	N/A	26,4	44,4	19,8	25,5	19,8	25,5	22	30,1	57,0	14
2342 ACE	N/A	N/A	30,1	64,2	22,3	36,3	22,3	36,3	22	30,1	64,2	17

Model	ΔT 11 °C		ΔT 17 °C		ΔT 22 °C		Minimum Flow			Maximum Flow		
	m ³ /h	kPa	m ³ /h	kPa	m ³ /h	kPa	m ³ /h	kPa	ΔT °C	m ³ /h	kPa	ΔT °C
302 ACE E8	5,9	2,7	N/A	N/A	N/A	N/A	4,6	1,5	14	20,5	29,4	3
402 ACE E8	7,8	4,5	5,2	2,0	N/A	N/A	4,6	1,5	19	20,5	30,0	4
502 ACE E8	9,6	7,5	6,6	3,3	5,0	1,9	5,0	1,9	22	20,5	31,2	6
652 ACE E8	12,5	13,2	8,7	6,0	6,4	3,3	6,4	3,3	22	20,5	32,4	7
752 ACE E8	14,4	18,3	10,0	8,4	7,5	4,8	7,5	4,8	22	20,5	33,9	8
902 ACE E8	17,3	26,7	11,9	12,3	8,9	6,9	8,9	6,9	22	20,5	35,1	9
992 ACE E8	19,6	16,8	13,0	7,5	9,8	4,2	9,8	4,2	22	30,1	39,3	7
1262 ACE E8	25,1	30,9	16,6	13,8	12,5	7,8	12,5	7,8	22	30,1	44,4	9
1532 ACE E8	30,1	49,5	20,3	22,8	15,3	12,9	15,3	12,9	22	30,1	49,5	11
1802 ACE E8	N/A	N/A	23,7	34,5	17,8	19,5	17,8	19,5	22	30,1	54,9	13
2002 ACE E8	N/A	N/A	26,4	44,4	19,8	25,5	19,8	25,5	22	30,1	57,0	14
2072 ACE E8	N/A	N/A	27,4	47,4	20,5	27,3	20,5	27,3	22	30,1	57,0	15
2342 ACE E8	N/A	N/A	N/A	N/A	23,3	38,7	23,3	38,7	22	30,1	64,2	17

**RAYPAK HI DELTA BOILERS/WATER HEATERS
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3.6.1. Freeze protection for outdoor boilers

Outdoor running pipes are advised to be heat insulated and their length to be minimized.



Heat insulating the pipes alone is not enough protection against freezing.

Freeze protection of the outdoor appliances is advised to be achieved by using a mixture of 40-50% concentration ethylene- or propylene-glycol and water, frost-protection thermostats or the combination of them. **Non-toxic propylene-glycol** must be used for **indirect heating of domestic water**, whenever direct contact with food or accidental contact with potable water can happen.

Consider higher viscosity, higher density and lower heat conductivity of glycol compared to water when selecting pumps for antifreeze systems. Both the flow rate and the pressure drop of the hydraulic system must be multiplied by the factors in the following table. The resulted flow rate must not exceed the "Maximum Flow"! The resulted greater values must be introduced into the graphs of the pumps applying to pure water.

Glycol	Rate of Heat Transfer at 80 °C Compared to the same Rate of Flow of Pure Water	Multiplying Factor of the Design Flow Rate			Multiplying Factor of the Pressure Drop		
		at 40 °C	at 60 °C	at 80 °C	at 40 °C	at 60 °C	at 80 °C
Ethylene-	87%	1,16	1,15	1,14	1,49	1,32	1,23
Propylene-	90%	1,14	1,12	1,10	1,32	1,27	1,23

The values apply to 50% concentration of glycol

3.7. FLOW RATE DEMANDS FOR DIRECT HEATING OF DOMESTIC HOT WATER

Model	Pipe Ø (")	Soft Water				Medium Water				Hard Water			
		ΔT (C)	m3/h	Pressure Drop through Heat Exchanger (kPa)	Total System Pressure Drop (kPa)	ΔT (C)	m3/h	Pressure Drop through Heat Exchanger (kPa)	Total System Pressure Drop (kPa)	ΔT (C)	m3/h	Pressure Drop through Heat Exchanger (kPa)	Total System Pressure Drop (kPa)
302ACE	2	7	9,1	6,0	12,9	6	11,9	9,9	21,3	3	20,5	29,4	60,9
402ACE	2	9	9,1	6,0	13,2	7	11,9	10,2	21,6	4	20,5	30,0	61,5
502ACE	2	12	9,1	6,3	13,5	9	11,9	10,5	22,2	5	20,5	31,2	62,7
652ACE	2	16	9,1	6,6	13,8	11	12,5	12,3	25,2	7	20,5	32,4	63,9
752ACE	2	17	9,6	7,8	15,6	11	14,4	17,1	33,3	8	20,5	33,9	65,4
902ACE	2	17	11,6	11,7	22,8	11	17,3	25,2	48,3	9	20,5	35,1	66,6
992ACE	2 ½	16	13,7	8,1	13,8	11	18,9	15,6	25,8	7	30,1	39,3	63,0
1262ACE	2 ½	17	16,4	13,2	21,0	11	24,2	28,8	44,4	9	30,1	44,4	68,1
1532ACE	2 ½	17	19,6	21,3	32,1	11	30,1	49,5	73,2	11	30,1	49,5	73,2
1802ACE	2 ½	17	23,0	32,1	46,5	13	30,1	54,9	78,3	13	30,1	54,9	78,3
2002ACE	2 ½	17	25,5	41,7	59,1	14	30,1	57,0	80,7	14	30,1	57,0	80,7
2072ACE	2 ½	17	26,4	44,4	63,0	15	30,1	57,0	80,7	15	30,1	57,0	80,7
2342ACE	2 ½	17	30,1	64,2	87,9	17	30,1	64,2	87,9	17	30,1	64,2	87,9

Cupro-nickel heat exchanger shall be used with hard water! Total System Pressure Drop includes the pressure drop through a 7,5 m equal length pipe system and a storage tank.

**RAYPAK HI DELTA BOILERS/WATER HEATERS
WITH FAN ASSISTED PREMIX BURNERS**

3.8. GAS SUPPLY

3.8.1. Maximum gas supply pressure

! The supply pressure measured at the inlet of the gas valves shall never exceed 200 mbar! Exceeding gas pressures can damage the gas valves. The PB gas operated appliances differ from those intended for natural gas. Appliances intended for one gas type cannot be operated on another gas without being converted. Never attempt to do so because it may be life-threatening! Converting the appliance to other gas type is allowed only by an authorized service listed in the warranty.

The nominal inlet gas pressure is 25/20 mbar for natural gas and 50 mbar for Propane or Propane-Butane.

3.8.2. Gas supply connection, reversing the side of the gas connection on site of the installation

The gas supply pipe system is allowed to be installed according to the regulations of the referring authorities only.

Install a manual gas valve in the gas supply pipe leading to the appliance. (The manual gas valve is not included in the appliance.) Before connecting the appliance, please clean the inside of the new pipes with compressed air and also make sure that the gas supply pressure is correct. The new gas supply pipe must be connected to the appliance by the installer. The side of the gas connection can be easily reversed on the site of the installation.

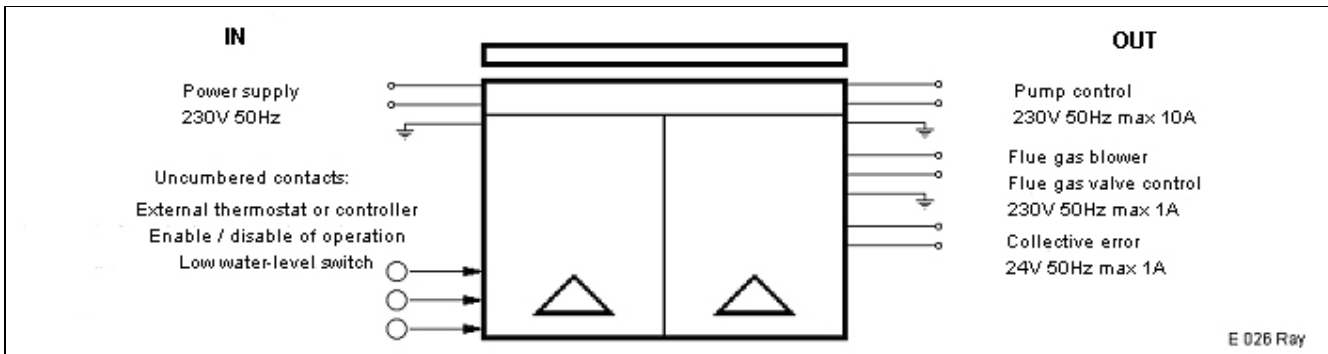
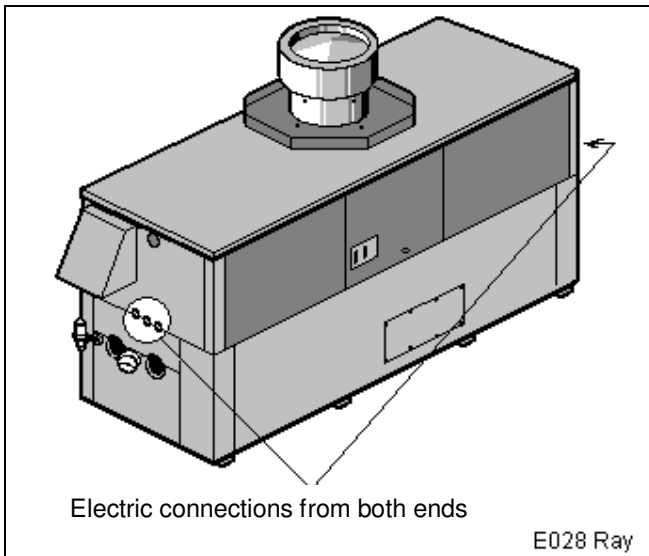
- Disconnect all electrical power from the appliance if applicable!
- Remove the upper service panels from the two sides on the front of the appliance!
- Remove the gas supply pipe from one end of the upper gas manifold if it were installed before!
- Remove the pipe cap from the opposite end of the upper gas manifold and reinstall to the former end of the gas supply pipe!
- Remove the rubber grommet and the plastic cap from the gas supply connection openings located on the side panels and interchange them!

- Install the gas supply pipe to its new side leading it through the rubber grommet! Use a coupling to connect it to its new end on the upper gas manifold!
- Make sure that the gas supply pipe is concentric with the gas supply opening and the rubber grommet seals properly! Take care that the plastic cap seals the opposite end gas supply opening perfectly!
- Replace both upper service panels!

! The supply pressure measured at the inlet of the gas valves shall never exceed 200 mbar! Exceeding gas pressures can damage the gas valves. Test the new gas line for leaking after it is ready! Keep the appliance disconnected by closing the manual gas valve. The first starting of the appliance is allowed to be executed by an authorized service only! The service will charge you for first starting the appliance.

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WITH FAN ASSISTED PREMIX BURNERS**

3.9. POWER SUPPLY



Electric supply demand for the appliance: 230V / 50Hz.
 Input demand: The own input demand of the gas appliance plus the input demand of external equipment supplied from the appliance, the such as 230V / 50Hz-es pumps, etc.
The appliance has IP X4 protection rating. The electrical connections and the grounding have to meet the requirements of the applying standards. Installing a ground wire connected to a proper earth is compulsory. Use separate electric line(s) with own electric protection for connecting the gas appliance(s), stage controllers, and further auxiliary equipments to the grid!

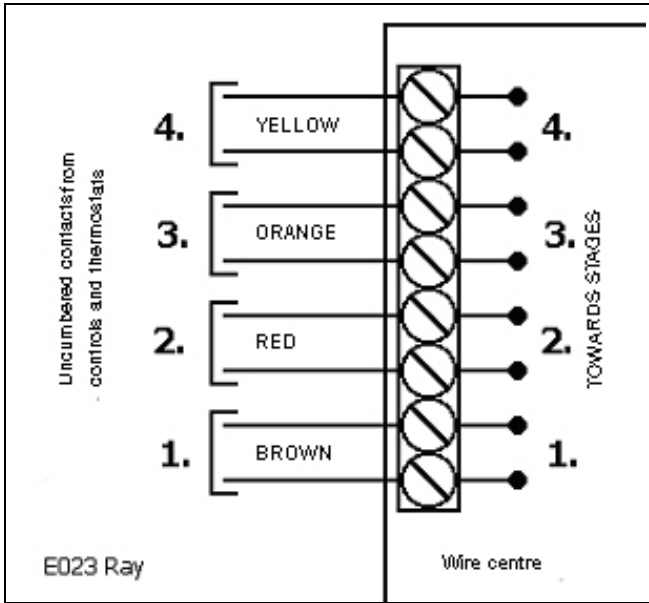
These electric lines must be separable from the grid one by one. They must be connected permanently via double pole disconnecting switches having at least 3mm contact gaps, meeting the applying standards! It is strongly recommended that all individually-powered control modules and the gas appliance(s) should be connected to the same electric source. Pay attention that the electric cables are connected into the appliance via glands to free the connections from tension and twist.

! There are polarity sensitive electronic equipments built into this gas appliance. Electrical connection of the gas appliance during the warranty period is allowed by an authorized service only.

! Disconnect all electric lines leading to the gas appliance before beginning any work in the electrical control box.

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WITH FAN ASSISTED PREMIX BURNERS**

3.9.1. External thermostat or stage-controller via voltage-free contacts



The Hi-Delta will operate as a multi-stage appliance when the appropriate burner stages of it are connected to an external multi-stage thermostat or stage-controller. The 1st stage of the controller must be connected to the first burner stage of the appliance,

the second stage of the controller must be connected to the second burner stage, and so on.

One thermostat or controller stage can control several burner stages, if the thermostat or the controller stage is connected to the lowest of the burner stages intended to be operated together and the other stages must be jumpered.

For example: Four stage Hi-Delta can be operated as a two stage boiler so that the 1st and 2nd burner stages are to be started by the 1st stage of an external stage controller. The 1st stage of the stage controller must be connected to the 1st burner stage and the 2nd burner stage must be jumpered for this.

The 3rd and 4th burner stages shall be started by the 2nd stage of the controller! The 2nd stage of the controller must be connected to the 3rd burner stage and the 4th burner stage must be jumpered for this! There are configurations, which are possible at some models only. See at 4.2.4.

! Only voltage-free contacts are allowed to be connected to the burner stages. The connection of external stage controllers or thermostats is allowed to be carried out only by an authorized service.

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WITH FAN ASSISTED PREMIX BURNERS**

3.9.2. Pump control via 230V 50Hz output

Detailed description at 4.2.3.

!	Check if the fuse or circuit breaker leading to the appliance is big enough to handle the total load of the gas appliance and the pump! Connecting electric wires into the appliance is allowed to be carried out by an authorized service only.
----------	--

3.9.3. Enabling/disabling of the operation via voltage-free contacts

Detailed description at 4.2.5.

!	Connecting external voltage or electrical load between the contacts of the enable/disable terminal is forbidden because it can cause failure to the gas appliance. Attention! The appliance is under power while the operation is disabled. Connecting electric wires into the appliance is allowed to be carried out by an authorized service only.
----------	--

3.9.4. Collected error signal via 24V 50Hz output

Detailed description at 4.2.6.

!	Connecting external voltage or short circuit between the contacts of the alarm terminal is forbidden because it causes failure to the gas appliance. Connecting electric wires into the appliance is allowed to be carried out by an authorized service only.
----------	---

3.9.5. External low water cut-off switch via voltage-free contacts

Detailed description at 4.2.7.

!	Connecting external voltage or electrical load between the contacts of the low water cut off terminal is forbidden because it can cause failure to the gas appliance. Attention! Connecting electric wires into the appliance is allowed to be carried out by an authorized service only.
----------	---

3.9.6. External flue gas damper and fan control

Detailed description at 4.2.8.

!	Connecting external voltage or short circuit between the contacts of the external flue gas damper and the fan control terminal is forbidden because it causes failure to the gas appliance. Connecting electric wires into the appliance is allowed to be carried out by an authorized service only.
----------	--

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4. TO THE ATTENTION OF THE SERVICE

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The works described in this chapter are allowed to be carried out only by an authorized service during the warranty period of the gas appliance. Neglecting this rule results the loss of warranty.



The works described in this chapter are allowed to be carried out only by a qualified person over the warranty period of the gas appliance.

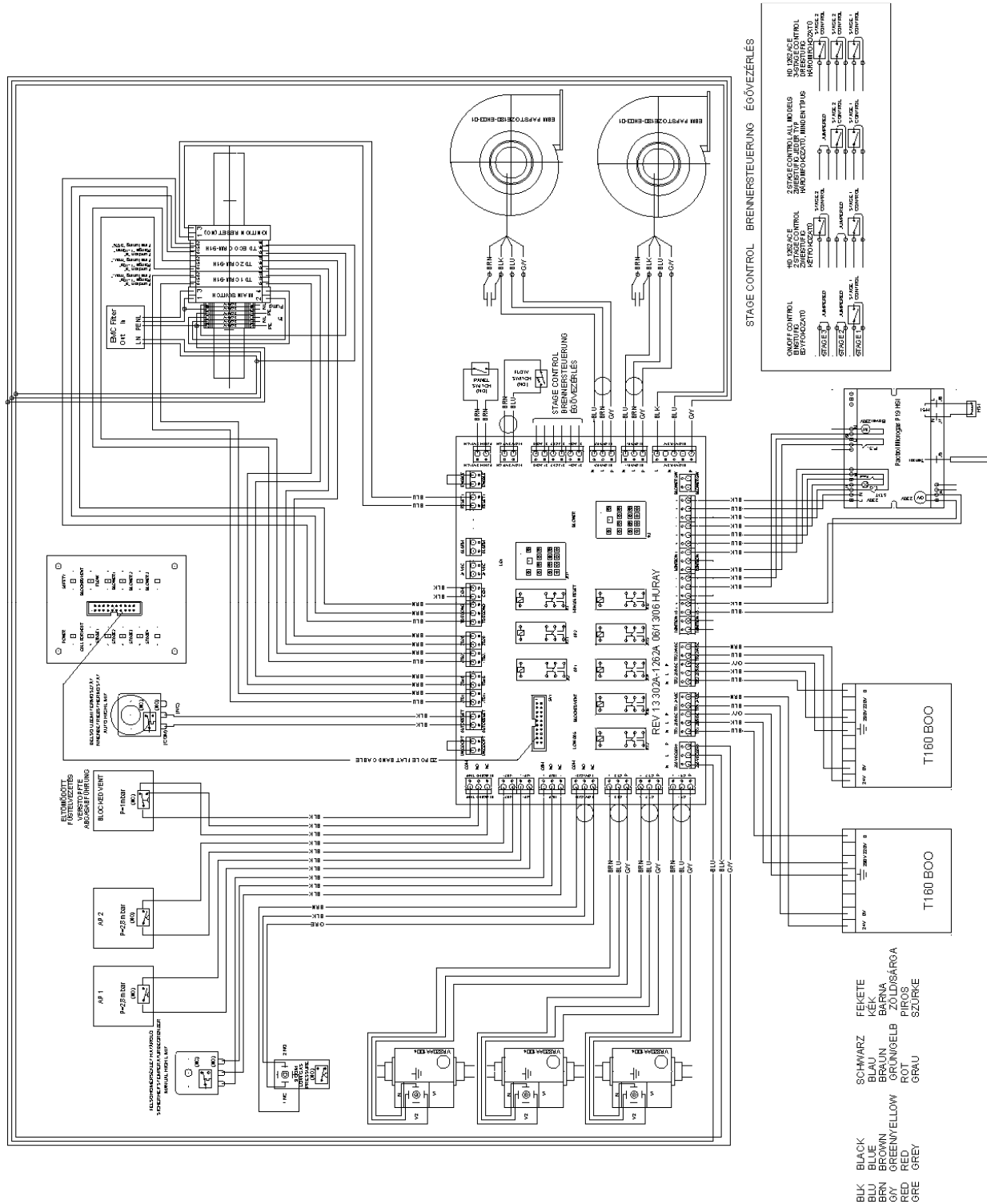
4.1. TOOLS NEEDED

- Cross-point screwdriver
- Slot-point screwdriver
- Multi-meter
- Illuminating pencil
- Manometer(s)
- Flue gas analyzer
- 14 mm claw wrench for the headers of the heat exchanger
- Thermometer
- Electric torch (for servicing outdoor boilers)
- 11 mm claw wrench for the gas orifices

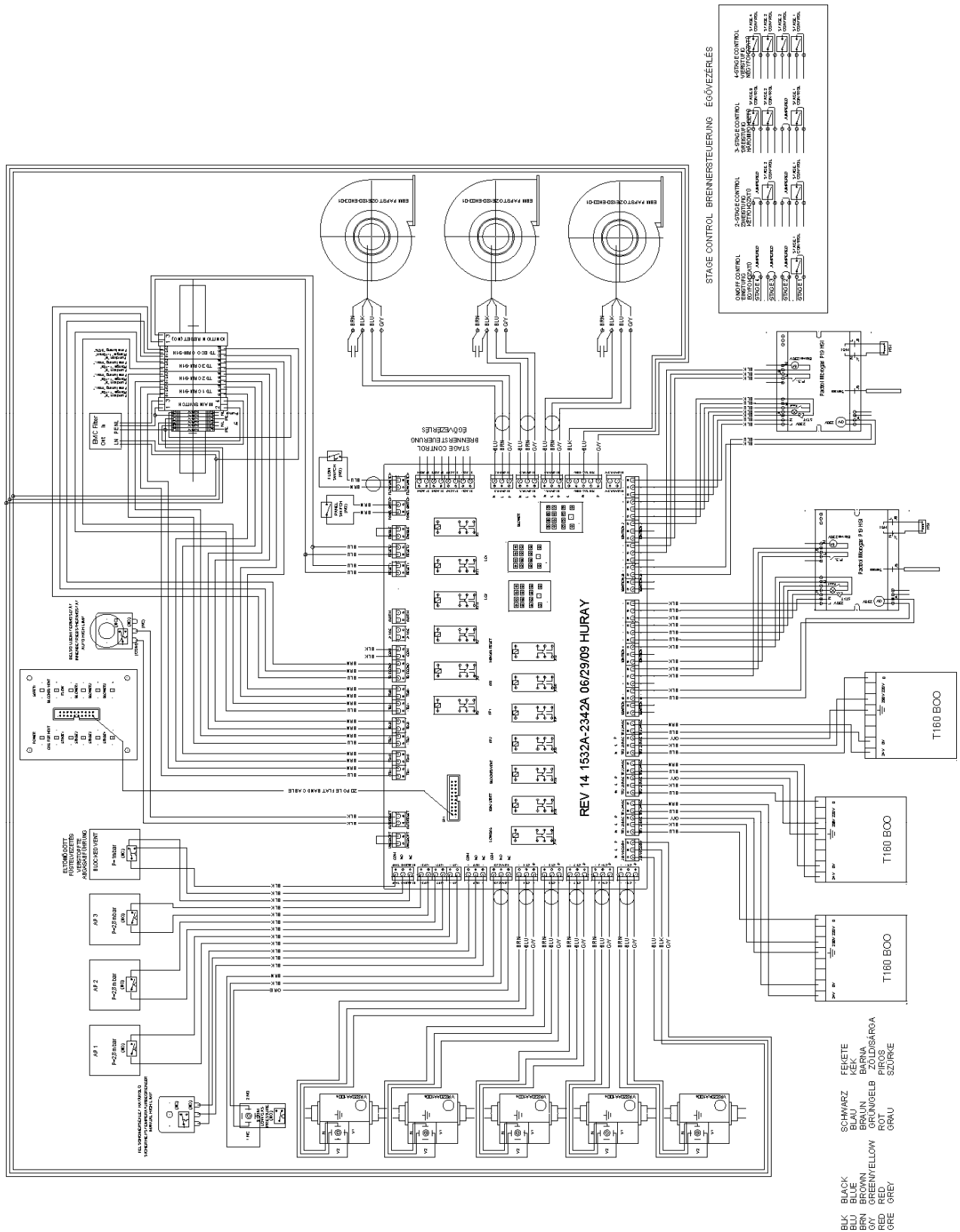
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4.2. ELECTRICAL CONNECTION OF THE APPLIANCE

4.2.1. Wiring diagrams



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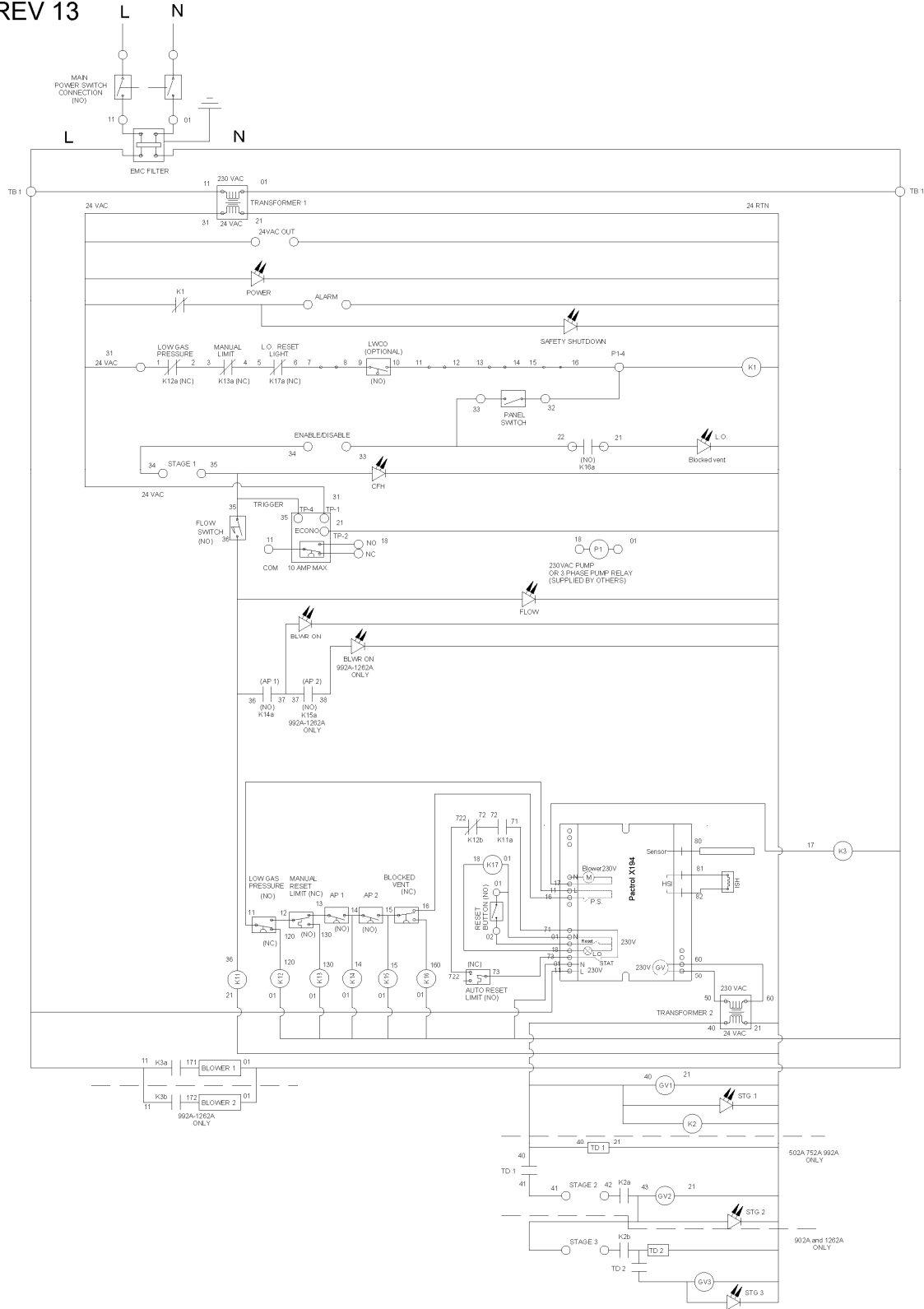


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Writings on the ladder diagrams and the panels. See also at 4.2.10.	
English text	Meaning
MAIN POWER SWITCH CONNECTION	BY DEFINITION
TRANSFORMER	BY DEFINITION
POWER	BY DEFINITION
STGX STAGEX	BURNER STAGE BY NUMBER
ALARM	BY DEFINITION
SAFETY SHUTDOWN	BY DEFINITION
LOW GAS PRESSURE	BY DEFINITION
MANUAL LIMIT	NON VOLATILE LOCK OUT DUE TO HIGH TEMPERATURE
LWCO (OPTIONAL)	EXTERNAL LOW WATER CUT OFF SWITCH
PANEL SWITCH	STAND BY SWITCH
ENABLE/DISABLE	ENABLING/DIABLING OF OPERATION
L. O. IGNITION	NON VOLATILE LOCK OUT DUE TO IGNITION FAILURE
RESET BUTTON	IGNITION FAILURE RESET BUTTON
L.O.BLOCKED VENT	NON VOLATILE LOCK OUT DUE TO BLOCKED VENT
L.O. RESET LIGHT	NON VOLATILE LOCK OUT RELAY CONTACT
ECONO	PUMP CONTROL RELAY
PUMP	BY DEFINITION
3 PHASE PUMP RELAY	BY DEFINITION
SUPPLIED BY OTHERS	BY DEFINITION
CFH	HEAT DEMAND
SAFETY	SAFETY ERROR
FLOW SWITCH	BY DEFINITION
FLOW	FLOW THROUGH THE HEAT EXCHANGER
KXX	RELAY BY NUMBER
TD X	TIME DELAY RELAY BY NUMBER
GVX	GAS VALVE BY NUMBER
BLWR ON	BLOWER IS ON, AIR PRESSURE IS PROVEN
BLOWERX	BLOWER BY NUMBER
SENSOR	ION CURRENT REMOTE SENSOR
HSI	HOT SURFACE IGNITOR

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4.2.2. Connecting the mains power supply

230V 50Hz mains power supply shall be connected by a three-wire cable to the “In” signed connection points on the C rail.

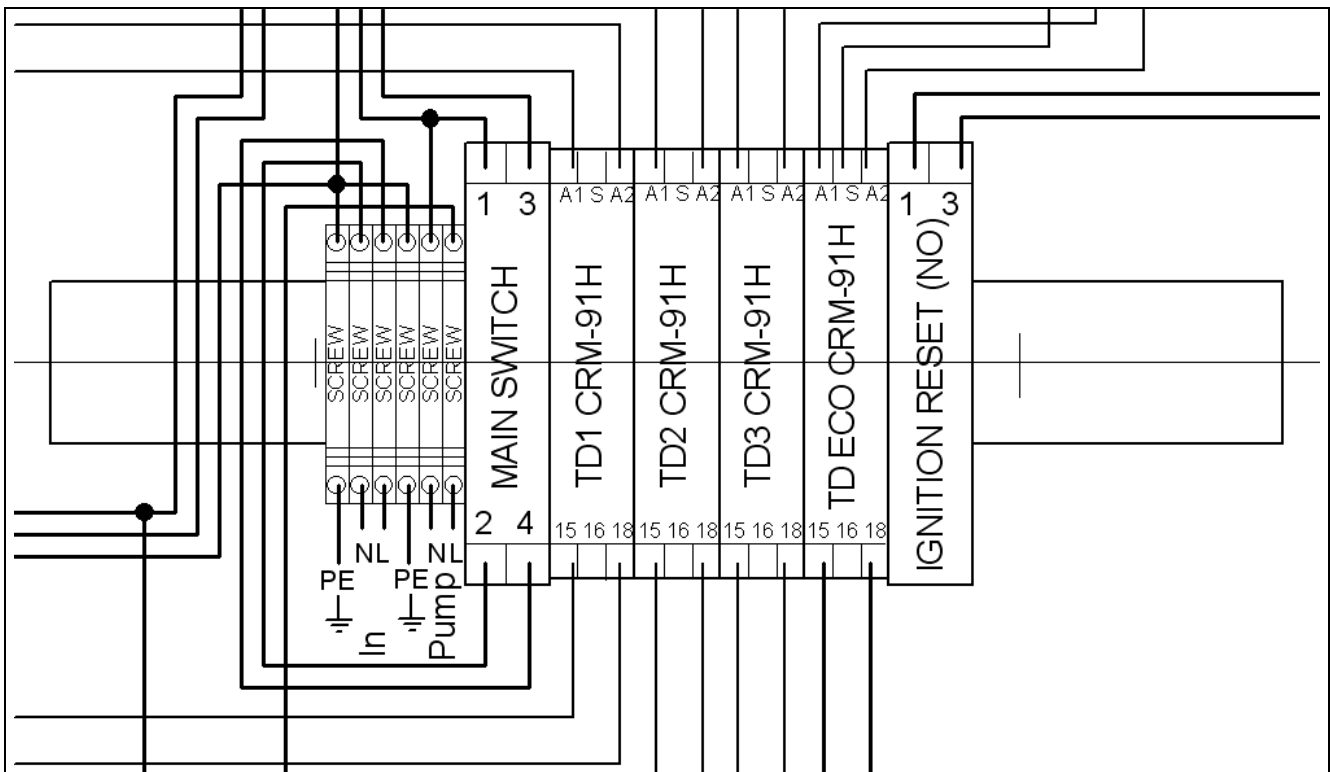
Before connecting check the followings by measuring:

- The voltage between the live and the neutral shall be ~ 230VAC!
- The voltage between the live and the ground shall be ~ 230VAC!
- The voltage between the neutral and the ground shall be <1VAC!

!	<p>Do not connect the appliance to the mains if the voltage between the neutral and the ground $\geq 1VAC$!</p> <p>Repair the fault of the grounding! The ignition will not operate without proper grounding and there will emerge a risk of electric shock.</p>
---	---

The appliance is sensitive to polarity.

- L: Line
- N: Neutral
- PE: Ground \perp



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4.2.3. Connecting the pump control

The appliance is able to supply 230V 50Hz output for a pump or a pump control relay through the connecting points on the C rail signed "Pump". The load is allowed to be up to 10A.

- L: Live
- N: Neutral
- PE: Ground \perp

!

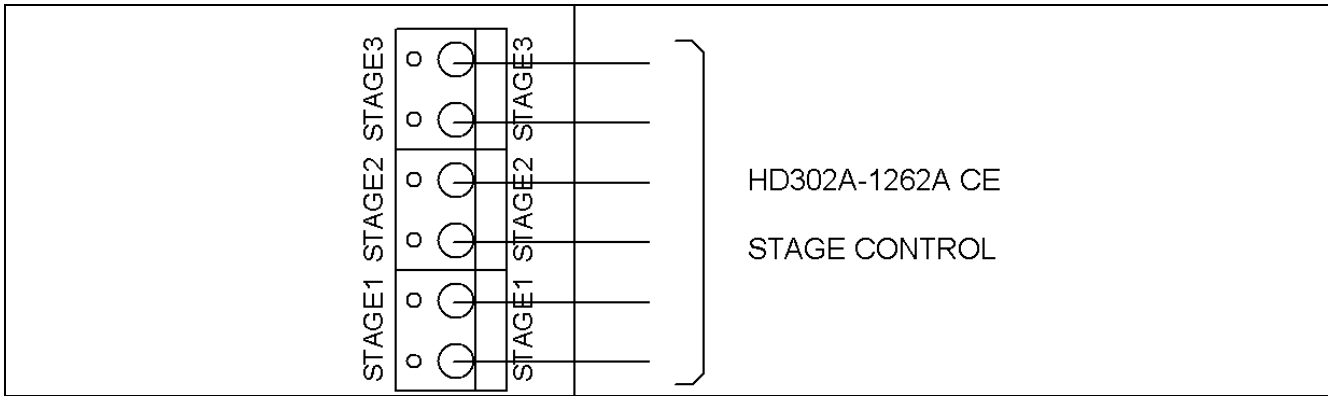
Check if the fuse or circuit breaker leading to the appliance is big enough to handle the total load of the gas appliance and the pump!

4.2.4. Connecting an external thermostat or burner stage controller

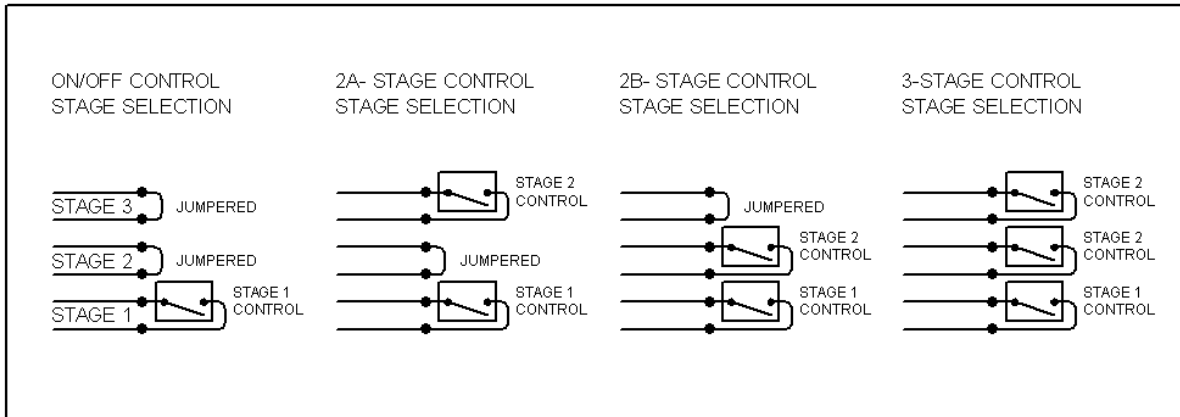
The burner stages are allowed to be connected by voltage-free contacts only. The following drawings show the realizable connections. Configurations, which are not illustrated, would not operate properly therefore they cannot to be used. 24 V 50Hz voltage of the inner control circuits emerges at the terminals of the burner stages.

!

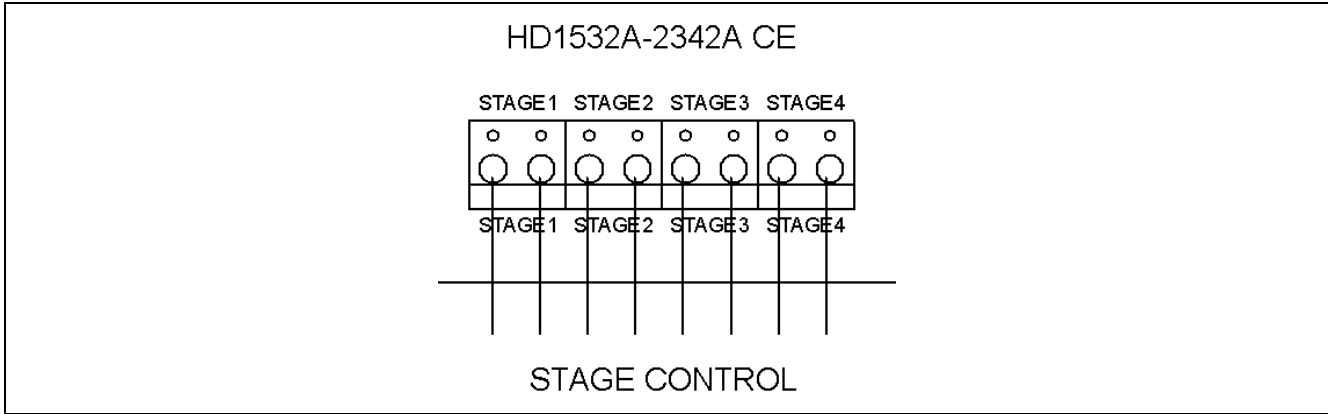
Connecting external voltage or electrical load between the contacts of the burner stages is forbidden because it can cause failure to the gas appliance.



**HD 302A-1262A CE
STAGE CONTROL**

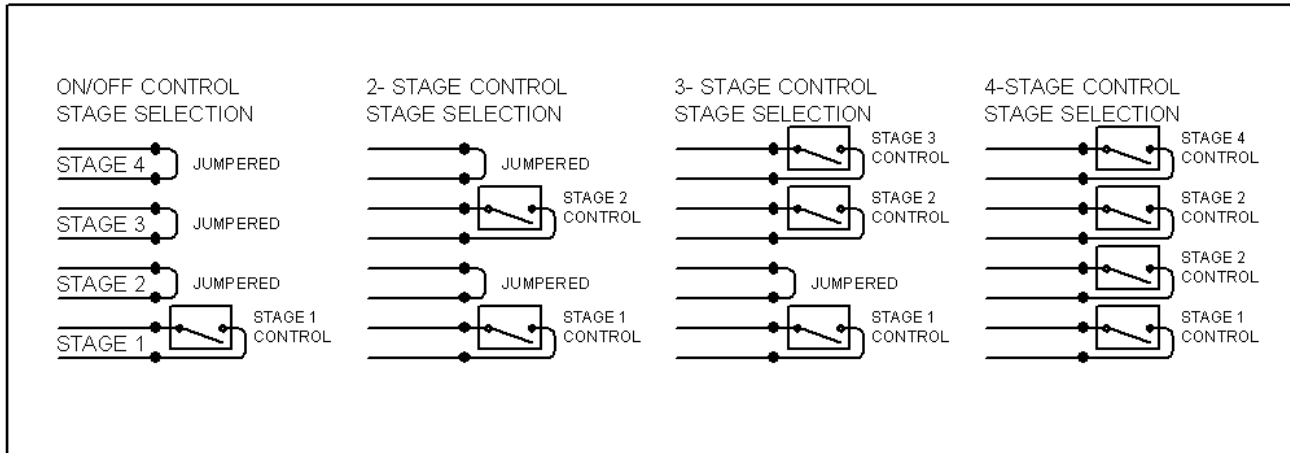


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HD 1532A-2342A CE

STAGE CONTROL

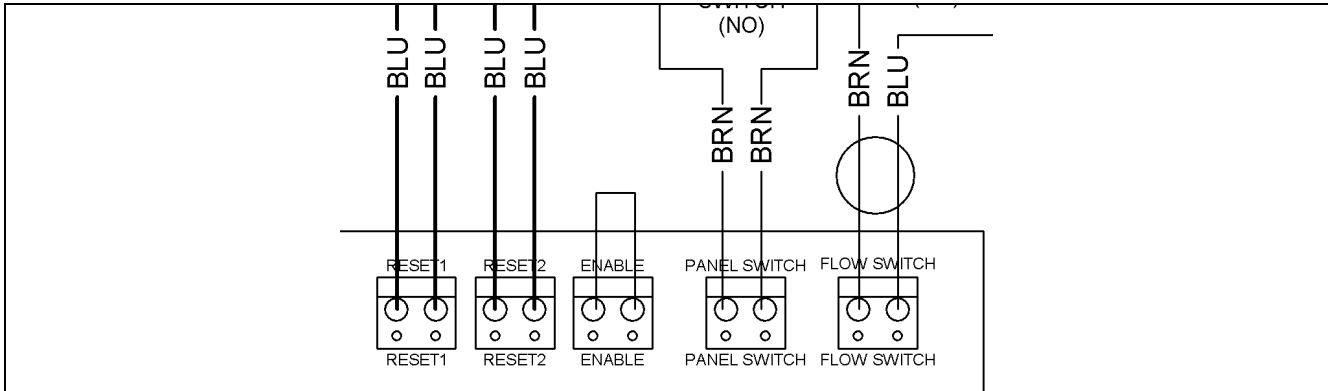


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4.2.5. Connecting the enabling/disabling of operation

Enabling/disabling the operation of the appliance is allowed by connecting voltage-free contacts only. Jumpering the contacts of the „ENABLE” terminal located on the inner panel enables the operation of the appliance. All burners must go out when the contacts open but the pump must overrun until the adjusted time. The appliance stops in standby position after the post purging period elapses. 24 V 50Hz voltage of the inner control circuits emerges at the “ENABLE” terminal.

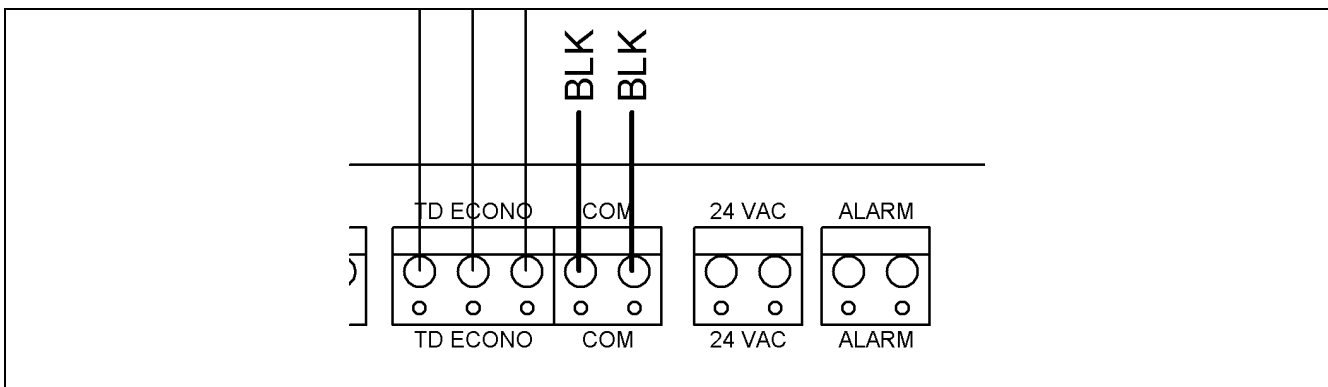
! Connecting external voltage or electrical load between the contacts of the enable/disable terminal is forbidden because it can cause failure to the gas appliance. Attention! The appliance stays under power while the operation is disabled.



4.2.6. Connecting collected alarm

24V 50Hz voltage emerges between the contacts of the “ALARM” output terminal of the inner panel whenever the main switch, located on the C rail, is turned on and there is any error detected by the built in control system of the appliance. It can switch an external load/relay for forwarding the collected alarm signal. The external load is allowed to be up to 1A. Upon switching on the main switch, located on the C rail, 24V 50Hz voltage emerges between the contacts of the “24_VAC” output terminal of the inner panel that can be used for an external load of general purpose. This external load is allowed to be up to 1A.

! Connecting external voltage or short circuit between the contacts of the „ALARM” or „24_VAC” output terminals is forbidden because it causes failure to the gas appliance.

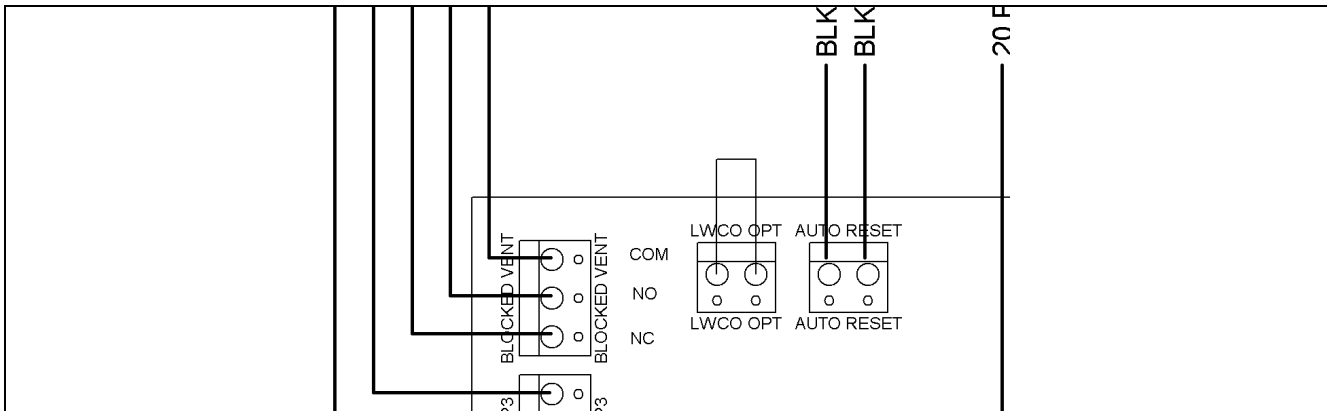


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4.2.7. Connecting external low water cut-off switch

Low water cut-off switch can be built into the hydraulic system of the gas appliance when needed, which is not included in the shipping content. Only voltage-free contacts are allowed to be used. Upon closing the contacts between the „LWCO_OPT” input terminal of the inner panel allows the operation of the appliance. All burners must go out when the contacts open but the pump must overrun until the adjusted time. The appliance stops in standby position after the post purging period elapses. 24V 50Hz voltage of the inner control circuits emerges at the „LWCO_OPT” terminal.

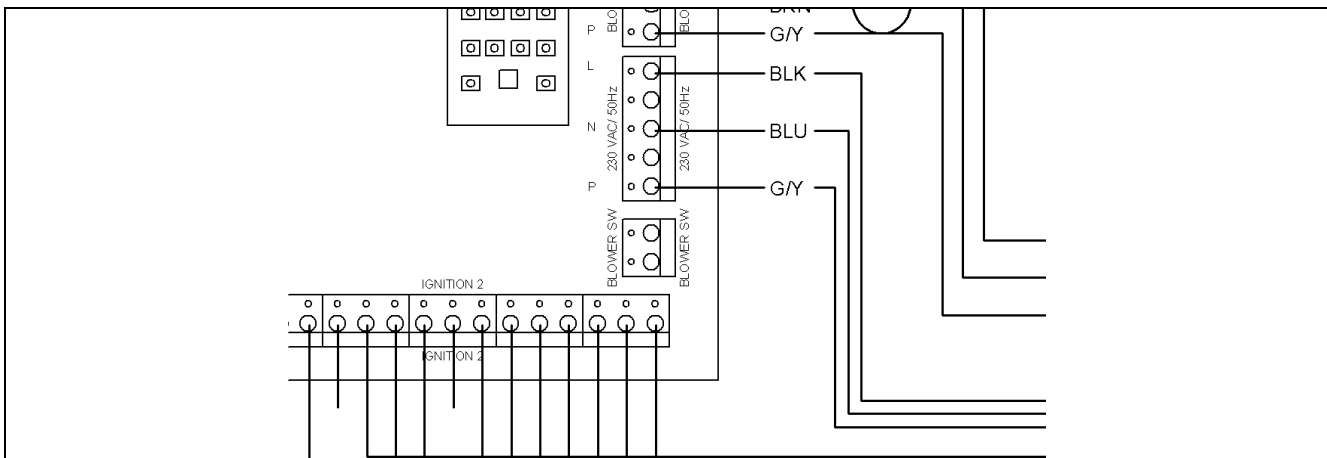
! Connecting external voltage or electrical load between the contacts of the „LWCO_OPT” terminal is forbidden because it can cause failure to the gas appliance.



4.2.8. Connecting external flue gas damper and fan control

External flue gas damper and fan control can be operated by the gas appliance when needed, which are not included in the shipping content, 230V 50Hz voltage emerges between the contacts of the „BLOWER SW” output terminal on the inner panel together with the operation of the blowers built into the gas appliance, which can be used for switching external load/relay. The applying external load is allowed to be up to 1A. The ground of the load can be connected to the grounding of the C-rail.

! Connecting external voltage or short circuit between the contacts of the „BLOWER SW” terminal is forbidden because it causes failure to the gas appliance.



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4.2.9. Operation of the hot surface ignition system

The burners are direct ignited by the hot surface igniter(s). The establishment of the flame is supervised by ion-current remote sensor(s). They can be removed and replaced through opening(s) on the lower front panel of the appliance. The resistance of the hot surface igniter must be 48-84 Ohm at 25 °C temperature. The ignition controller(s) is (are) located in the electric control box. It needs 230V 50Hz mains supply for the operation connected with respect of proper polarity and correct grounding. There is a 4A quick-break fuse located under the plastic cover to save the controller from damages due to overloading or short circuit.

The operating sequence of the Hi-Delta is detailed at 1.4.

The ignition cycle begins when all safety conditions are met, which means that the contacts of the built in automatic high limit are closed and there is a heat demand through the closed contacts of the first burner stage.

- The thermostat circuit „STAT” is closed now.
- 230V 50Hz voltage emerges at the „BLOWER230V”, output terminal that starts all blowers through K4 relay, thus begins the 15 seconds pre-purge period.
- The pressure switch circuit „P.S.” must close at this stage, which means that the manual high limit and the low gas pressure switches must be closed, all blowers must be able to supply sufficient overpressure and the vent system must not be blocked.
- The Hi-Delta stops and alarm signal emerges if the pre-purge is unsuccessful.

Error due to low gas pressure disappears automatically when the fault ceases. Other safety errors lead to in locked position lockout of the ignition that can be reset by pushing the button located on the C rail.

- After a successful pre-purge period begins the 15 seconds glowing-up period and the hot surface igniter glows up through the „HSI” output.
- At the end of the glowing-up period 230V 50Hz voltage energizes transformer #2. through the „GV” output that emerges 24V 50Hz voltage in the secondary coil thus opening gas valve #1. There are 4 seconds for cross igniting the burner group assigned to gas valve #1. and establishing ion-current sensing through the „Sensor” input.

- In case of a successful ignition the Hi-Delta begins to operate continuously. Further valves begin to operate after 10 seconds separation times’ elapse, which are controlled by the TD time delay relays when more heat demand applies through the burner stages.
- If ion-current sensing is not established within 4 seconds, supply voltage ceases at GV output and gas valve #1. closes. After 20 seconds post-purge period begins a new ignition cycle.
- After five successive attempts of unsuccessful ignition cycles the ignition controller locks out in locked position and error signal emerges. The fault can be reset by pushing the button located on the C rail.

The bigger models beginning with HI DELTA 1532ACE have two separate ignition systems. The firing sequence of the burner stages stays fixed at these models too.

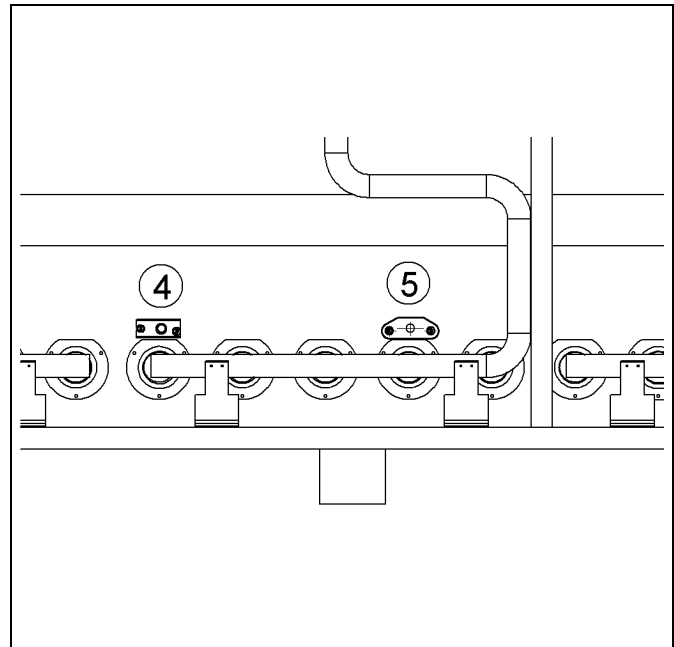
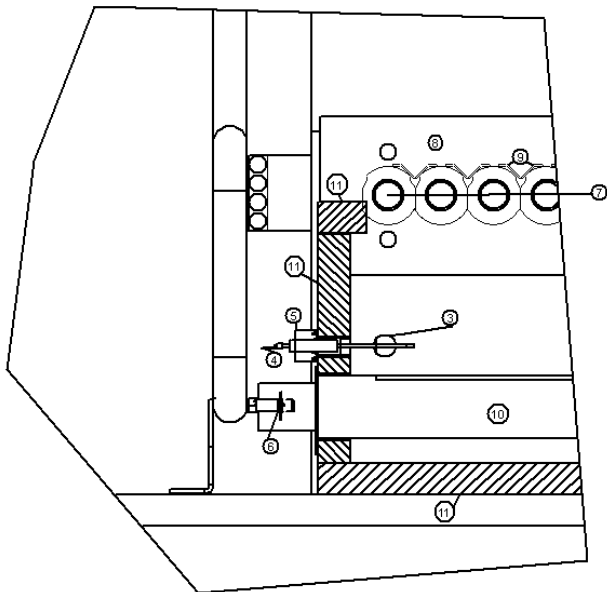
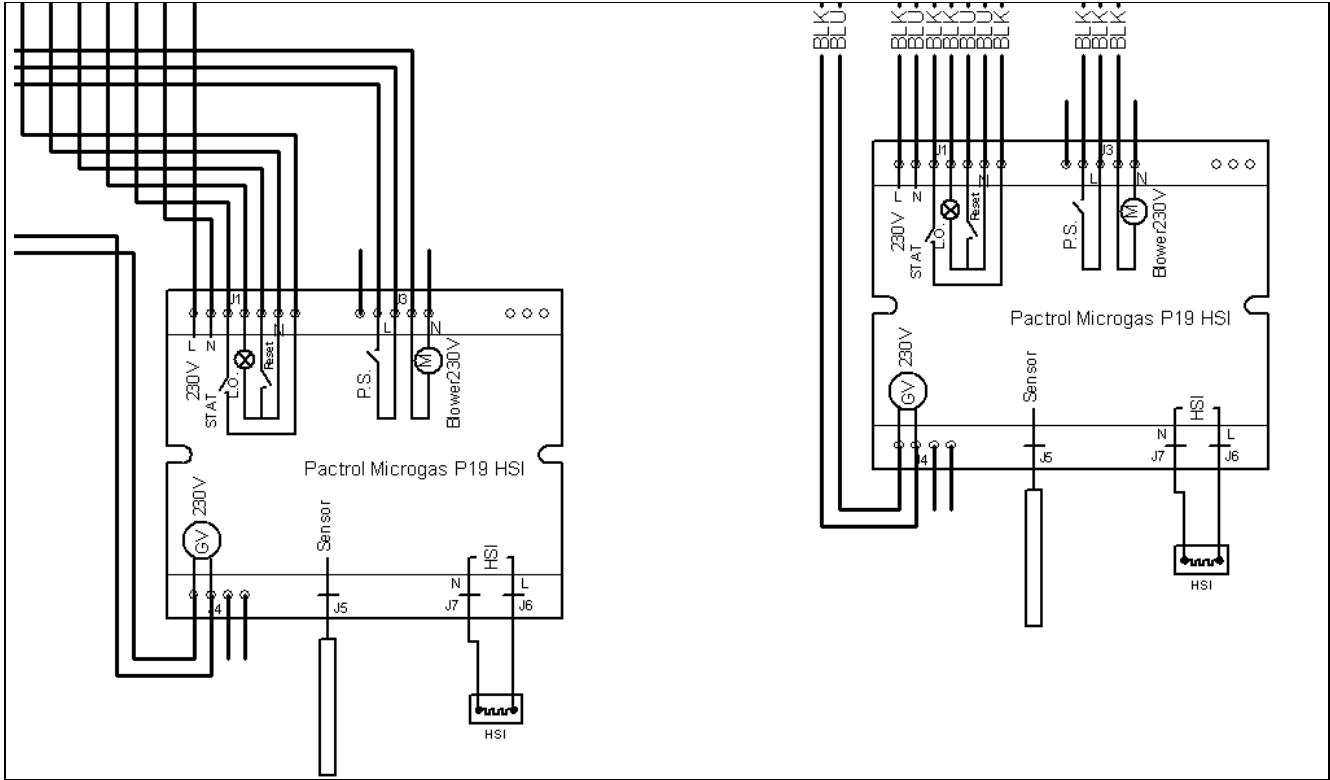
In normal operation:

- The 2. ignition controllers begin its ignition attempts after all successive burner stages are closed up to burner stage #3.
- At the end of the glowing-up period gas valve #3. will be energized by transformer #3. In case of a successful ignition the 3. burner stage begins to operate continuously.
- When heat demand applies to 4. burner stage, gas valve # 4. begins to operate after 10 seconds separation time elapses, which is controlled by the TD time delay relay.

In case the 1st ignition controller locked out in locked position earlier:

- The 2nd ignition controller begins its ignition attempts after all successive burner stages are closed up to burner stage #3.
- At the end of the glowing-up period gas valve #3. will be energized by transformer #3. In case of a successful ignition the 3rd burner stage begins to operate continuously.
- Gas valve #4. begins to operate after 10 seconds separation time elapses, which is controlled by the TD time delay relay even if the contacts of 4th burner stage is open. The appliance stays able to supply about 50% of its nominal output this way.

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4.2.10, Operation of the inner control panel, meaning of the control lights

Led lights inform you about the actual operation status and errors of the inner control systems. Such led lights are located:

- on the inner control panel,
- on the outer indication panel (See at 2.3.),
- on the TD time delay relays (See at 4.2.12.)

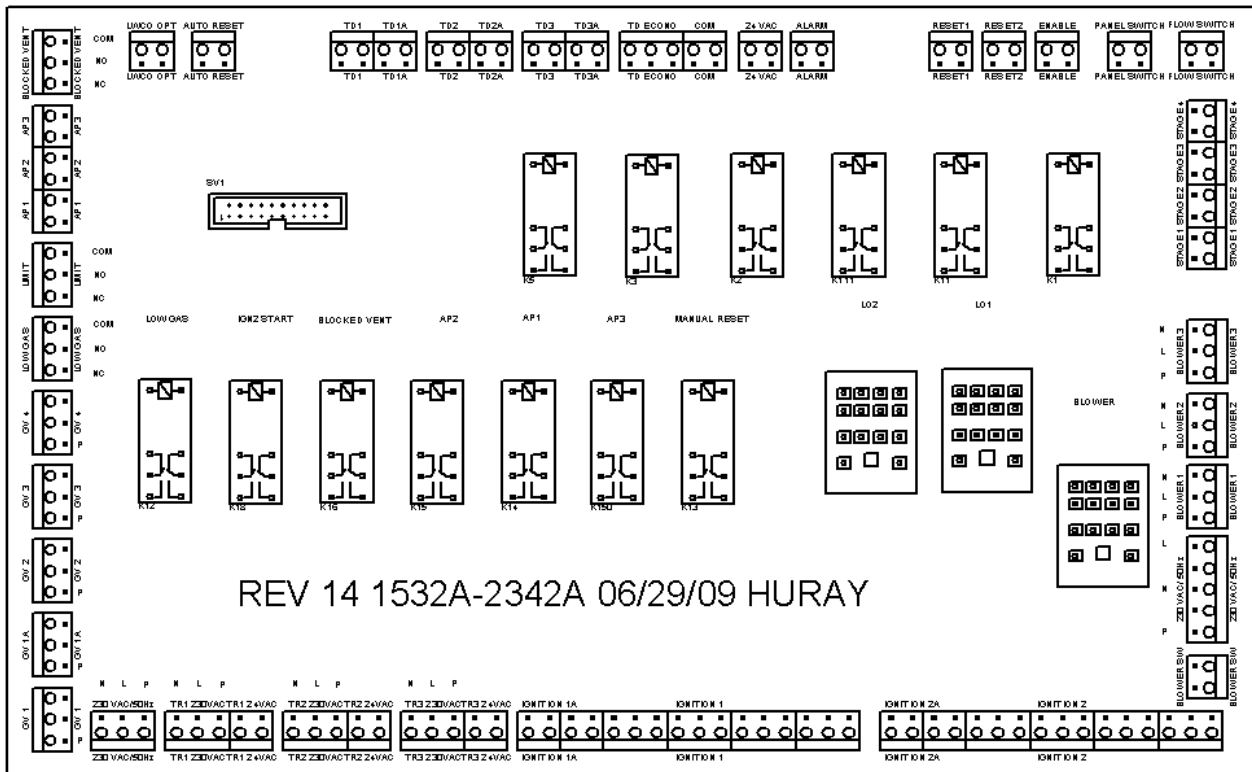
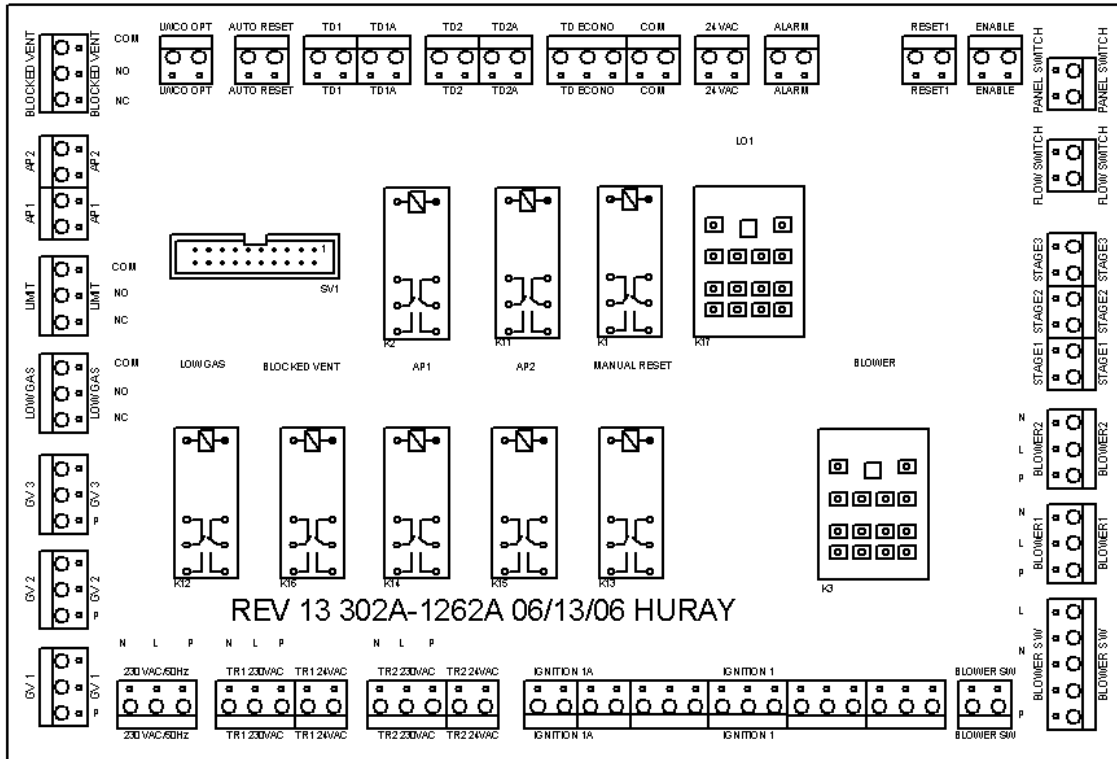
It is a prior for the proper operation of the lights that all built in relays are functioning well.

Check the relays for:

- correct model and operating voltage,
- being unloose, and being secured,
- burnt contacts,
- broken operating coil!

Operation of the Inner Control Panel				
Name of Light	English Text on the Panel	Colour of the Light	Operating Voltage	Meaning of the Light
K1	-	Green	24VAC	K1 relay is operating. There is not any error signal on the 24 VAC ALARM output.
K11	-	Yellow	24VAC	K11 relay is operating. Heat demand applies through STAGE1 voltage free input. 1. ignition controller begins its ignition cycle.
K111	-	Yellow	24VAC	K111 relay is operating. Heat demand applies through STAGE3 voltage free input. 2. ignition controller begins its ignition cycle.
K12	LOW GAS	Red	230VAC	K12 relay is operating. Low gas pressure at the supply inlet. There is an error signal on the 24 VAC ALARM output. The error signal disappears from the ALARM output when the fault ceases. In case of heat demand the appliance restarts again automatically.
K13	MANUAL RESET	Red	230VAC	K13 relay is operating. The manual high limit locked out in locked position. There is an error signal on the 24 VAC ALARM output. Restarting the appliance is only possible by resetting the error manually.
K14	AP1	Green	230VAC	K14 relay is operating. AP1 air pressure switch is operating. BLOWER1 light of the outer indication panel is on.
K15	AP2	Green	230VAC	K15 relay is operating. AP2 air pressure switch is operating. BLOWER2 light of the outer indication panel is on.
K150	AP3	Green	230VAC	K150 relay is operating. AP3 air pressure switch is operating. BLOWER3 light of the outer indication panel is on.
K16	BLOCKED VENT	Red	230VAC	K16 relay is operating while there is a heat demand. The vent system is blocked partially. BLOCKED VENT light of the outer indication panel is on. In locked position lockout of the operating ignition controller results if the error lasts longer than 15 seconds. K17, K170 lights go on.
K17	LO1	Red	230VAC	K17 relay is operating. 1. ignition controller locked out in locked position. There is an error signal on the 24 VAC ALARM output. Restarting the appliance is possible only by pushing the button located on the C rail.
K170	LO2	Red	230VAC	K170 relay is operating. 2. ignition controller locked out in locked position. There is an error signal on the 24 VAC ALARM output. Restarting the appliance is possible only by pushing the button located on the C rail.
K18	IGN2 START	Green	230VAC	K18 relay is operating. 2. ignition controller starts the blowers than starts the ignition cycle.
K2	-	Green	24VAC	K2 relay is operating and opens GV1 gas valve. TD1 time delay relay begins count-down then operation of GV2 gas valve is allowed, operation of STAGE3 is allowed.
K3	-	Green	24VAC	K3 relay is operating. In case of in locked position lockout of the 1. ignition controller the operation of the 2. ignition controller is allowed.
K4	BLOWER	Green	230VAC	K4 relay is operating. All blowers start.
K5	-	Green	24VAC	K5 relay is operating and opens GV3 gas valve. TD3 time delay relay begins count-down then operation of GV4 gas valve is allowed.

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4.2.11. Operation of the time delay relays, meaning of the control lights

The purpose of the TD time delay relays, which are located on the C rail is to separate the operation of each burner groups by time. A Hi-Delta contains up to 3 pieces, depending on the actual model. They need 24V 50Hz supply for their operation.

Control lights give information about their actual operating status.

- Continuous green light indicates that the relay is ready to operate by receiving supply voltage.
- Flashing red light indicates count-down.
- Continuous green light indicates that the selected function is operating.



It is forbidden to change any of the factory settings on the TD time delay relays because it can cause malfunction to the appliance resulting property damage and personal injury.

Correct factory settings are:

- FUNC: „a”,
- TIME: 1-10s,
- Middle knob: „max”

4.2.12. Operation of the pump control relay, meaning of the control lights

The TD ECO pump control relay, which is located on the C rail needs 24V 50Hz supply for its operation. Its purpose is to give 230V 50 Hz Voltage for a primer pump. (The pump is not included in the shipping content of the appliance.) The load on the pump control relay is allowed to be up to 10A.

Control lights give information about the actual operating status.

- Continuous green light indicates that the relay is ready to operate by receiving supply voltage.
- Flashing red light indicates count-down.
- Continuous green light indicates that the selected function is operating.



Do not change the factory settings of the FUNC and TIME knobs of the TD ECO pump control relay because it can cause malfunction to the appliance resulting in locked position and lockout.

Correct factory settings are:

- FUNC: „e”,
- TIME: 1-10 min,

The pump overrunning time can be freely adjusted between 1-10 minutes by rotating the middle knob to the desired value.

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4.3. FIRST STARTING OF THE APPLIANCE



The handling of the appliance is detailed in the 2nd chapter at 2.1., 2.2., 2.3., 2.4. and 2.5. First starting of the appliance is allowed to be executed by an authorized service only.

Remove the side cover of the electric control box on the middle and the two panels on the left and right sides of the upper front of the appliance to reach the gas valves and the blowers!

4.3.1. Checking the gas supply pressure

- Close the gas cock leading to the appliance!
- Check if the appliance is adjusted to the gas type supplied!
- The double seated "class A" combined gas valves are branched from the upper gas manifold parallel to each other. There is a gas pressure tap located upstream of each gas valve. Select one of them and connect a manometer!
- While the appliance is turned off, open the gas cock leading to it!
- Check if the inlet gas pressure does not exceed the nominal value allowed for the supplied gas type! Adjust the external gas pressure regulator leading to the appliance when needed! (It is not included in the shipping content of the appliance.)



The supply pressure measured at the inlet of the gas valves shall never exceed 200 mbar! Exceeding gas pressures can damage the gas valves.

- The inlet gas pressure shall be checked again when all burner stages are operating! The reading must not be less than 17 mbar for natural gas or 38 mbar for Propane and Propane-Butane in any case! There is a low gas pressure for controlling inlet gas pressure built on one of the gas valves. It must be adjusted to 15 mbar for natural gas or 36 mbar for Propane and Propane-Butane!
- After measuring is finished, close the pressure tap carefully. Check for gas leakage and stop it!

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4.3.2. Blower adjustment

- While the appliance is turned off, close the gas cock leading to it!
- Connect the manometer to the measuring point located near the air proving switch of a blower!
- Check the flue gas and the fresh air systems included the air filter for proper installation and cleanness.

Warning! Electrical equipment and blowers, located in the appliance, shall be put under power and operated during the following works.

- Start the appliance, while the gas cock leading to it stays closed yet! All blowers must start when heat demand applies.
- The flue exhaust connection of Hi-Deltas is installed to the top by the manufacturer. In case of need, it can be replaced to the rear of the appliance on site of the installation. See at 3.1.1. Remove outside covers to inspect the soundness and proper installation of the flue vent system! Stop any flue gas spillage when needed!
- Check overpressure, while the blowers are running! The reading must be 3, 3-3,8mbar.
- Repeat the measurement for all blowers! The appliance will lock-out for ignition error if the measurement and adjustment takes too long time. Restarting the appliance and the blowers is possible by pushing the reset button located on the C rail.
- In case of need, the desired overpressure value can be adjusted by moving the shutter located under the blower. The shutter becomes movable upon releasing the ear nut. Fix the ear nut after the adjustment is finished! The proper operation can be checked by the control lights of the outer panel too.

!	<p>Appliances installed outdoors do not need any chimney basically but the factory supplied outdoor vent kit must always be installed on the top of the appliance in such case. The factory supplied air filter must always be used on appliances installed outdoors. The factory supplied air filter outdoor cover must always be mounted over the air filter on appliances installed outdoors. Neglecting it might result the blockage of the air filter and stopping of the appliance while in operation!</p>
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- In case that any of the blowers is unable to produce proper overpressure for longer than 15 seconds after start, or the overpressure drops for more than 15 seconds temporarily, while in operation, the appliance will lock-out for ignition error. Restarting the appliance and the blowers is possible by pushing the reset button located on the C rail.
- In case that the overpressure drops at any of the blowers for not longer than 15 seconds temporarily, the blowers will post-purge for further 15 seconds after the recovery of the overpressure then a new ignition cycle restarts automatically.

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4.3.3. Burner gas pressure adjustment

- While the appliance is turned off, close the gas cock leading to it!
- There is a gas pressure tap located downstream of each double seated “class A” combined gas valves. Connect a manometer to the gas valve assigned to the burner group you wish to measure! The configuration of the gas valves and the assigned hot surface ignitions is detailed at 4.3.5. Open the gas cock leading to the appliance and start operation! All blowers must start and the ignition cycle must begin when heat demand applies. Proper operation can be checked on the control lights of the outer panel. The appropriate hot surface igniter must glow up in about 30 seconds. It can be checked through the two eyelets at the ends of the appliance. The gas valve must open in 45-65 seconds.
- In case of an unsuccessful ignition the controller repeats the attempts five times in succession then locks-out in locked position. Restarting is possible by pushing the button, located on the C rail.
- The gas valve stays open when the ignition is successful and the measuring becomes possible. For adjusting the burner pressure, remove the cover of the gas pressure regulator located on the lower left part of the gas valve, then turn the adjusting screw clockwise to increase, counter clockwise to decrease it. The reading must be 8,6-9,1 mbar for natural gas or 24 -25 mbar for Propane and Propane-Butane.
- Replace the cover of the pressure regulator!
- After measuring is finished, close the pressure tap carefully. Check for gas leakage and stop it!
- Repeat measurements and adjustments at every gas valve!
- Measure gas consumption at the gas meter if possible! Fine tune burner pressure when needed!

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4.3.4. Safety inspections

Leave the pressure manometer connected for checking the inlet supply pressure continuously during the safety inspections! Leave open the side cover of the electric control box that the control lights of the panels and the time delay relays help your work! Start operating the Hi-Delta and all other gas appliances on common gas supply and flue system at nominal input! The operation of the alarm output can also be checked meanwhile if the function is installed!

- Check the correct operation of the manual high limit! Decrease the setting below the actual water temperature! All burners must go out but the primer pump must overrun until the adjusted time. For resetting increase the setting over the actual water temperature and push back the reset button on the manual high limit! The appliance must restart again in case a heat demand applies.
- Check the correct operation of the built in automatic high limit! Decrease the setting below the actual water temperature! All burners must go out but the primer pump must overrun until the adjusted time. Increase the setting over the actual water temperature! The appliance must restart again in case a heat demand applies.
- **Set back the temperatures to the required values of the given system after the inspections are done! The manual high limit must be adjusted at least 5 °C over the automatic high limit! Please be aware that turning off the manual high limit and the automatic high limit has no influence on the operation of the "HEAT DEMAND" light, located on the outer panel.**
- Check the proper operation of the flow switch! Turn off the primer pump for a short time! All burners must go out. Turn on the primer pump again! Check the manual high limit if the appliance does not start to operate and reset if needed! The appliance has to start again when heat demand applies.
- Check the operation of the external low water cut-off switch according to the instructions of the manufacturer if there is such thing installed into the system. When it trips, all burners must go out but the primer pump must overrun until the adjusted time.
- Check the inlet gas pressure again! Make sure that it stays over the lower pressure limit in any case. Readjust the external gas pressure regulator if needed!
- Inspect the flame of the burners!
- Check the operation of the air proving switches by disconnecting than reconnecting the hoses again!
- Increase the setting of the low gas pressure switch over the actual value of the inlet gas pressure! All burners must go out but the primer pump must overrun until the adjusted time. Decrease the setting below the actual value of the inlet gas pressure! The appliance must restart again in case a heat demand applies. Adjust the setting to the value given at 4.3.1. finally!
- Repeat the inspections several times!
- Remove the pressure manometer! Close pressure tap and check around for gas leakages again finally!

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4.3.5. Flame cut-out test

The burners of the Hi-Deltas are divided into burner groups equal to the number of the built-in double seated "class A" combined gas valves, which are branched from the upper gas manifold parallel to each other. The burner groups consist of premix tube-burners built-in parallel to each other. A maximum of three burner groups may be controlled by a single hot surface ignition system. The hot surface igniter and the remote sensor are located over the opposite side tubes of the middle burner group, controlling them directly. The combined gas valves of the neighbouring burner groups can get operating voltage only after ion-current sensing is established at the middle group. They cross-ignite from the flame of the middle group. This way, one remote sensor controls three burner groups simultaneously. There are one or two hot surface ignition systems built into a Hi-Delta depending on the actual size, or else the number of burner tubes.

- The burner pressure of the direct controlled combined gas valve for the middle burner group must be examined for the flame cut-out test.
- While the appliance is turned off, close the gas cock leading to it!
- Connect the manometer to the downstream gas pressure tap on the gas valve assigned to the direct controlled burner group! Remove the cover of the gas pressure regulator located on the lower left part of the gas valve!
- Open the gas cock leading to the appliance and start operation!
- Slowly start to decrease the burner pressure in several steps while the Hi-Delta is operating. Check the burner pressure and the flame between each step! Ion-current sensing must cease before burner pressure drops below 5,1 mbar at natural gas or below 17 mbar at Propane and Propane-Butane. All burners of the common controlled burner groups must go out when the ion-current is lost but the primer pump must overrun until the adjusted time.
- It is a fault if the ion-current sensing does not cease until the burner pressure drops to the above specified values, therefore do not let it decrease any more!
- Set back correct burner pressure as it is specified at 4.3.3!
- Repair the fault if exists! Repeat the test several times!
- Test the flame cut-out of the second system on models with doubled ignition!
- Remove pressure manometer(s), close back all screws and check around for gas leakages again finally!

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4.3.6. Final check of the operating appliance

- Assemble the gas appliance to normal operation and replace back all side panels too!
- Start and stop the appliance several times meanwhile inspecting the regularity of the processes!
- Check the correct operation by turning on and off external thermostats or stage controllers!
- At outdoor units check the quality and concentration of antifreeze in the hydraulic system. Take care about refilling when needed!
- Operating at nominal input check the temperature difference between the outlet and the inlet. The measured temperature step (ΔT) shall refer to the values given at 3.6 and 3.7! In case of need set the correct value by changing the speed of the primer pump and/or adjusting the position of the choke built in the bypass line! On success secure the handling unit against dislocation or simply just remove it! See also at 3.5!
- Test the combustion of the Hi-Delta by using flue gas analyzer!
- Make sure that none of the chemicals mentioned at 1.2. can reach the appliance!

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4.4. CONVERSION TO ANOTHER TYPE OF GAS

For converting to another gas type:

- Replace all gas orifices! The lower side panel must be removed from the front of the gas appliance! Make sure that all gaskets and seals are closing tight at the end of the replacement!
- Set the low gas pressure switch, supply gas pressure and burner gas pressure to the value required for the new gas type!
- Indicate the adjusted gas type on the appliance!



The supply pressure measured at the inlet of the gas valves shall never exceed 200 mbar! Exceeding gas pressures can damage the gas valves. The PB gas operated appliances differ from those intended for natural gas. Appliances intended for one gas type cannot be operated on another gas without being converted. Never attempt to do so because you might cause danger of life! Converting the appliance to other gas type is allowed only by an authorized service listed in the warranty.

Model	Quantity of Orifices	Orifice Diameter/ Identifying Number For G20 Gas	Orifice Diameter/ Identifying Number For G25,1 and G27,1 gases	Orifice Diameter/ Identifying Number For G30 and G31 Gases
	Pieces	mm/#	mm/#	mm/#
HD 992 ACE	11	2,85/#285	3,20/#320	1,45/#145
HD 1262 ACE	14	2,85/#285	3,20/#320	1,45/#145
HD 1532 ACE	17	2,85/#285	3,20/#320	1,45/#145
HD 1802 ACE	20	2,85/#285	3,20/#320	1,45/#145
HD 2002 ACE	23	2,85/#285	3,20/#320	1,45/#145
HD 2072 ACE	23	2,85/#285	3,20/#320	1,45/#145
HD 2342 ACE	26	2,85/#285	3,20/#320	1,45/#145

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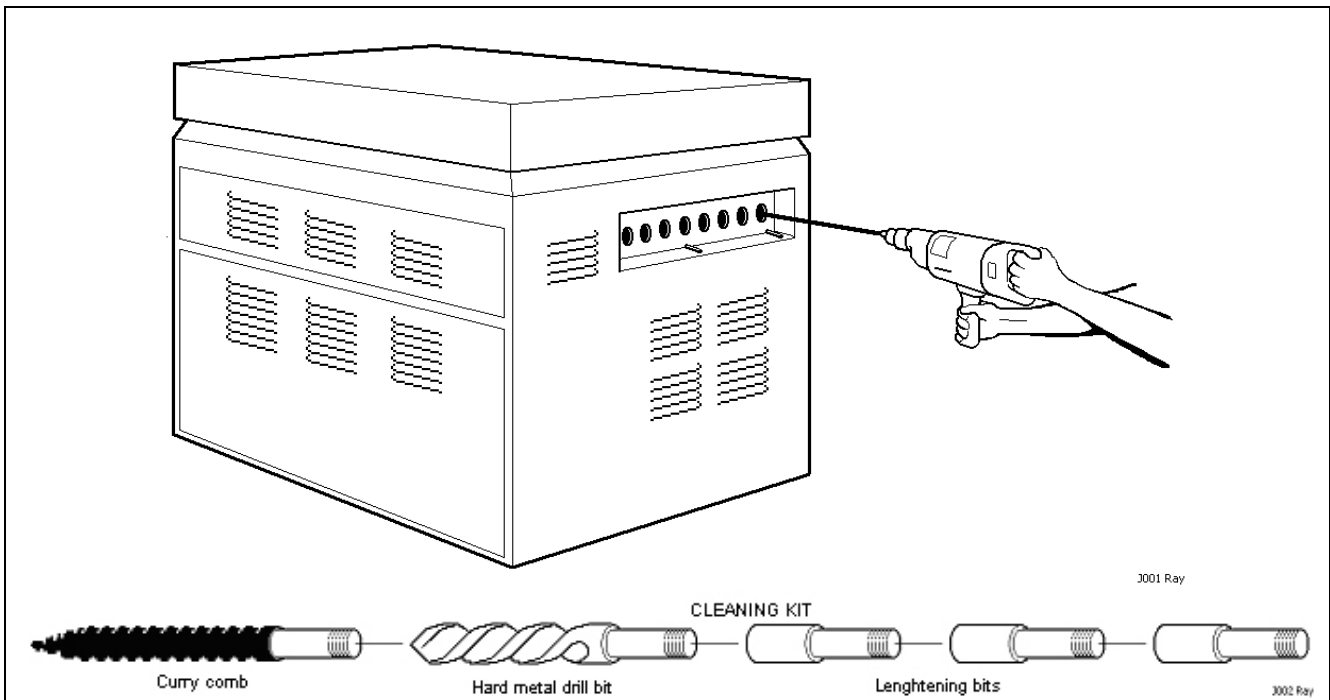
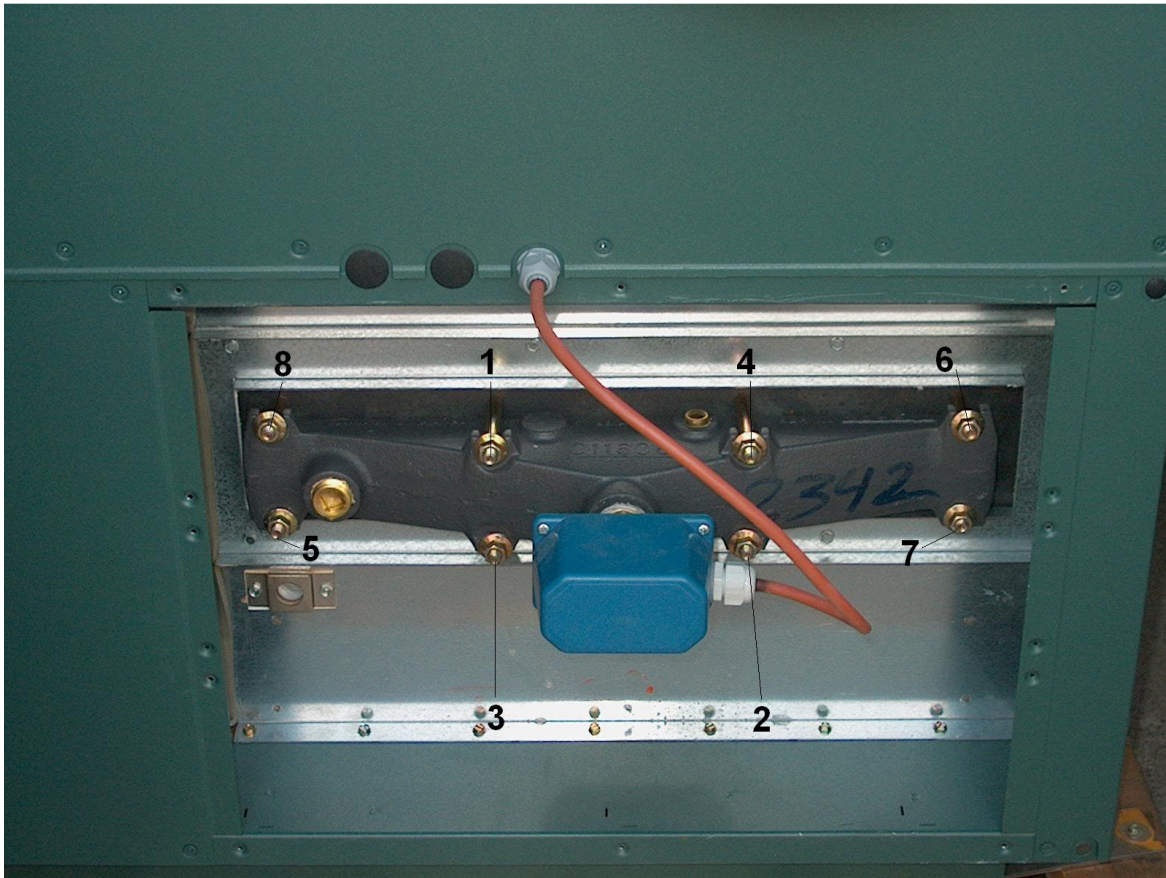
4.5. HEAT EXCHANGER ASSEMBLY AND CLEANING

Follow these instructions for removing the heat exchanger on site of the installation for cleaning or reversing the water connection side

- Disconnect electric power leading to the appliance!
- Close the gas cock leading to the appliance!
- Label than remove electric wires leading to the flow switch!
- Remove both in/out and return header access panels!
- Remove the sensor of the manual high limit, automatic high limit and external controller eventually! Pay attention to the soundness of the capillary bulbs!
- Remove releasable water connections to the header and remove discharge piping from the pressure relief valve!
- Remove the flange nuts and the in/out header!
- Remove the flange nuts and the return header!
- After removing both headers the heat exchanger tubes be inspected and cleaned mechanically! Upon removing further parts the complete heat exchanger can be slipped out toward the front of the appliance when needed.
- For changing the water connection sides reverse the headers!
- Use new kit of silicone O-rings for the reassembly! Seat them on the tubes with their flat side pushed against the tube sheets, the bevel facing outward!
- Push the header firmly against the O-rings, install and tighten the flange nuts onto the stud bolts until finger tight!
- Tighten the nuts in several steps evenly! Work around header sequentially, as indicated on the picture! Torque all nuts to 34 Nm. Do not over-tighten!
- Lead capillary bulbs and external sensors to the new side of the water connection! Beginning with HD 1802 ACE, the manual high limit and the automatic high limit must also be replaced to the opposite side of electric control box due to the limited length of the capillary tube. Use a tiny bit of heat-proof grease in the blank sleeves for assuring correct heat transfer to the sensors!
- The heat exchanger is factory tested for 12 bar operating pressure. However, it is recommended that after dismantling and reassembly again, fill up the system with water first and test against pressure drop for 24 hours, before filling in expensive antifreeze! Stop any leakage immediately!

Cleaning the heat exchanger is also possible without removing the headers by using a non-attacking descaling chemical that must not damage the materials in the heat exchanger and must be allowed by the local regulations. The use of Hydrochloric-acid is forbidden in all circumstances! Removal of the return header after cleaning is highly recommended to inspect the result of the work.

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4.6. PERIODIC MAINTENANCE TO BE CARRIED OUT BY THE SERVICE

Before beginning the maintenance make sure that the inspections described at 2.7 are all done! Execute them if needed!

- The tasks of the periodic maintenances are practically the same as the content of chapter 4.3.
- The cleaning of the heat exchanger is described at chapter 4.5.
- Check for signs of improper operating conditions such as: corrosion, traces of condensation, soot, too big temperature step (ΔT) on the heat exchanger. Suspect for periodic flue gas condensation if there are complains about erratic occurrence of ignition lock-outs! Eliminate the error by adjusting the hydraulics, thermostats and controllers!

- Disconnect the appliance from gas and electricity than remove lower front panel!
- Remove lower manifolds and burner tubes! Inspect and clean them!
- Inspect and clean combustion chamber!
- Remove and clean remote sensor!
- Check the resistance of the hot surface igniter!
- Check the general condition of the appliance!
- Clean repair or replace parts when needed!
- Reassemble the appliance! Check for any leakage of gas, air or liquid and stop it!

Periodic maintenance must be carried out at least once in a year. The actual frequency is worthy to be considered upon experience.

DUE TO CONTINUOUS PRODUCT DEVELOPMENT WE RESERVE THE RIGHT TO CHANGE THE DATA IN THE HANDLING MANUAL WITHOUT ANY PREVIOUS NOTICE.