Technical documentation

R18
Water Heaters

Andrews Water Heaters
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Edition B, 27-11-2000

We aim to achieve continuous improvement in our products. Therefore, specifications are subject to change without prior notice.

Due to changes the product can deviate from the information specified in this document. Therefore Andrews Water Heaters rejects any responsibility for the differences between the product delivered and the information mentioned in this document.

R18 WATER HEATER TECHNICAL DATA

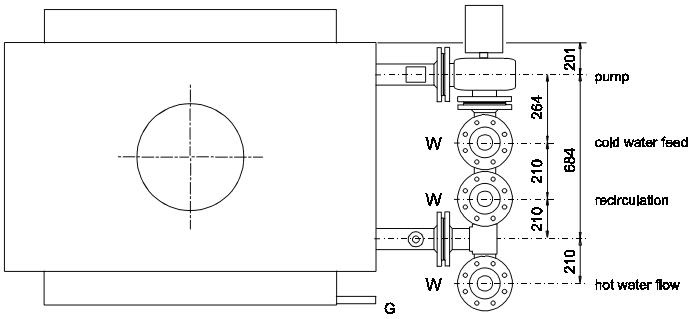
Type			**132**	**154**	**180**	**210**	**244**	**280**
Nominal heat output		kW	481	558	649	756	875	1002
Nominal heat input (nett. CV)		kW	538	625	727	846	980	1122
Gas consumption								
natural gas H (10,9 kWh/m³)		m³/h	49,3	57,9	67,4	78,4	90,8	104,0
propane		m³/h	19,0	22,1	25,7	29,9	34,7	39,7
Gas inlet pressure	(min.)	mbar	17	17	17	17	17	17
	(max.)	mbar	25	25	25	25	25	25
propane (max.)		mbar	50	50	50	50	50	50
Water volume		dm³	22,0	23,2	24,6	26,3	28,1	30,1
Max. working pressure		bar	11	11	11	11	11	11
Flue connection	D	mm	450	500	550	600	650	700
Gas connection	G		2"	2"	2"	2"	DN65 PN16	DN65 PN16
Water connections								
cold water feed + hot water flow	W		DN80 PN16	DN80 PN16	DN80 PN16	DN80 PN16	DN80 PN16	DN80 PN16
recirculation			DN80 PN16	DN80 PN16	DN80 PN16	DN80 PN16	DN80 PN16	DN80 PN16
Pressure relief valve	connection		1¼"	1¼"	1¼"	1½"	1½"	1½"
	relief connection		1½"	1½"	1½"	2"	2"	2"
	standard setting	bar	5	5	5	5	5	5
Electrical supply	water heater 1N~	V	230	230	230	230	230	230
	pump 3N~	V	400	400	400	400	400	400
Frequency		Hz	50	50	50	50	50	50
Fuse		A	6	6	6	6	6	6
Max. electrical consumption								
water heater		kW	0,04	0,04	0,04	0,04	0,04	0,04
pump		kW	0,75	0,75	0,75	0,75	0,75	0,75
Dimensions	B	mm	1430	1430	1430	1430	1400	1400
	H	mm	1795	1795	1795	1795	1895	1895
	L	mm	1461	1636	1842	2080	2350	2636
Weight, empty, ± 5 %		kg	620	660	705	760	820	885

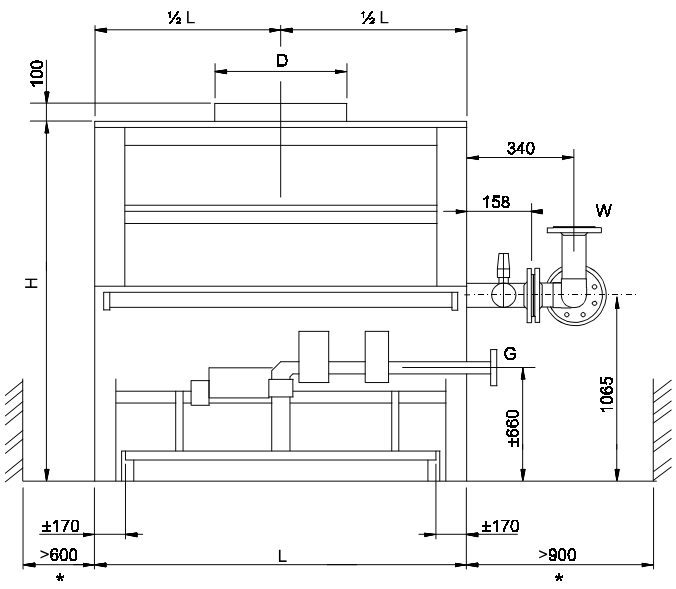
Table 1 Technical Data

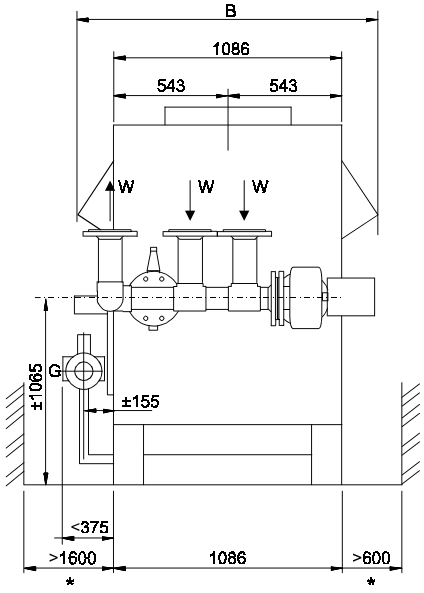
- Heat output measured with : 60 - 80 °C
- Gas consumption at : 1013 mbar, 15 °C, dry
- Gas specification : II_{2H3P}
- Appliance category : B11
- Protection degree : IP30

Changes in specifications and dimensions
The manufacturer reserves the right to change the above mentioned dimensions without prior notice.
Because of manufacturing tolerances, the above mentioned dimensions can vary slightly.

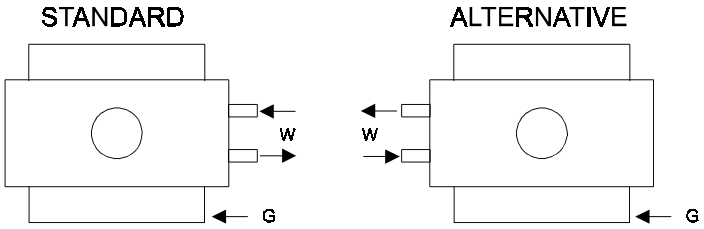
Dimensions

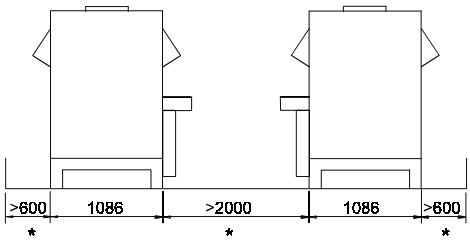






The water heater is available as either:





Top and side clearances are 600 mm MINIMUM.

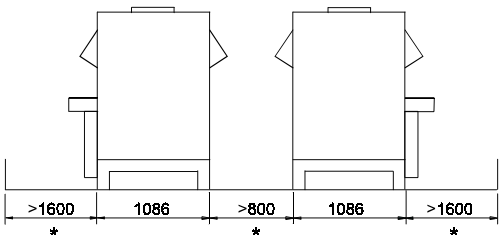


Fig. 1 Dimensions

R18 SUPA FLO PLUS with BT 500 litre tank

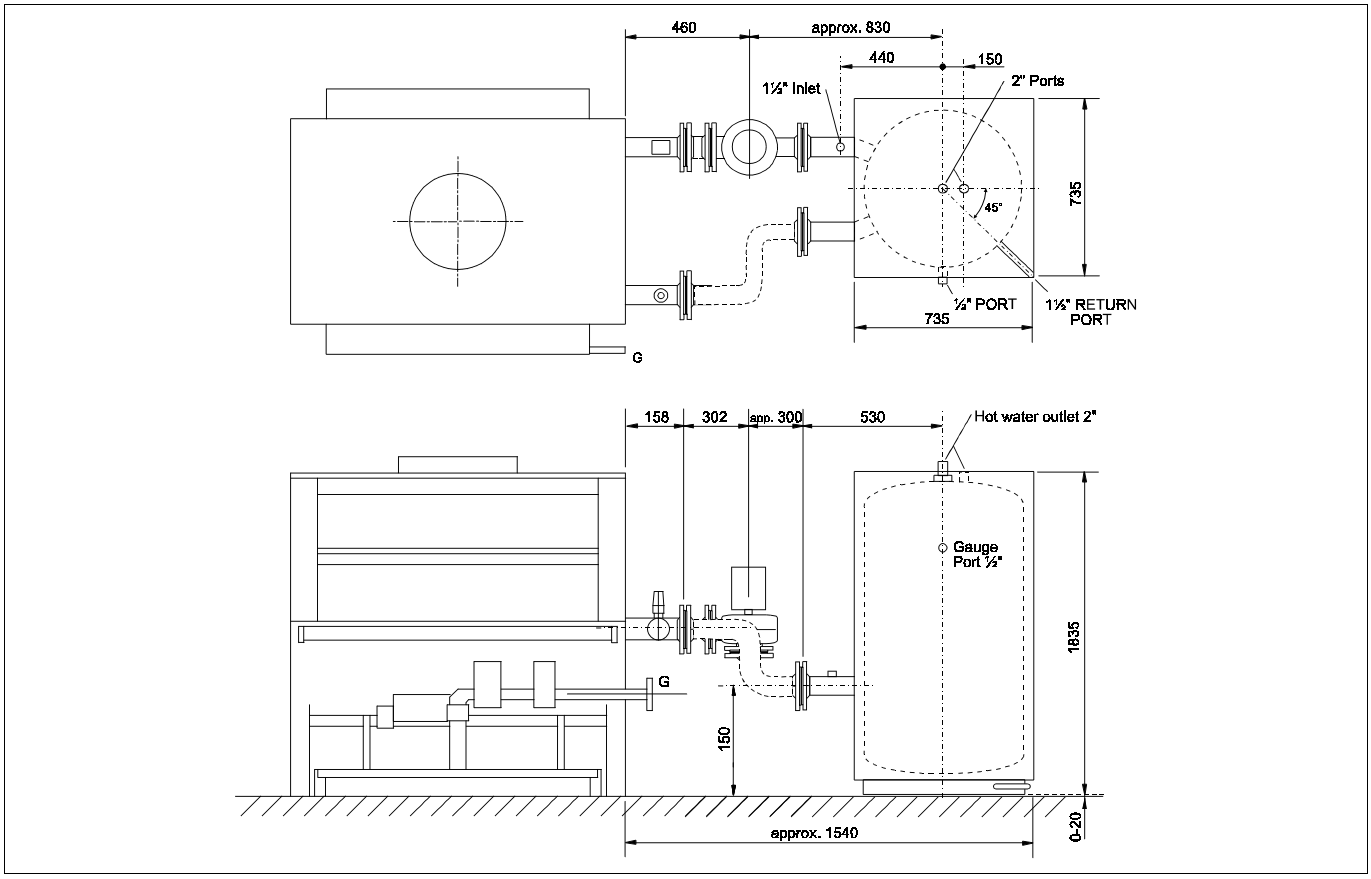


Fig. 2 Dimensions 500 litre tank

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1 INTRODUCTION

1.1 General

Through their unique construction, these water heaters are renowned for their:

- high thermal efficiency
- environmental friendliness
- light weight and small dimensions
- durability
- low noise production
- large regulating range
- available with many different options.

Continual research and development means that Andrews remains at the forefront of boiler and water heater technology.

1.2 Supplier

Andrews Supa Flo water heaters are sold throughout the United Kingdom by:

Andrews Water Heaters
Wednesbury One
Black Country New Road, Wednesbury
West Midlands WS10 7NZ
Telephone: 0121 506 7400
Facsimile: 0121 506 7401

For advice or more information with regard to our products contact Andrews Water Heaters.

1.3 This manual

This documentation has been produced to aid the following target groups:

- the consulting engineer
- the heating installer
- the service engineer
- the user.

Because these target groups require mostly similar information and also specific information, our technical documentation has been integrated to provide these target groups with the necessary general and specific information to install, service and operate this product.
The supplier (see 1.2) will be able to provide any further or supplemental information.

The following aspects will be explained:
- general description
- technical specifications
- necessary services for system design and unit installation
- example systems
- maintenance instructions.

Operating instructions for the user can be found on the unit. See also chapter 7.

1.4 Service

For commissioning and assistance in maintenance matters, please contact your supplier's service department. For more details see section 1.2.

1.5 Reservation

It is the law that the installation be carried out by a competent person. The water heater should be installed in accordance with the British Standards and Codes of Practice referred to in this manual, the Gas Safety (installation & use) Regulations 1994, Building Regulations, Water Bye-laws and any Requirements of the Local Gas Supplier, Local Authority, Water and Fire Authorities and I.E.E. Regulations.

Health & Safety at Work Act, 1974

Under Section 6 of the above Act, it is the duty of manufacturers and suppliers of products for use at work to ensure, so far as it is reasonable practicable, that such products are safe and without risk to health when properly used and to make available to users of such products adequate information about their safe and proper operation.

Andrews water heaters should only be used in the manner and purpose for wich they were intended, and in accordance with the recommendations detailed in this manual. Our heaters have been designed, produced and inspected with safety in mind, but there are certain basic precautions, wich should be taken by the user and, in particular attention is drawn to the safety precautions in this manual and to the operating instructions on the heater.

It is imperative, therefore, that all persons who make use of our heaters have all the information and instructions they require to ensure that they are fully aware of any hazard, and that they know both the purpose and correct manner of use of our heaters.

The manufacturer can alter its products without any preceding notification and is therefore not obliged to adapt earlier delivered products.

2 DESCRIPTION

2.1 General information

The R18 series water heaters are atmospheric open flued, low thermal capacity gas-fired water heaters.
These high efficiency water heaters are designed to provide hot water to various industrial and commercial applications where there can be varying demands and fluctuating loads.
Several models are available with heat inputs from 538 kW to 1122 kW and recovery rates from 10.513 litres per hour to 21.926 litres per hour, based upon a temperature rise of 44 K or 8.260 litres per hour to 17.226 litres per hour, based upon a temperature rise of 56 K.

The R18 series of water heaters are available in 6 types:
132, 154, 180, 210, 244 and 280.

The last three digits of the type number indicate the number of burner bars present in the burner assembly. The load at nett calorific value is approx. 3,6 kW per burner.
All water heater types are fitted with a 18-tube heat exchanger of the 2 pass type including stainless steel manifolds.
The use of extruded copper fin pipes in the heat exchanger leads to higher efficiency.
The R18 water heater is **supplied with a primary pump**, to ensure the optimum flow rate (to prevent the precipitation of lime scale) and a bypass.
Thermal radiation losses are minimized by the optimal construction of the combustion chamber in which high-grade insulation is integrated.
The advanced construction of the R18 enables swift assembly and dismantle, which simplifies maintenance and inspection.

All water heaters have full sequence automatic control with overheat cut off, water flow switch, modulating turn down on gas and combustion air (for improved efficiency at varying heat loads) and fault indicators.

The R18 has an **electronic protection and ignition system**, indicated by **E**.
The electronic PID version controlled by a simple to operate regulator is indicated in the **M version**.

Appliance category B11.

CE

The R18 series is CE approved for the following countries:
Great Britain, Belgium, Denmark, France, Ireland, Italy, Spain and Sweden under Product Identification Number 0063AQ6600.

2.2 Main components

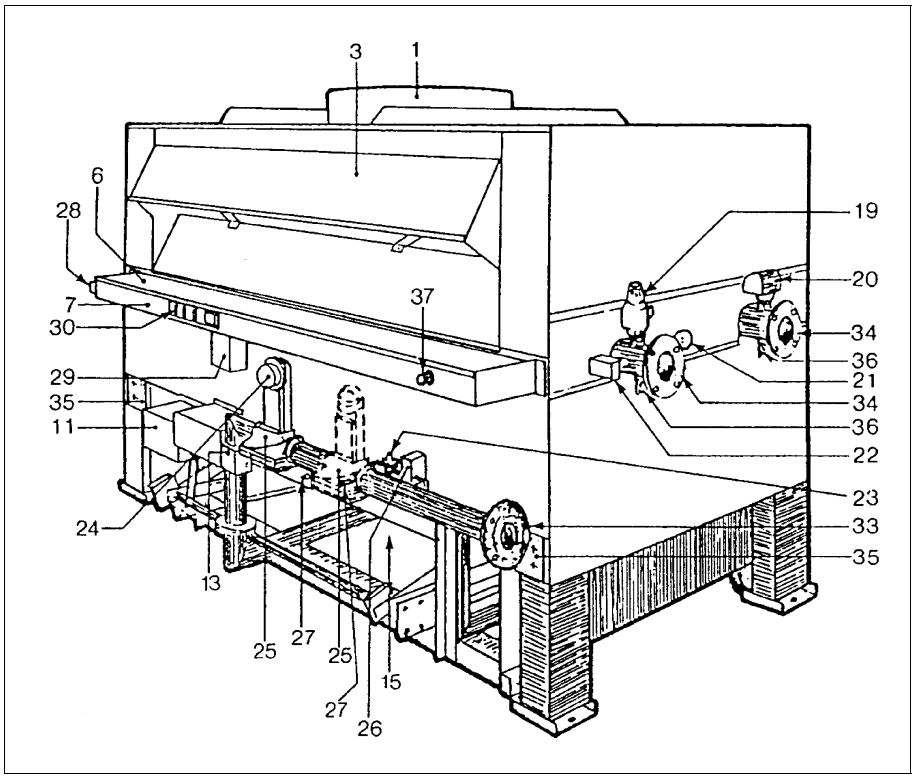


Fig. 3 View of the R18 series

1. Flue outlet socket
3. Draught diverter
6. Cover for electrical connection tray
7. Connection tray
11. Servomotor (air damper/gas input)
13. Modulating gas valve
15. Modulating air damper
19. Safety valve
20. Water flow switch
21. Pressure gauge/thermometer
22. Flow temperature sensor
23. Pilot governor
24. Gas governor
25. Main gas valve
26. Solenoid valve for pilot burner
27. Pressure test points
28. Temperature control unit
29. Safety system control box
30. Control panel
33. Gas connection
34. Water connections
35. Cover
36. Fill/drain cock
37. High limit thermostat

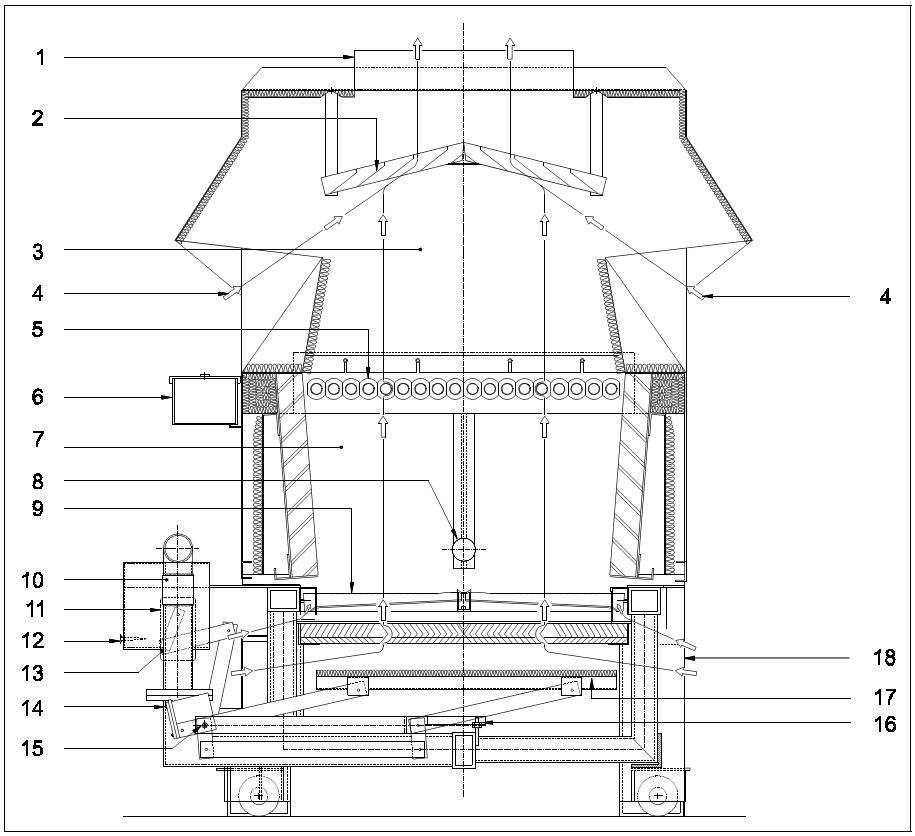


Fig. 4 Cross-section of the R18 series

1. Flue outlet socket
2. Deflector
3. Draught diverter
4. Air in-take
5. Heat exchanger
6. Connection tray
7. Combustion chamber
8. Sight glass
9. Burner assembly
10. Modulating gas valve
11. Servo motor
12. Front adjustment limit stop
13. Linkage assembly
14. Adjustment screw
15. Lock screw for air damper
16. Rear adjustment screw for air damper
17. Modulating air damper
18. Air deflector

Draught diverter

The R18 is fitted with a draught diverter. It is possible to connect the flue outlet connection on the top cover with a standard flue pipe. The inside of the draught diverter is insulated. The mantle is easily removed without the use of any special tools by means of a click system.

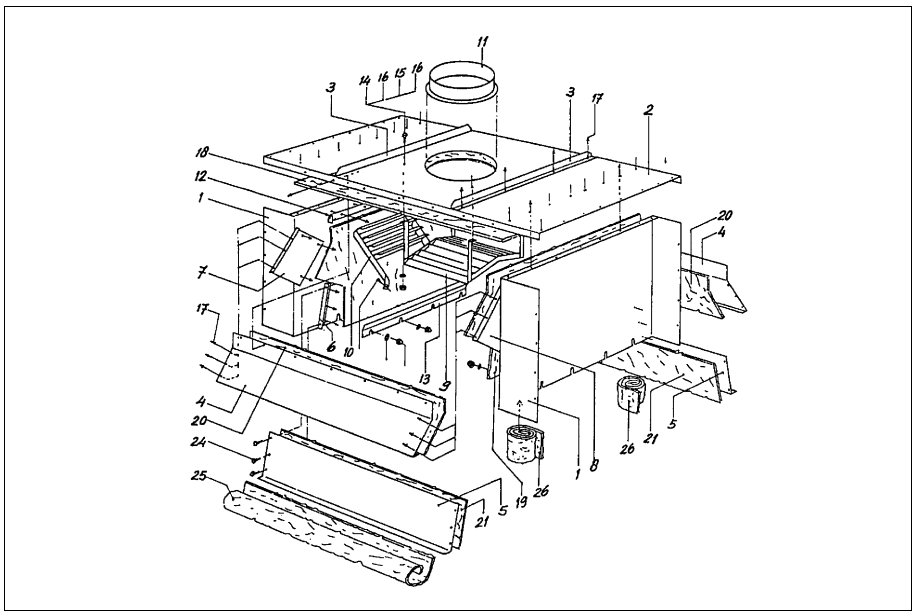


Fig. 5 Draught diverter

Combustion chamber

The chassis consists of two side frames with steel supports. Dura blanket type thermal insulation is sandwiched between the vermiculite refractory blocks and front, rear and side panels of the combustion chamber housing. These vermiculite refractory blocks are mounted so as to allow freedom of expansion. The refractory blocks backed with the Dura blanket insulation form the combustion chamber.

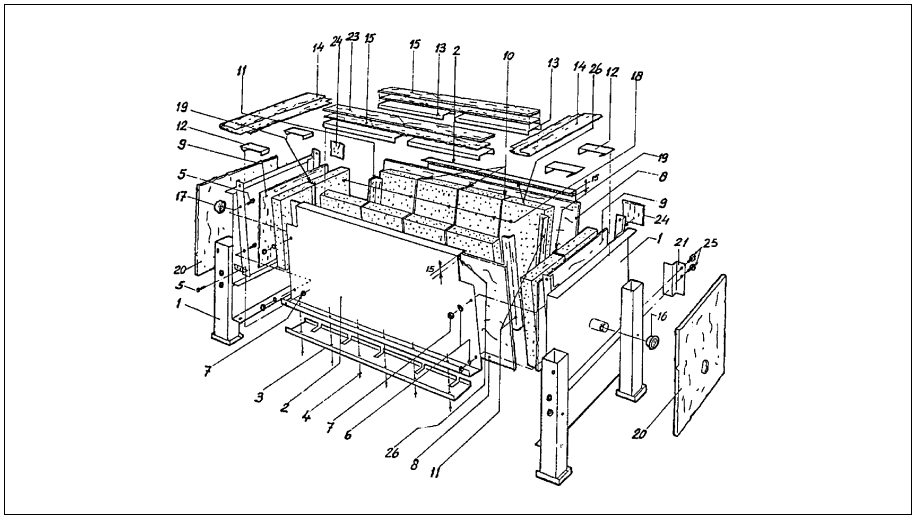


Fig. 6 Combustion chamber

Heat exchanger

The heat exchanger (type 2-pass) is mounted on the chassis. To ensure proper heat transfer of the combustion gases, the copper fin tubes are arranged side by side and expanded laterally into a mounting plate. The baffles on the copper fin tubes optimize the efficiency of the heat exchanger. The stainless steel supply and return pipes together with the water manifolds form the heat exchanger and is **pressure tested at 16 bar**. The R18 water heater is **supplied with a primary pump**, to ensure the optimum flow rate and a bypass (see fig. 8).

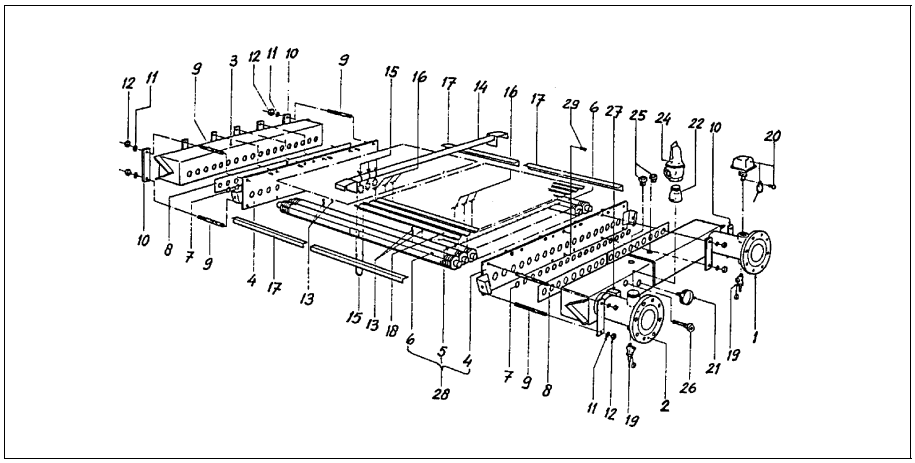


Fig. 7 Heat exchanger

Primary pump

The primary circulating pump is sized to prevent the depositing of limescale in the water heater under the following conditions.

Water hardness in ppm	Maximum temperature in °C
0 - 80	90
80 - 250	85
250 - 350	80
350 - 500	60

Table 2 Maximum temperature

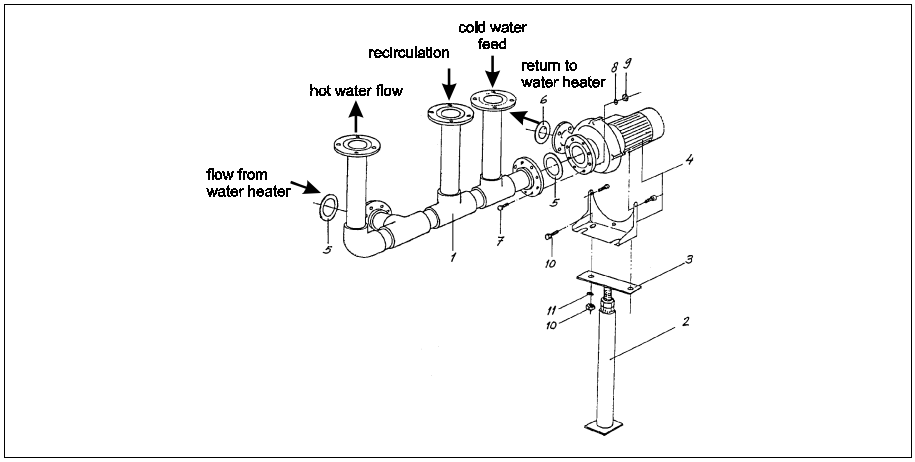


Fig.8 Pump and bypass with water connections

Burner

The burner is mounted under the combustion chamber in the chassis. The burner bars, mounted in the burner trolley are manufactured from stainless steel. Each burner bar is supplied by its own injector nozzle mounted on the gas manifold.

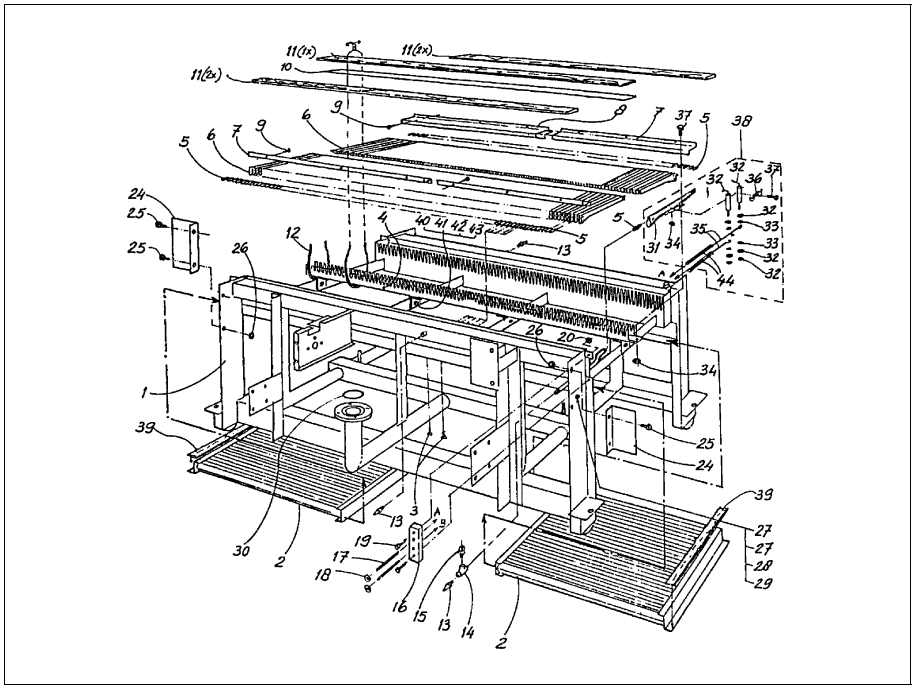


Fig. 9 Burner

Combustion air damper

A combustion air damper is situated underneath the burners.

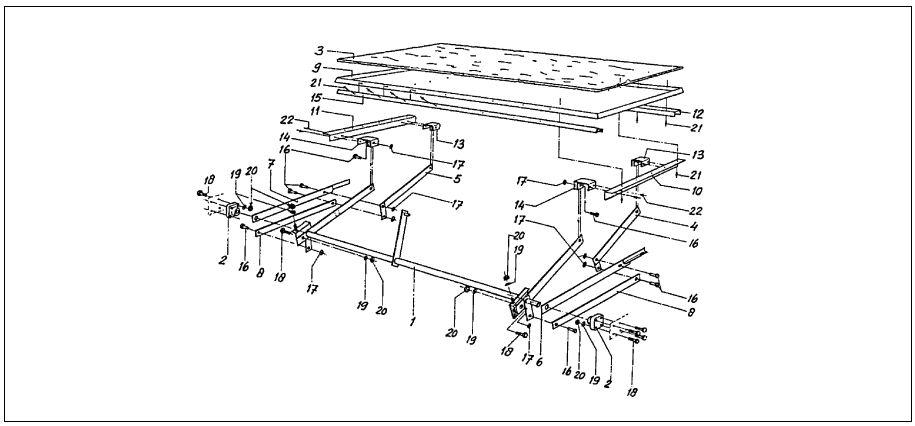


Fig. 10 Combustion air damper

Gas train

The principal components of the gas train are a main governor and two main gas valves or combined main governor and main gas valve. The quantity of gas is adjusted in proportion of the quantity of air being supplied by the air damper opening. The pilot flame has a separate pilot line with pilot governor and gas valve.

2.3 Principle of regulation

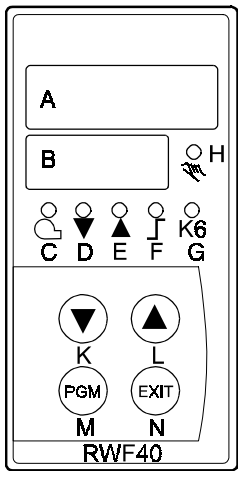
The flow temperature can be adjusted continously as a function of hot water demand and water hardness (see table 2 and 3). Several boilers can be connected by using cascade switching. With the EM or EW Control option you can reduce electricity consumption, both boiler and boiler primary pump can be switched off by the cascade control box.

2.3.1 EM Control option

Electronic Modulating version

This type of boiler control regulation (indicated by the EM control option) uses a built-in PID regulator to maintain a constant flow temperature to within a minimum temperature deviation of +1 to -1 K. This system allows the user to fine-tune the reaction of the boiler to the heating system or application process. An added bonus with this “EM” control system is that it allows a Building Management system to influence the flow temperature using a 0 - 10 VDC control signal.

Boiler temperature controller RWF40



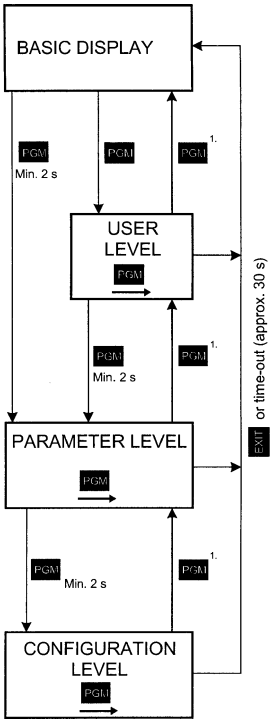
A Process value (actual temperature)
B Set point (temperature)
C Burner enable (not applicable)
D Mod. indicator (decrease fire rate)
E Mod. indicator (increase fire rate)
F Two-stage firing (not applicable)
G Limit comparator
H Manual operation

The keys K-L-M-N are used for displaying values and changing parameters in the temperature controllers configuration.

K Down key (reduce value)
L Up key (increase value)
M Programme key
N Exit key

Assignment of levels

All levels can be accessed from the basic display via the PGM button, as shown in the diagram. The upper actual value display (red) indicates the actual value and the parameter values for the various levels. The setpoint and the parameters are indicated in the lower setpoint display (green).



1. After using *PGM+ to step through all the parameters of a level, an automatic return occurs after the last parameter has been confirmed.

2.3.2 EW Control option

Electronic Modulating version with outside temperature compensation and night-time temperature reduction

This system (indicated by the EW control option) uses the above mentioned PID regulator to regulate the boiler. The “EW” control system maintains the advantages of the “EM” type boiler and adds to it the possibility of automatically changing the flow temperature according to the outside temperature and the required heating curve. The unit’s built-in week-clock also means that a night-time and weekend temperature reduction is possible with a “EW” control system.

Weather-dependent setpoint shift

The RWF40 can be configured in such a way that, if a Ni1000 outside sensor (e.g. QAC22) is connected, a weather-dependent setpoint shift is implemented.
The minimum and maximum setpoint values can be set by the lower setpoint limit *SPL+ and the upper setpoint limit *SPH+. Parameter *P+ can be used to apply a parallel displacement to the heating curve.

☝ Each RWF40 must have its own separate outside sensor connected (no parallel connection)!

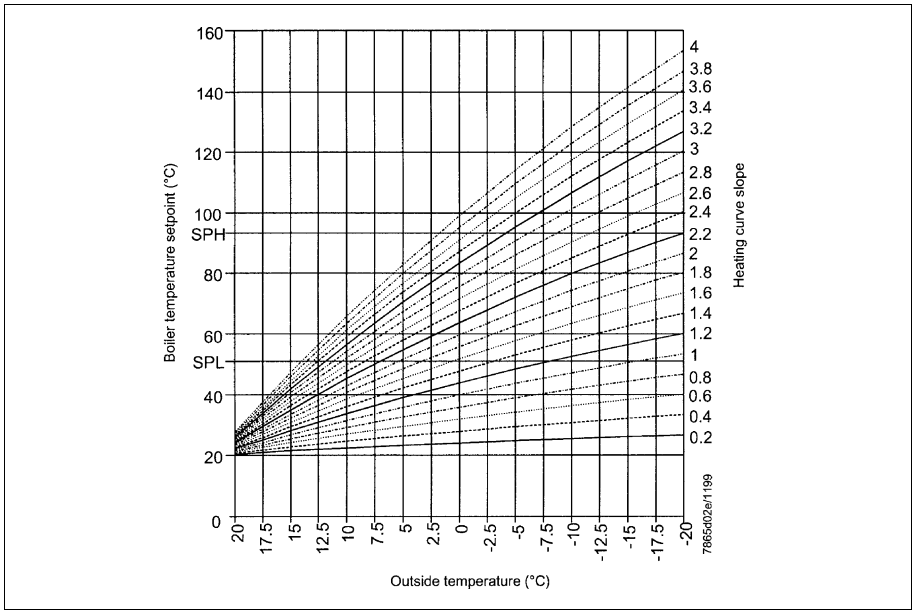


Fig. 11 Parallel displacement of the heating curve

Heating curve slope

Slope *H+ of the heating curve can be used to adjust the setpoint in response to the outside temperature, as shown in the diagram. The common origin of the heating curves is set at (20 °C / 20 °C). The effective range of the weather-adjusted setpoint is restricted by the setpoint limits ***SPH+** and ***SPL+**.

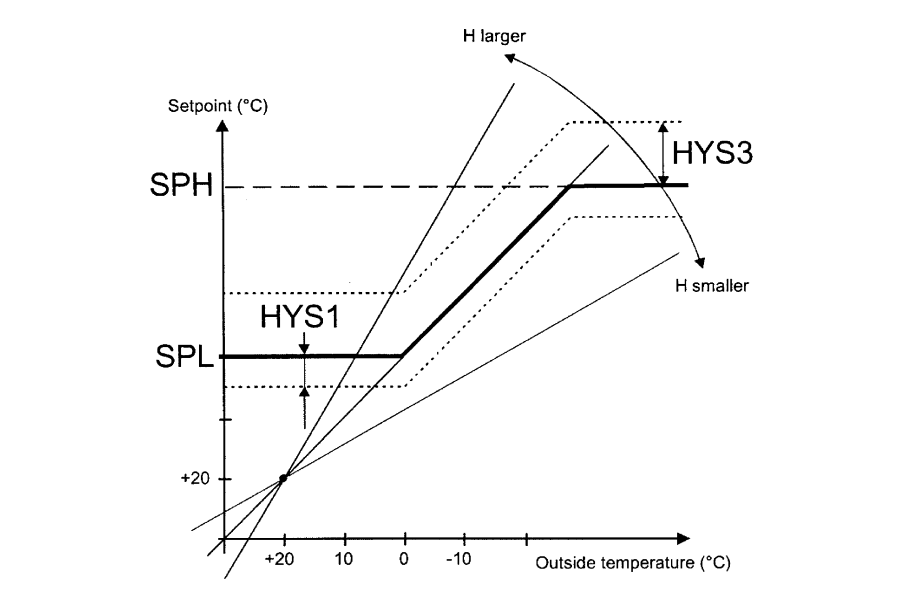


Fig. 12 Heating curve slope

***HYS1+** is the switch-on point for the burner, and ***HYS3+** is the switch-off point. As already described, they act with the set shift relative to the weather-controlled setpoint.

Process data

Parameter	Display	Value range	Factory setting
Setpoint 1 [1]	**SP1**	SPL-SPH	0
Setpoint 2 (option) [1]	**SP2**	SPL-SPH	0
Digital setpoint shift (option) [1]	**dSP**	SPL-SPH	0
Outside temperature (option) [1]	**tA**	***C111** Inputs+	-
Predefinition of external setpoint [1]	**SP.E**	SPL-SPH	-

Parameter level

Parameter	Display	Value range	Factory setting
Limit value of limit comparator [1]	**AL**	-1999...+9999 digit	0
Switching differential for limit comparator [1]	**HYSt**	0...999,9 digit	1
Proportional band [1]	**Pb.1**	0,1...999,9 digit	10
Derivative time	**dt**	0...9999 s	80
Integral action time	**rt**	0...9999 s	350
Contact spacing [1]	**db**	0,0...999,9 digit	1
Actuator running time	**tt**	10...3000 s	15 s
Switch-on threshold burner/stage II [1]	**H Y S 1**	0,0...-199,9 digit	-5
Switch-off level stage II [1]	**H Y S 2**	0,0... HYS3 digit	3
Upper switch-off threshold [1]	**H Y S 3**	0,0...999,9 digit	5
Response threshold	**q**	0,0...999,9	0
Heating curve slope	**H**	0,0...4,0	2
Parallel displacement [1]	**P**	-90...+90	0

Configuration level

Parameter	Display	Factory setting
Analog input 1, 2 and 3; setpoint changeover / shift	**C111**	9930
Limit comparator; controller type; setpoint 1; locking	**C112**	5010
Unit address; decimal place / unit signal for out-of-range	**C113**	0
Measurement range start analog input 1 [1]	**SCL**	0
Measurement range analog input 1 [1]	**SCH**	100
Measurement range analog input 2 [1]	**SCL2**	0
Measurement range analog input 2 [1]	**SCH2**	100
Lower setpoint limit [1]	**SPL**	30
Upper setpoint limit [1]	**SPH**	95
Actual value correction, analog input 1 [1]	**OFF1**	0
Actual value correction, analog input 2 [1]	**OFF2**	0
Actual value correction, analog input 3 [1]	**OFF3**	0
Filter time constant for digital filter, analog input 1	**dF1**	1

[1] These parameters are affected by the setting for the decimal place.

2.4 Water heater protection

The R18 is protected by the following systems:

minimum water flow switch

The water flow switch is installed in the flow manifold and continuously monitors the minimum water flow. If the water flow falls below a preset level, the burner is shut down and will go to lock-out. The water flow switch is factory set and should not be adjusted.

high limit thermostat (E.C.O.)

In the event of failure of the control thermostat, a preset high limit thermostat will shut down the burner and go to lockout.

pressure relief valve

The maximum operating pressure of the R18 water heater is 10 bar. The standard safety valve supplied is **set to 5 bar**. If a different pressure setting is required this should be specified and will be set at the factory.

gas burner control

The burner control unit provide control and supervision of the atmospheric burner. The sequence controller is coupled to the spindle of the control circuit and to the flame supervision unit displaying the status, the symbol appearing above the reading mark indicates the firing sequence or lock-out condition. The pilot flame is supervised by ionisation current detection.

Temperature limit control
The hot water heater is standard supplied with a preset temperature limit controller **set at 65 °C** to prevent from scalding and lime scale precipitation. When exceeding the preset level the temperature limit controller will shut down the burners.

The design and operating principle of the R18 water heater ensures that limescale precipitation is kept to an absolute minimum when operating under the following conditions.

Water hardness in ppm	Maximum pH	Maximum operating temperature in °C
0 - 80	8,4	90
80 - 250	7,6	85
250 - 350	7,2	80
350 - 500	7,0	60

Table 3 Maximum operating level

Where extreme conditions of water hardness exist, however consideration should be given to the provision of water pre-treatment.

3 SAFETY

Installation requirements
Please read these requirements before commencing installation.

The product has to be installed by a recognised installer fully according to the current national and local requirements, norms and standards.

To avoid the forming of steam the maximum outgoing water temperature must be less than 90 °C.

We emphasize that you should always give priority to the above mentioned standards and regulations and that the installation regulations should be considered as an addition to these standards and regulations.

Explanation of the icons used in this manual


Instruction of extreme importance in order to guarantee proper functioning of the water heater.


Not following the operation procedures can cause serious damage to the water heater, personal injuries or environmental pollution.


Electric shock hazard.


Useful information.

Maintenance
Work on the electrical installation should only be carried out by approved technicians and in accordance with the appropriate electrical regulations.

Work on the gas and hydraulic systems should only be carried out by approved technicians and in accordance with the safety regulations for gas installations.

Keep unauthorized people away from the installation. Do not place any objects on the water heater. Keep away from the hot water connections in order to prevent burns.

Always disconnect the water heater from the electric mains and close the gas service cock in the gas supply pipe before commencing maintenance and servicing operations.

Check the system for leaks afterwards.

In addition to the information in this documentation, always follow the standard safety regulations to prevent accidents. Cover panels should only be removed for maintenance and servicing tasks. Replace all panels after completing these maintenance and servicing tasks.

Safety precautions
The installation should never be switched on with panels removed or when water heater protection devices are not operational.

Instruction and warning stickers
Never remove or cover any of the instruction and warning stickers. They should always be legible throughout the life span of the water heater.
Immediately replace any damaged or illegible stickers.

Modification
Modification of the installation should only be carried out after obtaining prior written permission from the manufacturer.

Danger of explosion
Follow the health and safety regulations for working in hazardous areas when working in the water heater room.

Installation
The water heater should be installed by a recognised installer in accordance with current regulations and the regulations of the local electric companies (see supplement).

Make sure that you follow all safety instructions properly.

Operation
In case of gas leakage, switch off the water heater and close the gas service cock.
Open doors and windows, and notify the proper authorities.

Follow the instructions in the manual when you use the water heater again.

Technical specifications
Do not exceed the specifications as layed down in the installation and maintenance instructions.

4 DELIVERY AND TRANSPORT

4.1 Delivery

Before delivery, the R18 water heater is fully assembled and tested in the factory. The R18 is mounted on a pallet and covered in a "heat-shrink" protective covering.

Check for damage after removing the water heater's protective covering.

Check whether the water heater conforms to the order requirements.

Check whether the circuit diagram and gas-train diagram number is in accordance with the offer, order confirmation and the data on the water heater's data number plate.

4.2 Unit protective packaging

The water heater is mounted on a wooden pallet. For transportation the water heater is covered in a "heat-shrink" protective covering. The panel-work is also covered in a protective polyethylene layer. Before final installation in the boiler room the water heater must be removed from the pallet and all protective coverings removed.
The protective coverings should be disposed of in a environmentally friendly way. Contact your local authority.

4.3 Transport

Refer to the technical specifications on weight and dimensions when transporting the water heater.

WARNING:
- Incorrect moving or lifting of the water heater may cause damage
- Remove the protective covering after transport and after installation in the boiler room, when ever possible.

Pallet cart and/or forklift truck

When moving the water heater with a pallet cart or forklift truck, the forks should be placed at the back of the water heater.

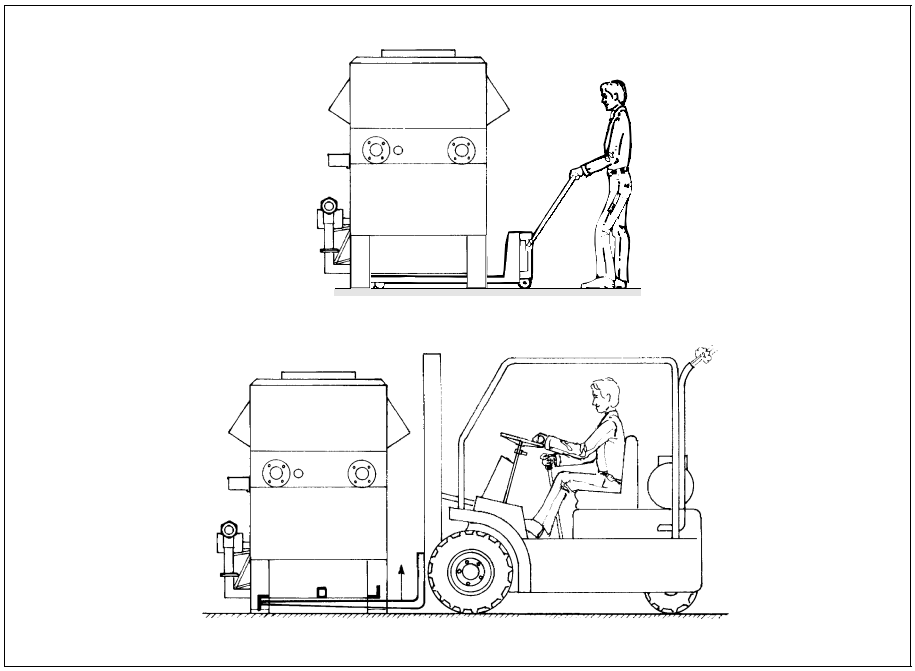


Fig. 13 Moving

Using a crane

- Never swing the load over bystanders.
- Always use special lifting harnesses which should be placed on the water heater
- Make sure that during lifting the harness does not damage the draught diverter.

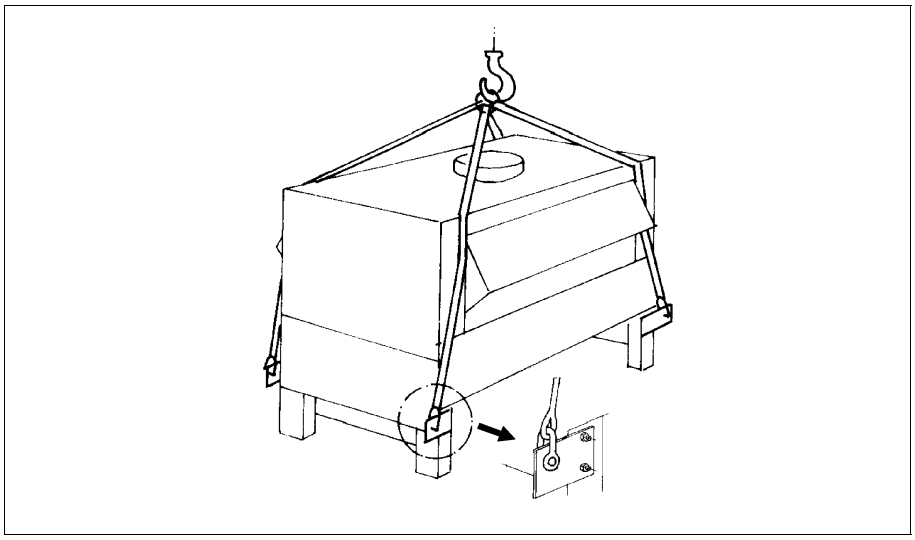


Fig. 14 Lifting

5 INSTALLATION

5.1 Boiler room

Installation of the R18 should only be carried out by a recognised installer in accordance with the current national and local requirements, norms and standards (see supplement).

5.1.1 Siting

Install the water heater as close to the chimney as possible. A plinth base is not required.

☞ To maintain ease of access and therefore ease of maintenance refer to clearances in figure 1.
If these dimensions are not met, maintenance operations could be seriously inhibited.

The location chosen for the water heater must permit the provision of a satisfactory flue system and air circulation around the water heater, see dimensions.
The water heater must be installed on a level non-combustible surface capable of supporting it's weight and any necessary equipment. **If the water heater is to be installed on a raised plinth, the plinth must carry forward by at least 1100 mm in front of the water heater** to allow removal of the burner trolley.
It is important that the water heater is sited so that extraneous material cannot be stored next to it.

5.1.2 Boiler room ventilation

The product has to be installed by a recognised installer fully according to the current national and local requirement, norms and standards.

Ventilation openings should be placed so that the boiler room is equally ventilated. More inlet openings in roof top boiler rooms should be used and situated at regular distances. By internally or externally casing the inlet openings the negative influence of wind on the boiler room can be minimised (see fig. 17).
In general, approximately half of the heat transmission in a boiler room is used to heat the room itself and the other half is lost through the draught diverter to the outside. To prevent air stratification, and therefore greater losses, the high level outlets should be situated as high as possible.
Incorrect or poorly sited boiler room ventilation can lead to high temperatures in the boiler room, poor combustion and early failure of control and regulation equipment caused by the higher ambient temperatures.

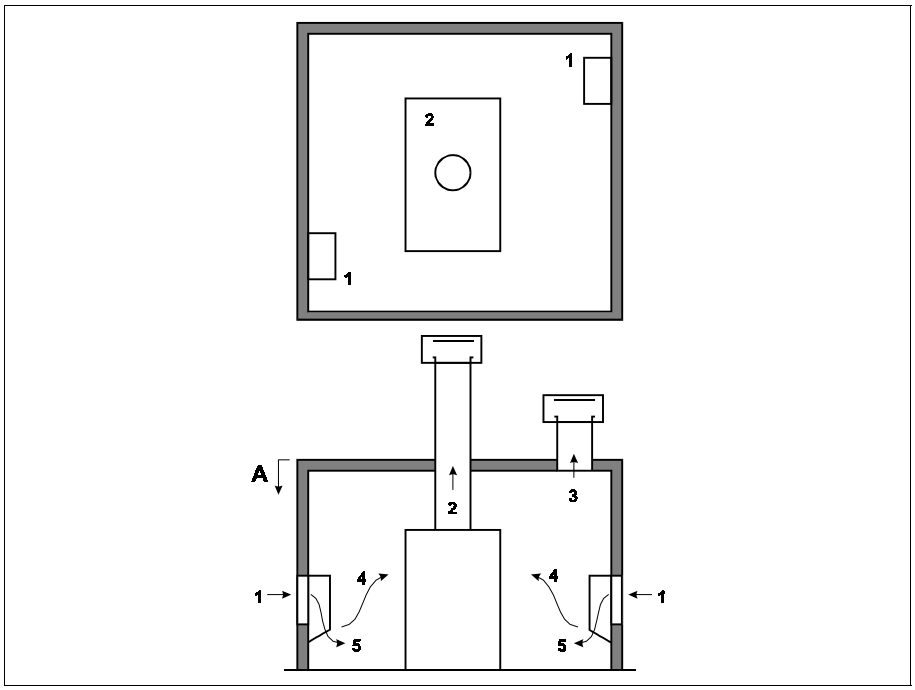


Fig. 15 Ventilation an flue placements

5.1.3 Air supply and ventilation

Natural ventilation

Where natural ventilation is required, permanent openings at low and high level, communicating directly with the outside air, shall be provided.

The openings shall be sited so that they cannot be easily blocked or flooded. The grilles shall have a total minimum free area as follows, taking account of all fuel burning appliances.

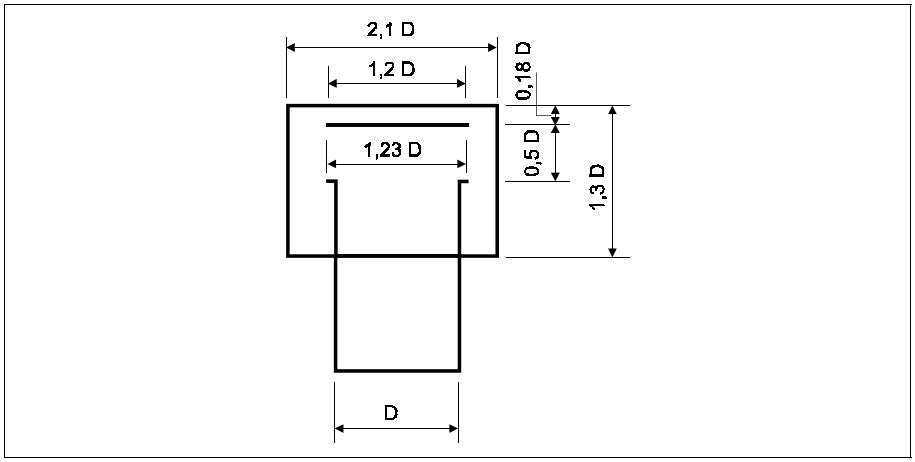


Fig. 16 Extraction cap

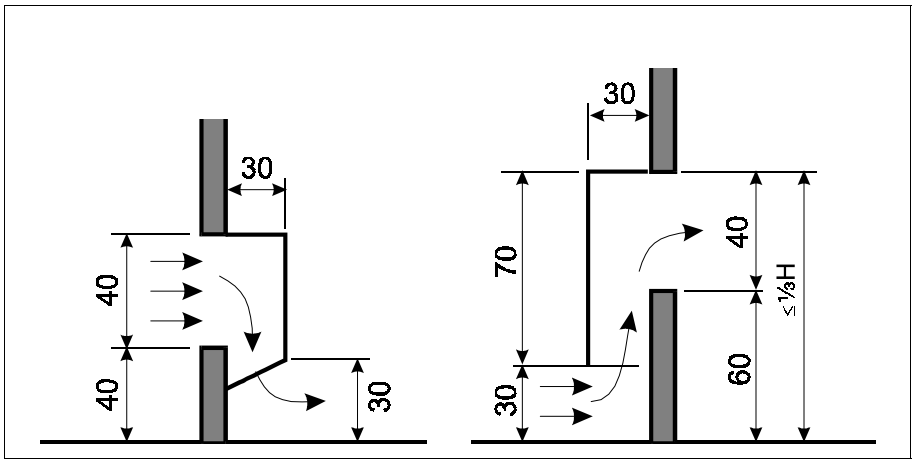


Fig. 17 Air inlet openings (sizes in cm)

Low level inlet
540 sq. cm plus 4,5 cm^2 per kilowatt in excess of 60 kW total rated input.
High level outlet
270 sq. cm plus 2,25 cm^2 per kilowatt in excess of 60 kW total rated input.

Mechanical ventilation
The supply of air by mechanical means shall be by mechanical inlet with natural or mechanical extractions, mechanical extraction with natural inlet must not be used.

The minimum flow rates with mechanical ventilation are as follows:
Inlet air (combustion ventilation) - 1,1 m^3 per second per 1000 kW total rated heat input.
Extract air (ventilation) - 0,45 m^3 per second per 1000 kW total rated heat input.
Further details regarding air supply are given in BS 6644.

5.2 Unit connections

5.2.1 Gas supply

The product has to be installed by a recognised installer fully according to the current national and local requirements, norms and standards (see supplement).

Gas connection can be found at the right side of the water heater.

Always mount a gas filter.
The main gas service cock and gas filter should be supplied by a qualified heating engineer. Install the main gas service cock and the gas filter as close to the water heater as possible.

The R18 series of water heaters are suitable for connection to a 25 mbar gas network.

☞ The minimum supply pressure **must never fall below 18 mbar**. With a lower gas pressure it is possible that the water heater will not run at 100% capacity. At the same time the water heater can be more prone to failures.

Adjust the burner pressure with a supply pressure of 20 mbar before the water heater.

5.2.2 Electrical supply

The product has to be installed by a recognised installer fully according to the current national and local requirements, norms and standards.

The water heater is wired according to the circuit diagram which is supplied with the water heater. The water heater must be protected by a 6 amp fuse.

⚠ The water heater must have an electrical supply voltage of 230 VAC. Do not cross connect 'live' and 'neutral'!
'Live' is connected to the terminal marked with “L” (brown), and 'neutral' is connected to the terminal marked with “N” (blue).
'Earth' is connected to the terminal "⏚" (yellow/green).

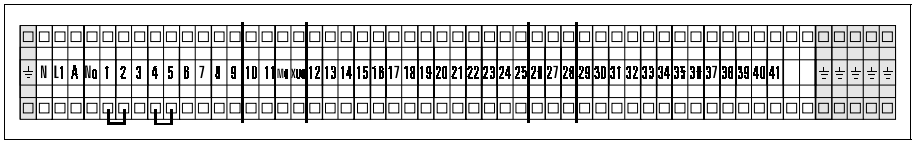


Fig. 18 Electrical terminal block

External control

It is possible to externally control the unit. The following terminals on the terminal block have the following functions:

1			common
1	-	2*	up signal
1	-	3	down signal
4	-	5*	enable
6	-	No	cascade signal (240 V)
M6	-	XU6	0 - 10 VDC control signal
32	-	No	external main gas valve
A	-	No	alarm signal (240 V)

⚠

For more information on the RWF40 see par. 2.3.2

* remove jumper.

Pump switching

The water heater's circulation pump must be in operation before the water heater is switched on. When the water heater is switched off, the circulation pump should continue to run for several minutes in order to reduce the amount of heat present in the water heater. If the pump is switched off too soon, the water temperature can rise above the maximum water temperature, as a result of which the maximum thermostat will cause the water heater to fall into "Lock-out".

5.2.3 Hydraulic connections

The product has to be installed by a recognised installer fully according to the current national and local requirements, norms and standards.

The cold water feed, recirculation and hot water flow are found on the side of the water heater. As standard all water heater types are fitted with a safety valve, **set to 5 bar**.

If requested the manufacturer can also safety valves which are set to between 5 and 8 bar. For the dimensions see Technical data table.

The water connections are found as standard on the right-hand side of the water heater, an alternative left-handed version is optional.

Fill and drain cocks are standard.

It is necessary to support the unit's flow and return pipes.
To ensure easy disassembly and reassembly, a removable spacer-pipe should be mounted to the unit's flow and return pipes as shown in figure below.

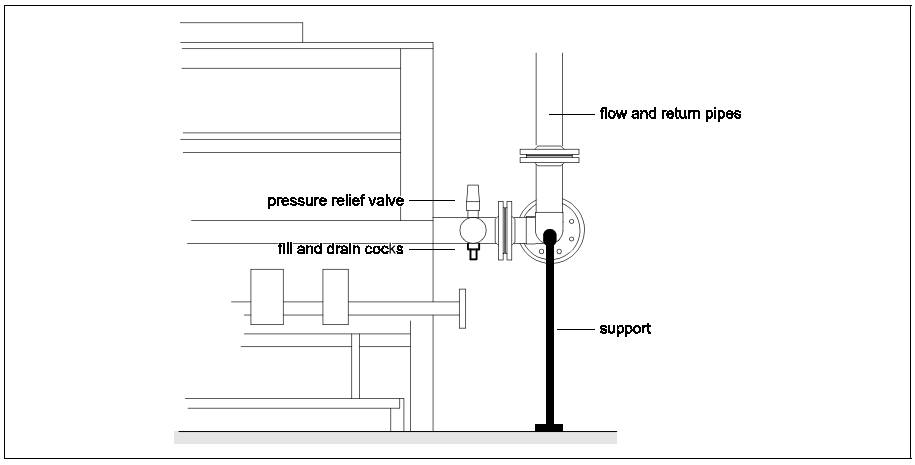


Fig. 19 Support flow and return pipes

5.2.3.1 Water system

The following notes are of particular importance to these water heaters.
A drain tap is fitted to the header at the connection end of the water heater to drain the content of the heat exchanger.
The water connections are normally on het right hand side of the water heater but can be supplied on the left hand side by special order, i.e. standard or alternative handing.
To prevent temperature lag time at the tappoint and to keep the water temperature uniform a suitable sized recirculation pump must be fitted.

Water treatment and suitable filtration is recommended for these water heaters and advice should be obtained from a reputable source.

5.2.3.2 Pump information

The primary circulating pump is sized to prevent the depositing of limescale in the water heater under the following conditions:

Water hardness in ppm	Maximum temperature in °C
0 - 80	90
80 - 250	85
250 - 350	80
350 - 500	60

Table 4 Maximum temperature

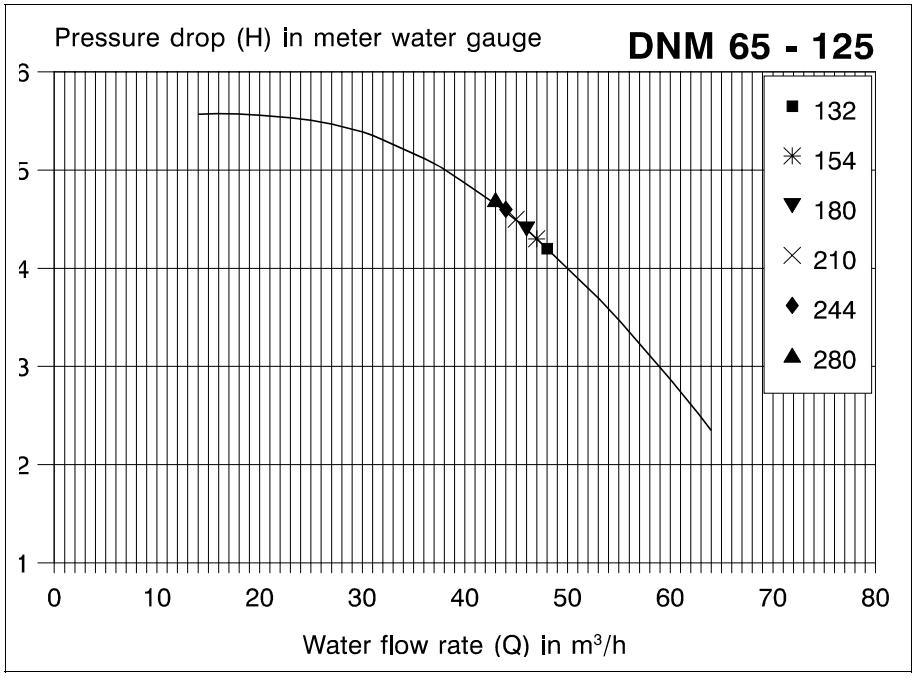


Fig. 20 TP 50 - 30

Type	Water flow rate Q in m^3/h	Pressure drop H in meter water gauge
132	48	4,7
154	47	4,6
180	46	4,5
210	45	4,4
244	44	4,3
280	43	4,2

Table 5 Water flow rate and pressure drop

Type	Grundfos pump	Pump motor rating			
132 154 180 210 244 280	DNM 65 - 125/136	3N~ 400 V	0,75 kW	1410 r.p.m.	2,22 A

Table 6 Pump motor rating

The water heater is supplied with a primary pump and must have a separate secured electrical supply (3 x 400 V) is normally required for the primary pump.
Tolerance on voltage: 400 V +10 % /-15 %

5.2.4 Flues

Flue dimensions

The water heater has its own integral draught diverter and does not require any other draught diverter in the flue.
The flue socket at the top of the water heater is sized for the direct attachment of single wall metal flue pipe.
Optional adapters can be obtained for twin wall metal pipe and BS 835 type flue pipe. It is recommended that the water heater be connected to it's own individual open flue systems, although some open flue systems can be used for multiple installations of the same type of water heater.
This section should be used for guidance only. A flue specialist should be contacted to rate a flue design.
You can use the following flue dimensions to assist in flueing:

Type	Q flue m^3/h	Chimney diameter mm
132	1770	450
154	2062	500
180	2421	550
210	2811	600
244	3270	650
280	3751	700

Table 7 Flue gas volumes

Heat input:	100 %
Flow temperature:	90 °C
Return temperature	70 °C
Flue gas temperature:	130 °C
CO_2	5,5 %

Average flue pipe resistance coefficients of various flue pipes. See also manufacturers information.	
bend 90E (R/D= 1,0)	ζ = 0,5
bend 90E (right angle)	ζ = 1,3
bend 45E	ζ = 0,5
T-piece	ζ = 2,0
outlet	ζ = 1,5

Table 8 Average flue pipe resistance coefficients

Flue condensation

Flue gases transfer heat when they pass through the chimney. If the flue gas temperature falls below dew-point, condensation will occur in the flue. Under normal conditions condensation will not occur. To prevent condensation the flue should be insulated. More than one atmospheric water heater can be connected to a single flue.

Fan diluted flue system

A fan diluted flue system can be used with this type of water heater. The principle is to mix the products of combustion with fresh air drawn from the outside atmosphere to reduce the CO_2 value below 1 % and so permit the flue discharge to be located at low level. Duct diameters are selected to give a duct exit velocity less than 8 m/sec. (See for further instructions Supplement).

5.3 General recommendations

The cold water feed pipes should be installed and protected in accordance with local regulations. Generally this means that a check valve and an expansion valve should be fitted.
Hot water pipes should be thermally insulated.
In order to maintain a constant temperature at all outlets it is necessary to have a return circuit with a **secondary H/W circulator of a correct size**.
Only the water heater pump is supplied with the R18.
The heat exchanger is made of copper, **galvanised pipes must not be used**.
With the R18 water heater an expansion vessel should be included to avoid water being expelled via the safety valve when the temperature rises.

The primary pump must run continuously when the water heat er is in operation.
To avoid the formation of steam, the **minimum water pressure must be 1,5 bar** at a maximum temperature of 90 °C.
Some variation in water temperature can be due to an increased demand coincident with a variation in water pressure. To avoid this **a water governor should be used**.
When using a water softener it is necessary to include a non return valve.

Where there is a risk of the water pressure falling below the minimum pressure a minimum pressure switch should be included which turns off the water heater.
Under certain conditions and following a high demand it is possible for the water heater to condensate. It is necessary to maintain the water heater above the minimum **condensation point of 36 °**C. To achieve this, a slow operating motorised valve controlled by a thermostat in the secondary return is required.

5.4 Water temperature

For hot water for personal purposes one can generally take a temperature of 43 °C.

When this water is used for other purposes and where there are temperature losses in the pipework a temperature of 60 °C is considered suitable.

Installations supplying large kitchens demand much higher temperatures. For degreasing a temperature of 65 °C is required, for sterilising 85 °C. In this case the hot water supply unit will be operating at a temperature of 85 °C and for sanitary purposes tempered down to the required levels using thermostatic mixing valves. (See fig. 22)

5.5 Demand for hot water for sanitary use

In general the demand for hot water in sanitary hot water installations is not constant. For example, in a hotel for baths and showers the highest demand will be in the morning and early evening.
To determine the output of the water heater, it is therefore necessary to know the volume and temperature of the water during these peaks.
The following tables serve as a guide. They are derived from various sources and from extensive experience.

User	Single use or fill in litres	Temperature in °C	Demand in litres/minute
Dwellings			
kitchen sink	13 - 15	40 - 60	12 - 18
basin	7 - 10	40	6 - 8
hand washing	5	30	6 - 8
shower	60	40	8 - 12
bath	100 - 150	40	12 - 18
dishwasher	60	60	12
Hotel - motel			
basin	10	40	8 - 12
hand washing	5	30	6 - 8
shower	60 - 80	40	8 - 12
bath	120 - 180	40	12 - 18
dishwasher (ind.)	60 - 90	60 - 85	18 - 24
Industries			
basin	10	40	8 - 12
hand washing			
10 people	150 - 300	35	5 - 10 per outlet
6 people	120 - 180	35	6 - 12 per outlet
shower	60 - 80	40	10 - 15
Taps (fitting) capacity diameter in mm			
10	half open	40	5
	fully open	40	10
15	half open	40	10
	fully open	40	18
20	half open	40	25
	fully open	40	45

Table 9 Delivery from fittings

5.6 Water quality

Water hardness

The hardness of water is caused by the dissolved salts of calcium and magnesium, principally carbonates, sulfates and silicates.

Temporary hardness

When the temperature of the water is raised, part of the salts are precipitated as calcium carbonate and magnesium hydroxide. This is termed temporary or carbonate hardness.

Permanent hardness
The permanent hardness consists of minerals contained in the water which are not deposited such as calcium sulphate and calcium silicate. These salts form permanent hardness or non carbonate hardness.

Total hardness
The total hardness is the sum of the temporary hardness and permanent hardness.

Degrees of hardness
The temporary hardness of the water is expressed in mg/litre (ppm).

NOTE: 1 ppm (parts per million $CaCO_3$) = 1 mg $CaCO_3$ /litre

It is necessary to advise us of the hardness of the cold feed mains water supply in order to correctly size the circulation pump. Where the water hardness varies from season to season it is necessary to ascertain the maximum hardness.

The potential Hydrogen (pH)
The amount of hydrogen ions determines whether the water is acid or alkaline.
- A solution is acid when pH is less than 7
- A solution is alkaline when the pH is greater than 7.

The pH is measured at 25 °C. A pH of 7 corresponds to a neutral water. The pH varies with temperature. See graph A below. The pH of the water is very important as it influences precipitation of the carbonates. The pH of water is generally between 6,5 and 7,5. The temporary hardness is between 50 % and 100 % of the total hardness.

There is a relationship between water temperature and hardness. It is necessary to know the hardness of the cold feed main water supply in order to correctly the water heater pump.

If the concentration of magnesium chloride is higher than that of calcium chloride use a water softener. The use of water softeners is strongly recommended where water hardness exceeds 200 ppm.

Water hardness in ppm	Setting of the limit thermostat in °C
0 - 80	95
80 - 250	90
250 - 350	85
350 - 500	65

Table 10 Setting of the limit thermostat

Standard factory setting of the limit thermostat is 65 °C.

For higher temperature requirements contact your supplier. They will make the necessary water quality measurements and advise you with regards to high temperature settings and the use of water softeners as required.

Water hardness in ppm	Maximum pH	Maximum operating temperature in °C
0 - 80	8,4	90
80 - 250	7,6	85
250 - 350	7,2	80
350 - 500	7,0	60

Table 11 Maximum operating level

When the operating temperature exceeds the limit settings, the water heater will be turned off and will not go to lock-out.

5.7 Formula to calculate hot water requirements

From table 12 select the application, the number of hot water units and the formula to apply.
From table 13 as a function of the number of hot water units determine delivery in l/h at 60 °C.
From table 14 apply the formula to obtain the performance of the system.

Type of property	Hot water units *	Formula to apply **
Houses		
individual dwellings		
4 or 5 rooms, 1 bathroom	1 or 2	3
4 or 5 rooms, 2 bathrooms	2 or 3	3
flats		
3 or 4 rooms, 1 bathroom	1,5/flat	2 - 3
5 rooms, 2 bathrooms	2/flat	2 - 3
hotel, motel		
overnight visitors *family hotel*	1/room	2
bed and breakfast	1/room	3
resident *touristic*	1,5/room	3
luxury	2/room	3
Public sector		
car wash	0,5	4
restaurant	15/100 meals/sitting	4
hairdresser	3/seat	1
beauty salon	4/assistant	1
offices	1/washroom	1
Institutions		
sport club	5/shower 0,5/tap	4
school	4/shower 0,5/tap	3
factory	5/shower 1/tap	2 - 4
hospital	2 or 3/bed	1 - 2

Table 12 Application numbers

Number of hot water units *	Delivery G in litres/hour at 60 °C for numbers of hot water units***
1	700
2	1100
3	1250
4	1350
5	1400
6	1475
7	1550
8	1600
9	1675
10	1700
****15	1900
20	2100
25	2300
30	2500
40	2850
50	3200
60	3600
70	4000
80	4350
90	4750
100	5100
125	6050
150	7000
175	7950
200	8900
225	9850
250	10800
275	11700
300	12700
325	13650
350	14550
375	15500
400	16450

Table 13 Delivery

Formula for application		Hot water units *
1	Low demand	Q_{60} = G x 28 output in W
2	Medium demand	Q_{60} = G x 35 output in W
3	High demand	Q_{60} = G x 42 output in W
4	Constant demand	Q_{60} = G x 57 output in W

Table 14 Formula for application

* The hot water unit is determined as a function of the delivery from the taps.

** The formula set out in table 12 is not to be considered as a directive. To find a good formula it is necessary to compare one with another and adapt by experience.

*** The hot water units are based on a maximum delivery of 15 litres/minute for each outlet point.

**** When there is demand of less than 20 units and when high peaks are expected (sports clubs) we do recommend the use of a storage tank.

5.8 A small selection of applications

5.8.1 Single temperature system

Without storage tank using sufficient recirculation
Only applicable in projects with a constant draw or small fluctuations without large peak load. Such as hotels without catering towards the tour operators, hospitals, chemical industry, food processing, dairy produce etc.

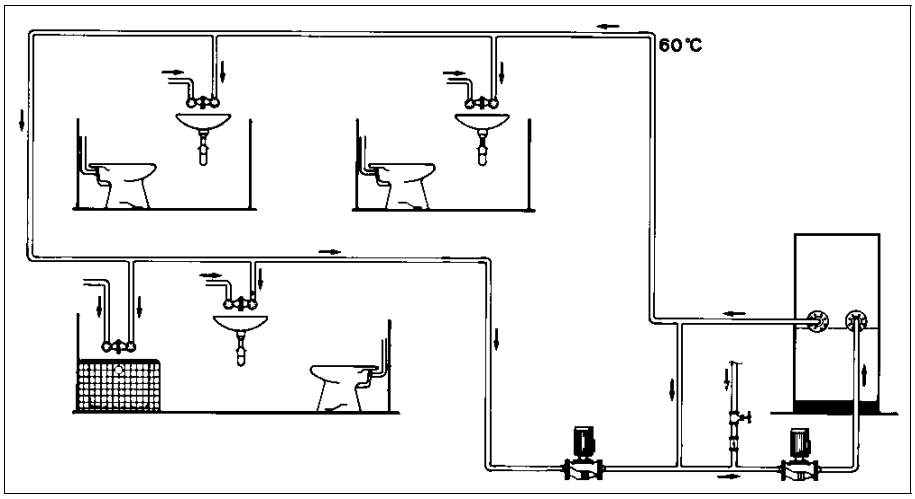


Fig. 21 Single temperature system without storage

5.8.2 Dual temperature system

With storage tank 500 l
Applicable to projects where exact temperatures have to be adhered to or in projects with large peak loads and fast changing water demands. High rise apartments, hotels, kitchens, meat processing, fish processing industry etc.

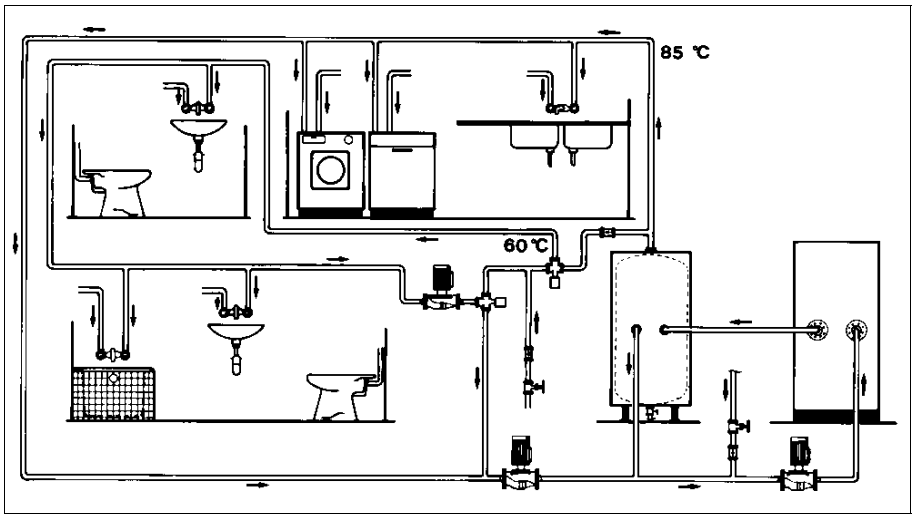


Fig. 22 Dual temperature system with storage

5.8.3 Industrial application

With storage tank 500 l +

This type of system has many applications in areas with large water demand fluctuations and variable temperatures to be kept within small tolerances. Industrial applications such as carwash (removing of protective wax layer), photo and film processing, laboratories, plating processing, slaughterhouses etc.

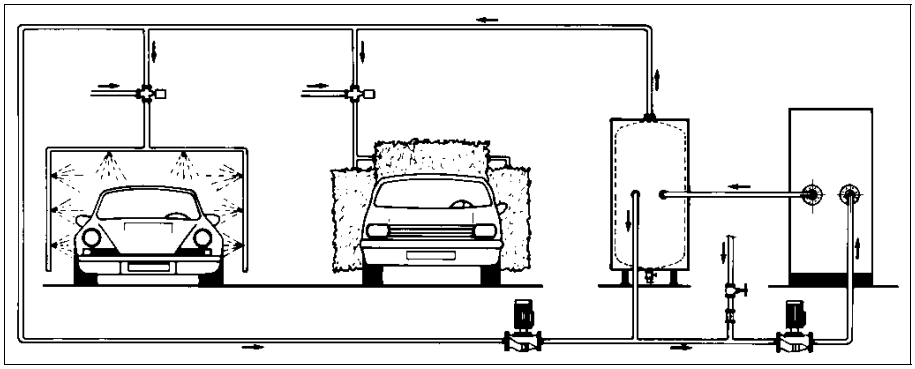


Fig. 23 Industrial applications with direct multiple temperatures

5.8.4 High peak demand use

With large storage tank

This application finds its way in projects with large peak loads in regular intervals. Schools, washing fountains at manufacturing facilities, launderettes etc.

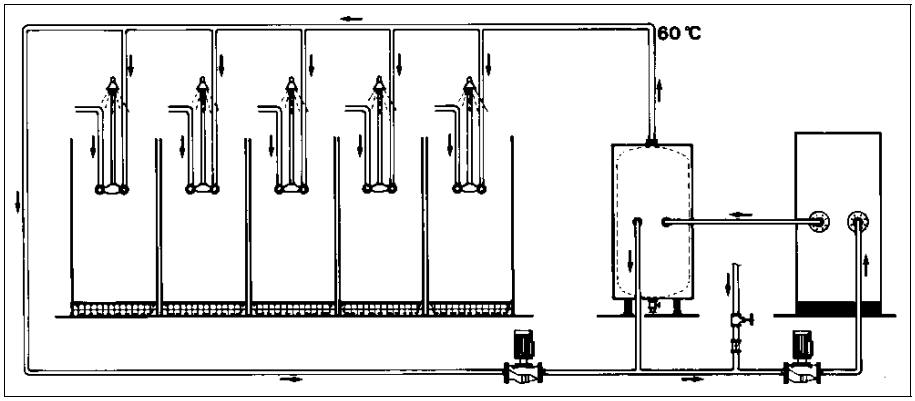


Fig. 24 High peak demand use during a short period with waiting periods

Other applications
Bottle cleaning and desinfection crate cleaning
Meat processing
Fish hatchery
Plating industry
Film processing
In other words where ever warm or hot water is needed an Andrews Supa Flo water heater is the solution.

6 COMMISSIONING

6.1 General

COMMISSIONING OF THE WATER HEATER MUST BE CARRIED OUT BY PROPERLY QUALIFIED AND AUTHORISED PERSONNEL. OTHERWISE, THE GUARANTEE WILL BECOME VOID.

Never deviate from the instructions in this manual.

Flushing the system

To prevent damage from rust, sealing compounds, sand, metal particles etc., the system must be flushed thoroughly, before the system is switched on. Also ensure that the heat exchanger is free of any such deposits after flushing the system.

Water heating system

- fill the system up to the standard set pressure
- bleed the system
- switch on all pumps and check for correct direction of rotation
- close the stop-valves in the secondary groups.

Electrical connection

- check the water heater electrical connection
- switch on the water heater with the ON/OFF switch
- adjust the temperature regulator to the desired flow water temperature.

Gas connection

- open the gas service cocks
- bleed the gas pipe.
  NB: Ensure adequate ventilation during bleeding
- connect the measuring equipment to check:
  * pre-pressure
  * burner pressure
  * water heater ionisation

6.2 Pre-lighting checks and dry run

The following is a list of appliance checks to be carried out.

6.2.1 Check 1 *With the water heater gas inlet service cock closed and electricity supply switched off*

I) Ascertain from the gas supplier or the customer that the meter installation is operational.
II) Ensure that the gas installation pipework up to and including the gas inlet service cock has been tested for gas soundness in accordance with IM/5 or BS 6891 as appropriate.
III) Ensure that the gas installation pipework to the gas inlet service cock has been purged in accordance with IM/2 or BS 6891 as appropriate.
IV) Check that all electrical supplies are isolated
V) Check electrical earth continuity between the water heater gas pipework and the mains supply.
VI) Check the electrical components are of the correct voltage range, particularly low voltage ancillary controls.
VII) Check the pump motor current and adjust the starter overload settings.
VIII) Fill and vent the water system and check for leaks.

6.2.2 Check 2 *With the water heater gas inlet service cock closed, electrical supply switched on but on/off switch on water heater control panel switched off*

I) Check that the direction of rotation of the pump(s) is correct.
II) Check the correct operation of the water flow switch.

Components within the connection tray
(Remove cover from electrical connection tray)

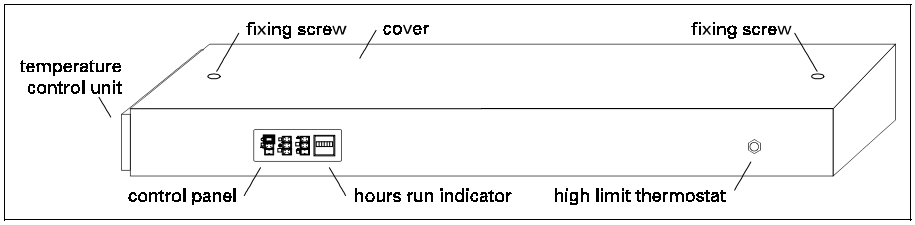


Fig. 25 Connection tray

☞ III) Check the setting of the modulating combustion air damper situated underneath the burners, there should be a gap **of 8 mm with the damper in the fully closed** position against the stops for Natural Gas (11 mm for L.P.G.) See tables 15a and 15b.

Burner trolley assembly

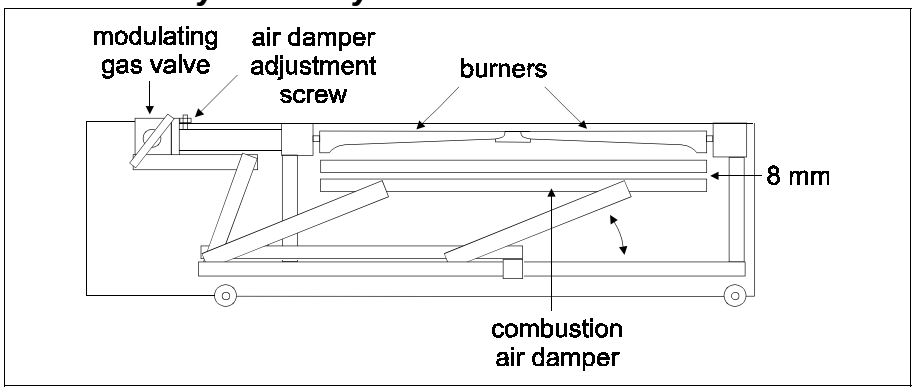


Fig. 26 Burner trolly assembly

IV) Check the operation and interlocking of any air inlet and extraction fans.
V) Check the correct connection and operation of any external controls.
VI) With the control thermostat on a high setting turn on the on/off switch at the water heater control panel, check that the combustion air inlet damper cycles open and then closes, that there is a spark at the ignition electrode, that the pilot safety shut off valve is heard to be opening and that the water heater goes to lock-out in approximately 5 secs later as there is no gas.

6.2.3 Check 3 ***With the electricity supply switched off check the gas train downstream of the gas inlet service cock as follows:***

Refer to Gas trains, fig. 34.

1. Ensure that gas service cock and pilot manual cock are closed.
2. Unseal and connect a pressure gauge to test point 10/1 and unseal test point 10/2.
3. Open and then close the gas service cock to pressurise up to the 1st safety shut off valve and the pilot manual cock.
4. Allow 1 min. for temperature stabilisation and then check for any loss of pressure during the next 2 minutes.
5. If there is a pressure loss the pipework up stream of the 1st safety shut off valve should be checked with a suitable leak detection fluid with the gas service cock open.
6. If no leak is found, this indicates that the 1st safety shut off valve is letting by and should be replaced.
7. With test points 10/1 and 10/2 unsealed connect them together with a short piece of flexible tubing which incorporates a tee connection to the pressure gauge.

8. Open and close the gas service cock to pressurise up to the 2nd safety shut off valve.
9. Allow 1 min. for temperature stabilisation and then check for any loss of pressure at the gauge during the next 2 minutes.
10. If there is a pressure loss the pipework between the 1st and 2nd safety shut off valve should be checked with a suitable leak detection fluid with the gas service cock open.
11. If no leak is found this indicates that the 2nd safety shut off valve is letting by and should be replaced.
12. Seal test point 10/2, replace pressure gauge on unsealed test point 10/1 and open pilot manual cock.
13. Open and close the gas service cock to pressurise up to the pilot safety shut off valve.
14. Allow 1 minute for temperature stabilisation and then check for any loss of pressure at the gauge during the next 2 minutes.
15. If there is a pressure loss the pipework upstream of the pilot safety shut off valve should be checked with a suitable leak detection fluid with the gas service cock open.
16. If no leak is found this indicates that the pilot safety shut off valve is letting by and should be replaced.

Adjusting the burner pressure

The burner pressure must be adjusted when the water heater has been running for 20 minutes at high load (state of equilibrium).

Natural gas H (G20) Gas service pressure 20 mbar Nozzle diameter 1,85 mm			
minimum load (20 %)			
Type	**Burner pressure (mbar)**	**Pilot pressure (mbar)**	**Air damper opening closed (mm)**
132	0,8	3,5	8
154	0,8	3,5	8
180	0,8	3,5	8
210	0,8	3,5	8
244	0,8	3,5	8
280	0,8	3,5	8
full load (100 %)			
Type	**Burner pressure (mbar)**	**Pilot pressure (mbar)**	**Air damper opening maximum open (mm)**
132	10,5	3,5	125
154	10,4	3,5	125
180	10,2	3,5	125
210	10,0	3,5	125
244	9,9	3,5	125
280	9,8	3,5	125

Table 15a Burner pressure Natural gas

Liquid Propane Gas Gas service pressure 50 mbar Nozzle diameter 1 mm			
minimum load (20 %)			
Type	**Burner pressure start/min. (mbar)**	**Pilot pressure (mbar)**	**Air damper opening closed (mm)**
132	7	11	11
154	7	11	11
180	7	11	11
210	7	11	11
244	7	11	11
280	7	11	11
full load (100 %)			
Type	**Burner pressure (mbar)**	**Pilot pressure (mbar)**	**Air damper opening maximum open (mm)**
132	46	11	125
154	46	11	125
180	46	11	125
210	46	11	125
244	46	11	125
280	46	11	125

Table 15b Burner pressure Propane

6.3 Live run check

a. Disconnect the electrical connections to the 1st and 2nd safety shut off valves by removing the plug from the front electrical tray.
Open the gas service cock and pilot manual cock and with the control thermostat on a high setting turn on the electrical supply and the on/off switch on the front control panel.
Check that the combustion air inlet damper cycles to the fully open position and back before ignition of the pilot burner commences.
Using the sight glass at the lower right hand side of the water heater check that the ignition electrode ignites the pilot burner and that the pilot burner is stable in operation.
(It may be necessary to purge the ignition system if there is air in the gas supply; although seven minutes must be allowed between each attempt to ensure that any gas has been dispersed from the combustion chamber).
Press reset button to override water heater lockout.

b. Carry out step a) above and close the pilot manual cock once the pilot burner has ignited. Check that the water heater proceeds to lock-out.

c. Connect a pressure gauge to pressure test point 10/3 (see gas train fig. 34) and carry out step a) above. Check that pilot burner pressure is as indicated in table 9, with the pilot burner on test the pilot pipe and connections from the pilot manual cock to the burner connection or gas sound.

d. Connect a pressure gauge to the main burner manifold, test point 10/4 and re-connect the electrical connections from the main safety shut off valves into the front electrical tray.
Switch the on/off switch to on and the water heater will ignite in the sequence described in a) above with the main burners igniting from the pilot burner at minimum rate. Check ignition of the main burners is smooth. Observe that the modulating air damper opens and the gas rate increases to maximum. Check the main burner pressure on maximum is as indicated in table 15 and adjust if necessary.
Check all pipework and connections downstream of the safety shut off valves for gas leaks with a suitable leak detection fluid.
Switch off the water heater, remove pressure gauge and reseal test point.

e. Connect a µA-meter (0 - 50 µA) in series with the flame detection circuit. While measuring ionisation the main burner should stay switched off. To do this, disconnect the main gas valve by breaking the electrical connection by removing the plug. Connect the black wire (-) (1) of the µA-meter with the ionisation connector electrode (2) on the water heater (fig. 27). Connect the red wire (+) (3) of the µA-meter with the ionisation cap (4). The ionisation of the pilot burner must show a minimum of 5 µA during 10 seconds after which the burner falls into flame detection lockout. Wire the main gas valve back to its originally conditions.
Repeat the test by starting the water heater to maximum operation. Check that the µA-meter reads at least 5 µA after 10 seconds.

f. Switch on the water heater. Check for spillage of products of combustion from the draught diverter opening with a smoke detector or other suitable apparatus, ensuring that any openable windows, doors etc., fitted in the water heater space are shut and any extraction fans are operating. Spillage checks should be done with the water heater cold and when the system has heated up, both on maximum and minimum rates.

h. Re-check the main burner pressure at maximum and by modulating the damper down also check the main burner indicated in table 15, adjust if necessary at the main burner governor.
Check this against a gas rate reading at the installation gas meter.

i. Check the operation of the water flow switch by gradually closing down one of the water heater isolating valves. The water heater should go to lock-out.

j. Check that the pump overrun is operating correctly when the water heater is switched off and that any time controls are operational.

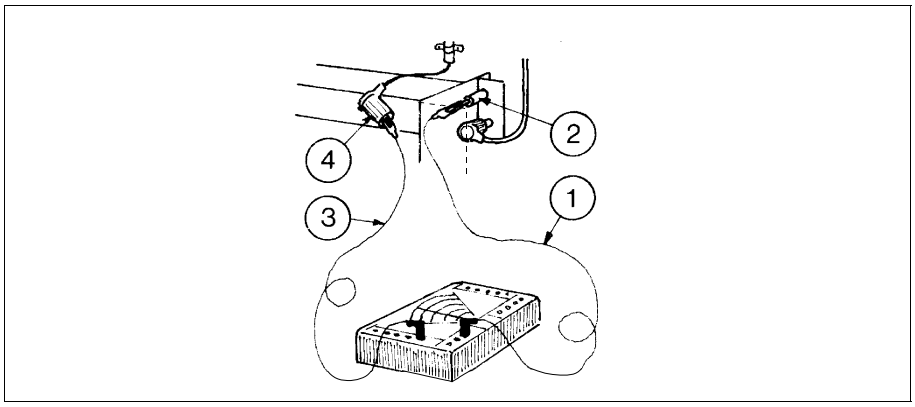


Fig. 27 Measuring ionisation

6.4 Instructions to user

Upon satisfactory completion of commissioning hand the Technical documentation to the person responsible for the plant and explain the method of safe operation. Ensure that he/she is fully conversant with the starting, shut down, general operation and emergency shut down procedures. Explain the operation of the high limit thermostat, but stress that in case of repeated overheating of the water heater that the fault should be corrected by a competent person.
Stress the importance of regular servicing for safe and efficient operation and that if a gas leak is detected to turn off the water heater at the gas service cock and to call the local gas supplier.

Water heater failure

In case of water heater failure the system will fall into lock-out. Reset the water heater with the reset button on the control panel. Repeat this several times if necessary. If the water heater still does not start, refer to chapter ‘Operation and fault finding’ (7).

7 OPERATION AND FAULT INDICATION

7.1 Function

The water heater starts up in the sequence described below: Heat demand. Air damper test. Ignition of pilot flame. As soon as pilot flame is detected, an ionisation current will pass to the flame safeguard control box. The main gas valve opens and gas ignites over complete burner tray. The modulating control will commence from low fire condition.

7.2 Regulation

The burner (input) is controlled through a butterfly valve and modulates between 20 % and 100 % heat demand. If the heat demand is smaller than 20 %, the burner will remain off. The temperature is controlled through an electronic PID regulator.

7.3 Control panel

To assist with fault finding the control panels incorporate a number of warning indicators and switches.

1 Power on/off switched indicator
2 Water heater lock-out indicator (ionisation)
3 Reset switch
4 Overheat temperature indicator
5 Insufficient water flow indicator
6 Low gas pressure indicator (optional)
7 Gas leak indicator (optional)
8 High gas pressure indicator (optional)
9 By pass switch for high limit test
10 Hours run indicator

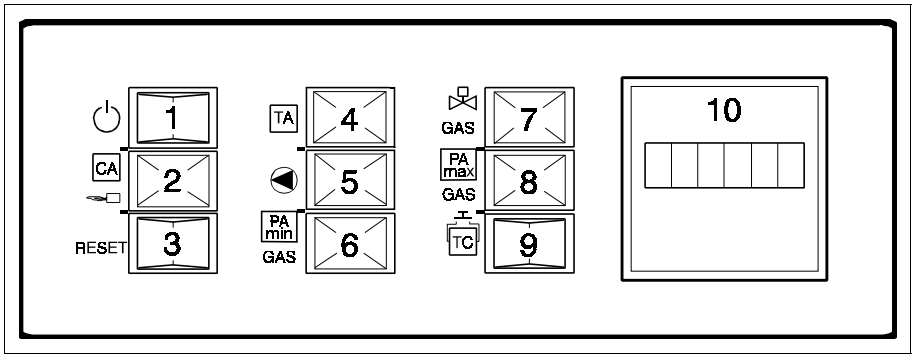


Fig. 28 Control panel

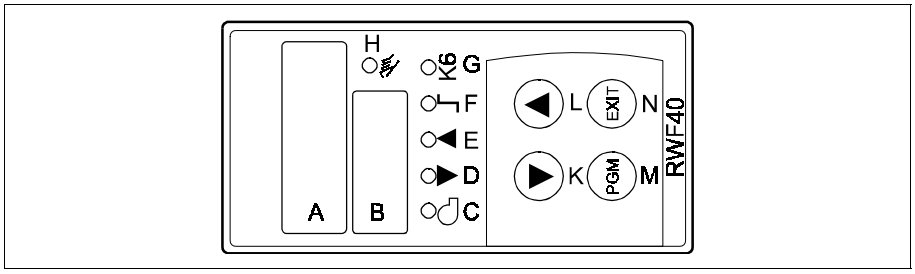


Fig. 29 Electronic temperature regulator Rwf40

RWF40

A Process value (actual temperature)
B Set point (temperature)
C Burner enable (not applicable)
D Mod. indicator (decrease fire rate)
E Mod. indicator (increase fire rate)
F Two-stage firing (not applicable)
G Limit comparator
H Manual operation

The keys K-L-M-N are used for displaying values and changing parameters in the temperature controllers configuration.

K Down key (reduce value)
L Up key (increase value)
M Programme key
N Exit key

7.4 Fault indications

If there is insufficient water flow the water heater will turn off and lock-out. Red lamps 2 and 5 on. Reset by pushing button 3.

If the flow temperature exceeds the **high limit** setting, the boiler will mechanically lock out and red lamp 2 illuminates. Reset by pushing button 3 and allow the unit to fire. If lamp 4 TA then illuminates, reset button in high limit thermostat. Remove the high limit thermostat cap nut placed at the right hand side of the cover (see sticker high limit thermostat) with a 17 mm ring-spanner. Press a screwdriver against the green peg until a light click is heard. Lamp 4 turns off. Refit cap nut. Then press button 3 to reset red lamp 2 (CA).

If an ionisation failure occurs, red lamp 2 will light, burner will switch off. Reset by pushing reset button 3.

The pilot flame on the main burner can be observed through the sight glass on the lower left hand side of the water heater.

7.5 Start-up

Ensure that gas and electric supplies are connected.
Start sequence:

A Turn manual gas cock open.
B Turn the pumps on.
C Ensure that all hot water outlets are closed.
D Turn the supply voltage to the water heater on and turn the water heater on using the power switch 1.
E In case of failure, observe type of failure, take necessary steps to rectify, refer to section 7.8 for details.
F Set temperature regulator as required.

7.6 Shut-down

A To turn off for short periods switch water heater off by using the power switch 1.
B For long periods switch the pump off and after 6 minutes close the main gas cock and main electrical supply.

7.7 Warnings

Non operation of water heater during the winter time can cause freezing. By draining the water out of the heat exchanger, using the drain taps mounted on the under-side of the flow and return header manifold, damage to water heater will then be avoided.

WARNING
In case of failure obtain assistance from a qualified CORGI gas/heating engineer. Don't repair yourself.

7.8 Fault finding table

Fault	Possible cause	Solution
Water heater does not attempt to light	No electrical supply to water heater	Check whether switched indicator (1) is alight
		Check all external controls for continuity
	No heat demand	Check control thermostat is set high enough
	High limit thermostat has operated	If lamp 2 is illuminated, press reset button and allow unit to fire. If lamp 4 then illuminates, reset button in high limit thermostat (see 7.4)
	End switch gas valve is not in rest position	Check end switch gas valve
	Insufficient water flow indicator (5) alight	check water system
		Check air damper relais, replace if necessary
	Control panel fuse blown	Check fuse
	Faulty control box	Change box
Air damper cycles and water heater does not light	Micro switch minimum setting (II) servo motor is set above 20 %	Readjust minimum setting micro switch (II) servo motor
Heat demand Servo motor does not react	Closed control switch main gas valve is inoperative	Check and repair
	Turn open relay inoperative	Replace turn open relay
	Up signal is present at contact 22	Check servo motor connector, if operative replace servo motor
Heat demand Servo motor turns the air damper only open but not close	Micro switch maximum setting (I) is not set correctly	Readjust maximum setting micro switch (I)
	Micro switch contact is coroded or broken, no voltage at contact 23	Replace servo motor
	There is voltage at contact 23 but close down relay does not react	Replace close down relay
Heat demand Servo motor opens en closes the air damper but water heater does not start	No voltage at contact 21	Check 20 % setting micro switch, readjust. If this does not correct problem replace servo motor
	Voltage at contact 21 and 20 % micro switch is operative. Check pre requisite relay	If relay does not react replace requisite relay

Fault	Possible cause	Solution
Air modulating damper cycles, no ignition spark and water heater then goes to lockout, indicator (2) alights	HT lead disconnected or faulty	Correct
	Ignition electrode incorrectly set or faulty	Check setting or replace
	Faulty ignition generator	Change
	Faulty control box	Change box
Ignition sparks, pilot burner does not light and water heater then goes to lock-out indicator (2) alights	Gas supply turned off	Turn on
	Pilot manual cock turned off	Turn on
	Air in gas line	Purge air
	Faulty pilot safety shut off valve or Connections	Rectify
	Pilot injector blocked	Clean
	Pilot governor set too low	Adjust
Pilot burner ignites but water heater then goes to lock-out, indicator (2) alights. Main burners do not light	Check flame probe	If damaged, replace
	Flame probe lead(s) not connected or faulty	Rectify
	Faulty connections to main safety shut off valve(s)	Rectify
	Faulty main safety shut off valves	Change valves
	Faulty control box	Replace
	Check ionisation current, as per instructions	
Water heater operates but then goes to overheat indicator (4) alights	Fault in water system	Rectify
	Main burner pressure set too high	Reset
	Pump overrun inoperative	Rectify
	Water heater does not shut down	Min. fire is set below minimum setting, reset servomotor.

8 MAINTENANCE

8.1 Safety

Always wear the proper protective clothing and shoes when servicing the water heater. Wearing jewelry and loose clothing can contribute to unsafe situations.

8.2 General information

In order to keep the R18 in a safe working condition, the water heater should be inspected and serviced at least once every year and cleaned if necessary.

Frost protection

When water heater is not in operation for a long period of time, the heat exchanger should be protected against frost. This can be achieved by draining water from the heat exchanger.

8.3 Inspection

Inspecting the draught diverter

The draught diverter and heat exchanger can be inspected and cleaned with the minimum on tools and time. Place yourself in the draught diverter and execute the following:

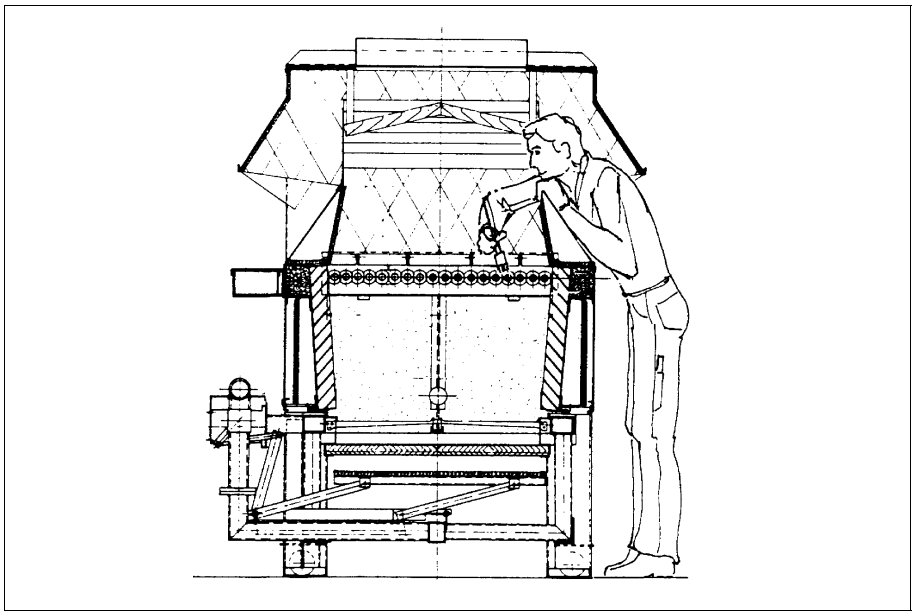


Fig. 30 Inspection and cleaning of the draught diverter and heat exchanger

Heat exchanger (external inspection)

As you inspect the inside of the draught diverter, the top of the heat exchanger can also be inspected. Check for dirt and sooting. For cleaning the heat exchanger, refer to chapter 8.4 ‘Cleaning’.

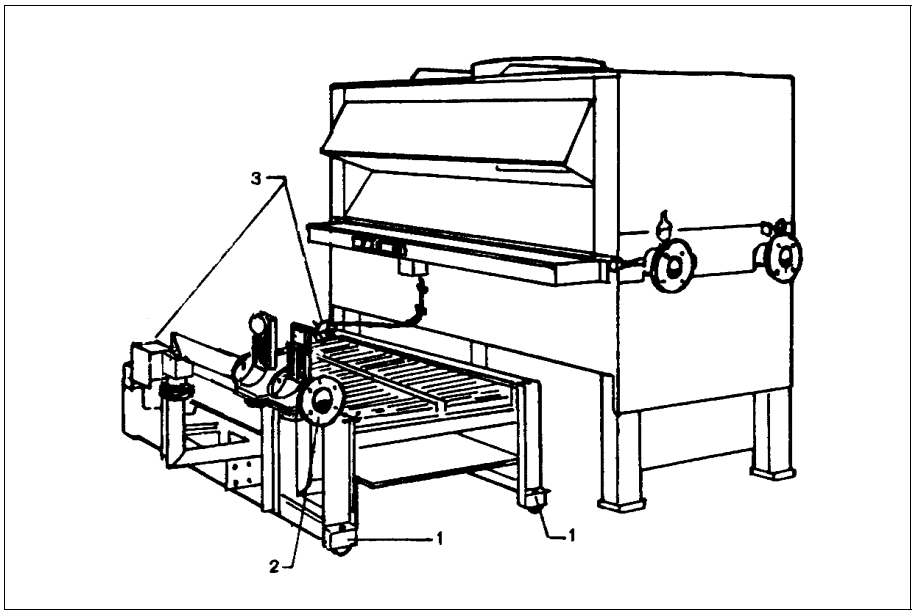


Fig. 31 Removing the burner

After removing the burner, the combustion chamber and the underside of the heat exchanger can easily be inspected.

Heat exchanger (internal inspection)
Internal inspection must be carried out by qualified and authorised personnel.

Sight glass
A sight glass can be found on the left hand side (on alternative handings the sight glass will be located on the right side) of the burner assembly for inspection of:
- water heater ignition
- combustion
- pilot flame

Burner tray
The burner manifold and the gas regulator are connected by means of a coupling.

⚠ Remove the burner for inspection as follows:
1 Close the gas service cock and disconnect from the supply.
2 Release the burner from the water heater frame (4 bolts).
3 Disconnect the spark plug, ionisation caps, servo-motor plugs and solenoid value plugs and remove the ‘earth’ lead.
4 Carefully withdraw the burner from the water heater unit. Inspect for dirt and clean the burner bars if necessary.

8.4 Cleaning

Before using chemicals and cleaning agents in the water heater, please contact your supplier for advise.

Always read the instructions on the bottle of the cleaning agents before using them.

Heat exchanger (external cleaning)
Remove the baffles before cleaning the heat exchanger.
- Use compressed air when the heat exchanger is lightly soiled.
- Use a stiff brush and soap when the heat exchanger is very dirty, do not allow the refractory brick-work to get wet.

NB.

The heat exchanger may become heavily soiled (soot for example), when the instructions are not followed properly.
This may be caused by:
- insufficient ventilation
- condensation on the heat exchanger.

If this is the case, clean the complete heat exchanger, including the baffles. Furthermore, the cause of the problem should be ascertained and rectified.

Heat exchanger (internal cleaning)
Descale the heat exchanger with the correct chemicals.

Filter inspection (use of a gas filter is recommended)
When the pressure loss over the gas regulator gets too high, the burner pressure will decrease noticeably. A dirty gas filter may be the cause. The filter should be inspected at least once every year. To allow access to the filter element, first remove the side cover of the gas regulator assembly. Then remove the filter and replace it if necessary. Replace the cover and check for leaks.

8.5 Servicing

WARNING: ONLY COMPETENT PERSONS SHOULD CARRY OUT SERVICING ON THIS WATER HEATER IN ACCORDANCE WITH THE GAS SAFETY (INSTALLATION AND USE) REGULATIONS 1984.

Ensure that both gas and electrical supplies are switched off before carrying out any service operation.
After carrying out any service operation it is important to check for gas soundness and re-commission the water heater as described in Section 6 - Commissioning.
Ensure that any panels covering live connections are replaced securely upon completing any service operation. Wiring diagrams and components lists are supplied separately.

Routine maintenance
The frequency of routine maintenance depends on the use and environment in which the water heater is used although it must be carried out at least annually.

The scope of routine maintenance includes the following:

I Cleaning the heat exchanger
II Cleaning the burner assembly and inspect the condition of the burner and ignition components
III Checking the gas train for soundness
IV Inspecting the adjustment of the air damper and operation of the modulating gas valve and servo-motor
V Checking the effectiveness of natural or mechanical ventilation
VI Inspecting the flue system including terminal, for damage and ensure it is evacuating the products of combustion without any leakage or spillage
VII Check gas pressure settings, safety lock-out systems and water flow switch
VIII Inspect condition of refractory lining.

Procedure
Release the gas train.
Disconnect all the plugs from the front electrical panel, release the screws at all 4 sides of the burner trolley. The burner trolley can now be withdrawn from underneath the water heater.

Remove the stainless steel sidebaffles down holders by releasing two screws in either side and remove the flueway baffles from the top of the heat exchanger. Inspect the heat exchanger for deposits and clean if necessary, check condition of the copper fin tubes and replace flueway baffles when damaged. Check the condition of the water heater for any possible corrosion damage. Also check the condition of the combustion chamber insulation panels, replacing if necessary.
With the burner trolley removed each individual burner bar can be removed and cleaned, with the exception of the right hand burner bar. This is done by first removing the insulation covered stainless steel channels, located at the front and rear of the burner assembly, and then removing the burner bar by first lifting the end of the burner out of its locating notch and then withdrawing the burner from its injector (avoid damaging the electrodes when removing the pilot burner assembly).

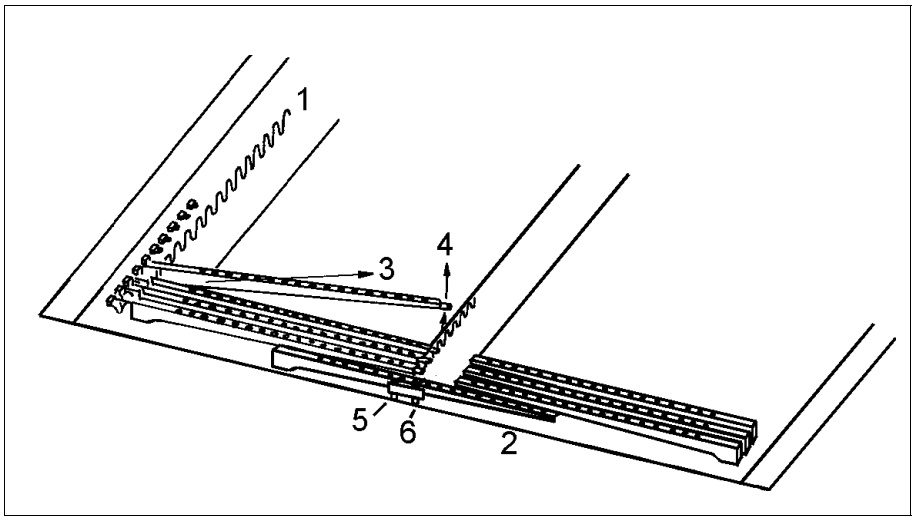


Fig. 32 Burner assembly

1 Burner location tabs
2 Burner assembly frame
3 Withdrawal direction from holder & injector
4 Lift burner out of notch at end
5 Ignition electrode
6 Sensing electrode

Each burner bar can be withdrawn from its injector.
With the burners removed check the injectors for any blockage and if necessary clean in spirit. Remove the air guides located beneath the burners and clean. Check the setting of the modulating combustion air damper. See fig. 26, there should be **a gap of 8 mm with the damper in the fully closed position** against the stops (Natural gas) (see table 15a and 15b).
(11 mm LPG)
Check the condition of the ignition and sensing electrode at the right hand end of the burner assembly. There should be no burning of the metal tip and the ceramic should not be cracked.
Replace the burners starting with the pilot burner. Ensure that the shaped venturi end at each burner locates properly over the injector and that the tab at the end of the burner bar locates fully in its notch.
Ensure that the insulation covered stainless steel channels are correctly positioned as they guarantee the correct location of the burners. The front tip of the channels locates over the burner location tabs, see fig. 32.
Ensure that the ignition and sensing electrodes are correctly positioned as shown in fig. 33. If the position or gaps are not correct the electrodes must not be bent. In that case the electrodes have to be replaced.

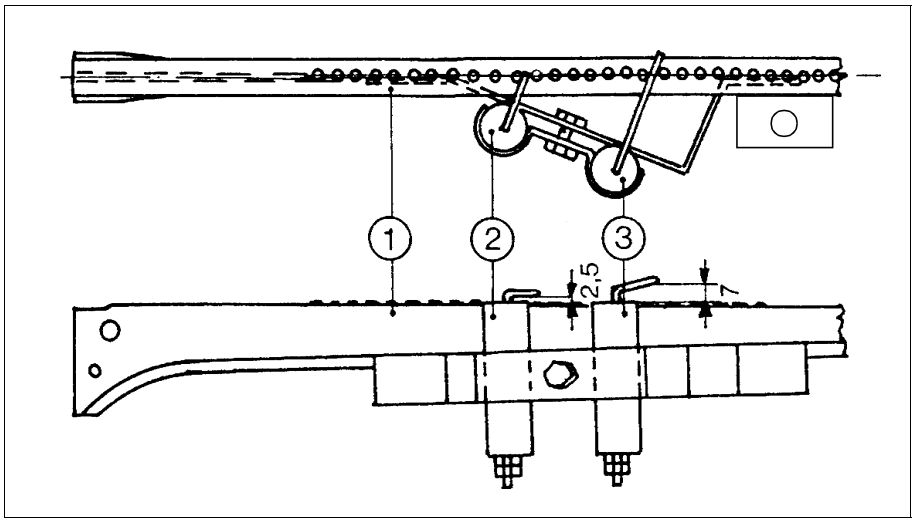


Fig. 33 Electrodes

Check that the modulating combustion air/gas control linkages are in good working order and that there is no play in the gas control spindle.
Replace the burner trolley and bolt into position. Re-connect the electrical connectors to the connection tray.
Re-commission the water heater as described in Section 6 commissioning.

Gas train

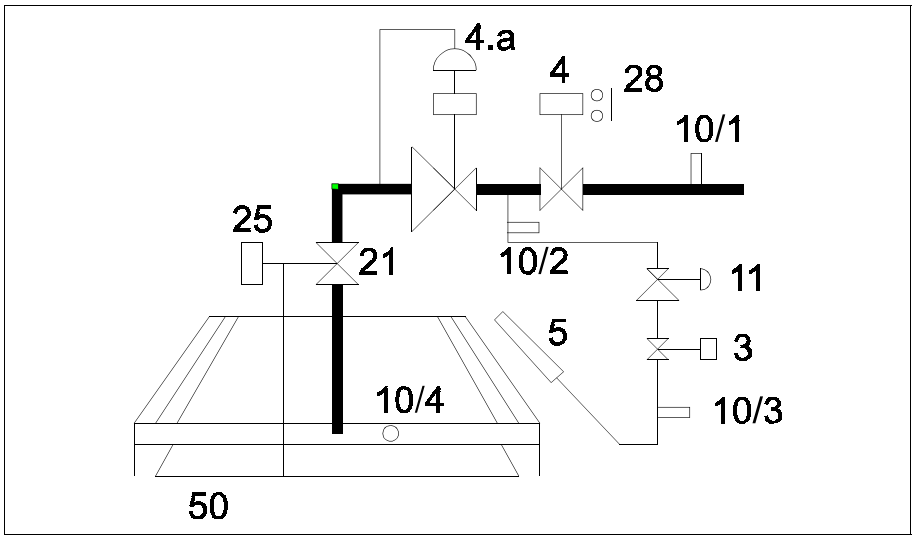


Fig. 34 Gas train

8.6 Component replacement

Electrodes

Remove the burner trolley as described earlier. The ignition and sensing electrodes can now be replaced as follows:
Disconnect the aluminium wire from the base of the electrodes.
Remove central bolt securing the electrodes to the pilot burner bar and lift off the electrodes.
When re-assembling ensure that the electrodes are correctly replaced (refer to fig. 32) with the pilot burner bar in position.
Check operation of electrodes by carrying out the relevant parts of section 6, commissioning.

Burner bars

Remove the burner trolley as described earlier. Remove the insulation covered stainless steel channels.
With the exception of the pilot burner bar, the burner bars are removed by first lifting the end of the burner out of its locating notch and then withdrawing the burner from its injector.

To remove the pilot burner assembly, disconnect the wiring to the sensing electrode and the ignition electrode. Avoid damaging the electrodes. Replacement of the burner bars is described in section Servicing. Ensure that the burners are not damaged or warped.

Injectors

Remove the burner trolley and burner bars as described before.
With the burner bars removed the injectors can be unscrewed from the gas manifold.
Ensure that injectors are unblocked and are the correct size - 1.85 mm diameter (natural gas).
Use an approved pipe sealant on the injector thread to ensure a gas sound seal.
Replace components in the reverse order of removal.

Gas train

(including gas train components).
Ensure that the gas service cock is closed, release the gas union, disconnect the plugs from the front electrical tray and release the bolts at all 4 sides of the burner trolley and withdraw the burner trolley. Solenoid valve heads can be replaced with valve in situ by releasing the appropriate fixing on the valve head. Ensure that the new valve head is wired in accordance with the separate supplied wiring diagrams.

The main gas train is removed as follows:
Remove first the cover plate from the servo-motor coupling.
Loosen the grub screw securing the keyed shaft of the modulating valve servomotor to its coupling and remove the motor by unscrewing fixing screws. It is not necessary to remove the gas train if only replacing this component.

Remove the pin connecting the modulating air damper to its actuating arm at the modulating valve by releasing the clip. Remove the pilot supply pipe by releasing the union nut at each end. Unscrew the four screws that secure the modulating valve to its flange connection on the gas manifold being careful not to loose the "O" ring, and withdraw the gas train from its locating slot in the burner trolley, the various controls in the main gas train can now be replaced by unscrewing from the gas train. The pilot solenoid valve can also be unscrewed at its outlet connection and replaced.
An approved thread sealant should be used when re-connecting any pipe threads. Ensure that any controls replaced are fitted squarely on the gas train, the "O" ring seal on the outlet of the modulating valve is in good condition and correctly located and the modulating valve drive shaft and linkages are correctly assembled.

Upon replacement if components carry out the relevant portions of section 6 commissioning.

Control panel components
Release the fixing screws from the cover of the electrical connection tray.
Refer to fig. 25 for the locations of the various controls.
Replace components by removing electrical connections and screw fixings.

Ignition generator
Release the two screws at each side of the cover lid. Disconnect the ignition transformer electrical connection from within the electrical connection tray and release the ignition electrode lead from the transformer. Replace the transformer by releasing its screw fitting and reconnect the electrical connections according the separate supplied wiring diagram.

The control thermostat RWF40 is fixed to the left or right hand side of the electrical connection tray and its fixing screws can be accessed via bottom of the electrical connection tray.
Re-connect any electrical connections in accordance with the separate supplied wiring diagrams.

It is necessary to drain the water heater when replacing the water flow switch as it incorporates water connections.
The temperature sensing phials for both the limit thermostat and the high limit thermostat are contained within a thermostat pocket in the flow header. The phials are released by first removing the securing clip.

Replacing fin tubes

Header and manifold removal

Release water pressure and drain the unit.
Disconnect the system water-pipes at the manifold flanges.
Remove all pressure and temperature sensors from the flow/return manifolds immersion tubes then electrically disconnect the flow-switch.
Remove the mounting bolts and spacers from sides of the manifolds.
Remove the mounting bolts and spacers from sides of the header.
Remove the manifold retaining bars (10) and carefully remove the water manifolds, spacer plate and 'O'-rings.
Remove the header retaining bars (10) and carefully remove the header, spacer plate and 'O'-rings.

Fin-tube replacement

Refer to fig. 7 for the locations of the various part numbers.
Cut a hole in the side panel directly above the tube to be replaced close to the tube mounting plate. This hole should be large enough to pass the replacement fin-tube through.
From the top of the heat exchanger remove the fin-tube supporting bridge (14) and two baffles (18), one on either side of the damaged fin-tube (5),
Using a suitable tool carefully saw through the damaged fin-tube and remove from the fin-tube mounting plates (4).
The fin-tube will be de-finned approximately 80 mm on one side. The end of the fin-tube should be passed through the hole and slotted into mounting plate at the other end of the unit.
Once the tube has been slotted fully into the mounting plate it will be possible to position the replacement fin-tube between the two mounting plates ensuring that the protruding ends are equidistant at both ends.
Clean the bore of the replacement tube of swarf, dirt and metal particles.
Using a small 'G'-clamp, clamp the replacement tube to a neighbouring tube in order to hold the replacement tube in the correct position.
Using the correct expanding tool, expand the free tube end.
When a torque of **20 - 25 Nm** has been reached the expanding process is complete.
Remove the 'G'-clamp and expand the other end also to a torque of **20 - 25 Nm**.
Replace the spacer pins, baffles (13, 16).

Wrap a suitable insulating material (article No. GIK 080) around the exposed area to prevent overheating.
Patch the hole in the side panel and insulate.
Refit the fin-tube supporting bridge (14), the two baffles (18) and replace the stainless steel wire ties (15).

Inspection of the headers and the fin-tube mounting plate mating surfaces
Inspect the mating surfaces of the water header, flow/return manifolds and the fin-tube mounting plate. These should be clean, smooth and undamaged.

O-ring replacement
Fit new O-rings to all finned-tubes

Fitting and retensioning the water heater and flow/return manifold
Refit the header spacer plate.
Carefully replace the header and hold it in place with one of the retaining bars with the nuts screwed in finger tight.
Refit the rest of the header retaining bars also with the nuts screwed in finger tight.

Tighten the retainer bars in four stages and in the sequence shown in the drawing below to a torque of 25 Nm.
Refit the manifold spacer plate.
Carefully replace the manifolds and hold them in place with one of the retaining bar with the nuts screwed in finger tight.
Refit the rest of the manifold retaining bars also with the nuts screwed in finger tight.
Tighten the retainer bars as above (in four stages and in the sequence shown in fig. 36 to a torque of 25 Nm).
The remainder of the heat exchanger assembly is a reversal of the removal procedure.

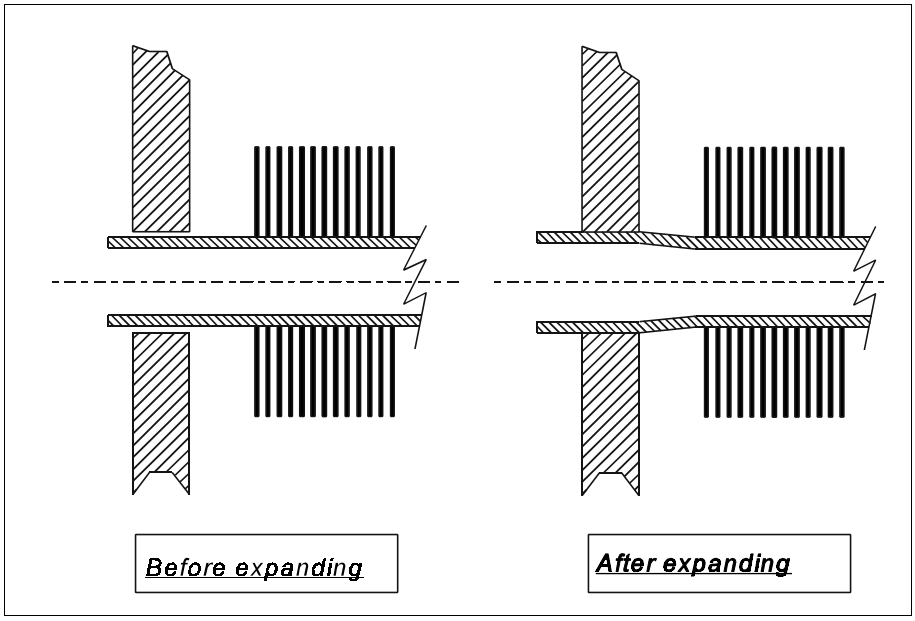


Fig. 35 Expanding the fin-pipe ends

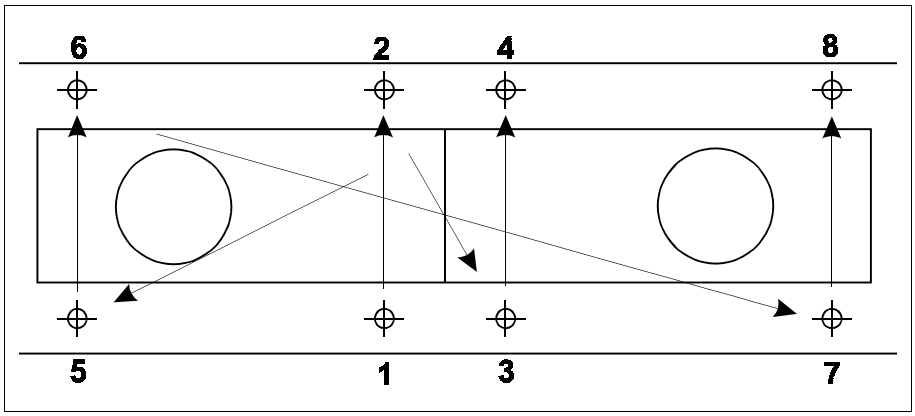


Fig. 36 Tightening the manifold nuts

8.7 Service

For service and maintenance the service department of your supplier can be contacted.

Andrews Water Heaters
Wednesbury One
Black Country New Road, Wednesbury
West Midlands WS10 7NZ
Telephone: 0121 506 7400
Facsimile: 0121 506 7401

9 LIST OF SERVICEABLE PARTS

When ordering parts it is important to specify the model and serial number of the water heater. When ordering under warranty it is also necessary to specify the date of installation and commissioning.

Part	Manufacturer	Article code nr
1st Main gas valve		
Model 132 - 210	L&S VGG10/SKP20	RKM002/RMK010
Model 244 - 280	L&S VGF10/SKP20	RKM003/RMK010
2nd Main gas valve		
Model 132 - 210	L&S VGG10/SKP10	RKM002/RMK005
Model 244 - 282	L&S VGF10/SKP10	RKM003/RMK005
Modulating gas valve		
Model 132 - 180	Rmx 2"	8132G1GS
Model 2034 - 2043	Rmx 2½"	8210G1GS
Modulating valve servomotor	Berger/Lahr STM30Q15.63	RMS005
Pilot gas valve	Johnson control SM474	RKS025
Ignition transformer	Danfoss EBI 1P	ETH005/ESB010
Flame safeguard relay	L&S LFL 1.148	RBA004
Temperature control unit	L&S RWF 40	RRW007
High limit thermostat	L&S RAK 754591	RTR035
Ignition electrode	Rmx	REE001 CS
Flame sensing electrode	Rmx	REE001
Burner bar		
Standard	Rmx	RIB001
Pilot burner assembly	Rmx	8000BIBA
Water flow switch	IT Regelgeräte JSF-1E	RSS010
Temperature gauge	Stork IFC 48-045-KRF	ROT020
Pressure gauge	Stork IM 48-04-KRF	ROM030
"O"-ring for fin tube	Rmx	ARO050
Pump	Grundfos DNM 65 - 125/136 PN10	

SUPPLEMENT

Regulations and standards
At the time of printing the following regulations and standards were taken into account:

British Standard

1. **BS 5440** - parts 1 + 2 (fluing and ventilation).

2. **BS 6644** - Installation of gas fired water heaters (60 kW - 2 MW).

3. **BS 6700** - Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.

4. **BS 6891** - Installation of low pressure gas pipework.

The following British Gas publications may be helpful:

IM/2 - Purging procedures of non domestic gas installations

IM/5 - Soundness testing procedures for industrial and commercial gas installations.

IM/11- Flues for commercial and industrial gas installations.

IM/16 - Guidance notes on the installation of gas pipework boosters and compressors.

Any other requirements currently in force.

These water heaters are tested to **BS 5978** part 1 by British Gas plc for use on natural gas.

The following regulations should also be taken into consideration:

Gas Safety (Installation and Use) Regulations.

Building Regulations.

Local fire regulations

Regulations from the local gas distribution agency.

New Water Regs - The water supply (water fittings) Regulation 1999