Heating boiler

UNIMAT

UT-L

Technical guide

BOSCH
Invented for life

6 720 807 794(2013/04)EN

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1 Oil/gas special boilers

1.1 Types and heating output

The UNIMAT UT-L boilers are special boilers for positive pressure combustion in accordance with the requirements of EN 303. They are constructed with reference to the guidelines of the relevant TRD 300. Bosch offers these boilers in the output range from 650 kW to 19200 kW.

The boilers are designed to produce low pressure hot water with no more than 110 °C (shutdown temperature of the high limit safety cut-out) for heating systems that correspond to the requirements of DIN-EN 12828. The boiler is available with excess pressures of 6 bar, 10 bar and 16 bar.

1.2 Overview of models

	Unit	UNIMAT UT-L boiler Boiler size 650 to 19200
Safety temperature	°C	≤ 110
Safety pressure	bar	≤ 16
Measurements		→ page 12 f.
Technical Data		→ page 25

Table 1 Overview of UNIMAT boiler models UT-L

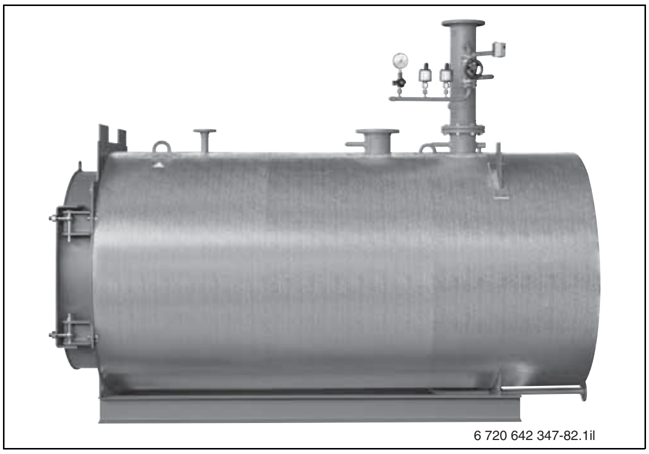

Fig. 1 UNIMAT UT-L boiler without heat exchanger

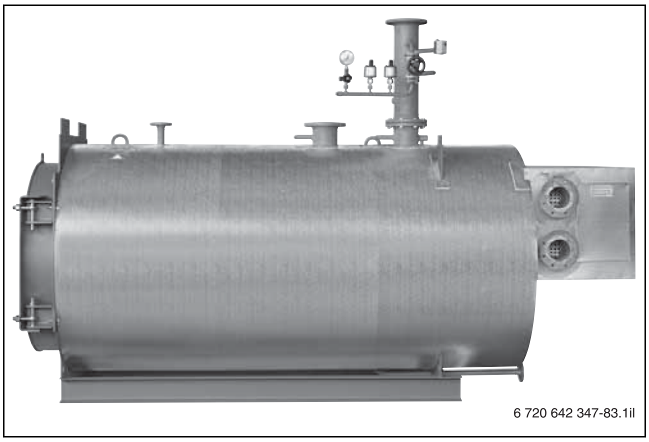

Fig. 2 UNIMAT UT-L boiler with heat exchanger or condensing heat exchanger

1.3 Possible applications

The modular design and additional equipment mean the boiler can be used in any application. A suitable version is available for the requirements of any project.

The optimum application is in large-scale systems, e.g. hospitals, industrial plants, district heating centres, heating stations and commercial operations.

1.4 Features and benefits

- **3-pass design**
  The 3-pass technology enables the UNIMAT UT-L boilers to achieve outstanding combustion figures.
- **Optimised temperature characteristics**
  The boilers have a generously sized secondary heating surface in the second pass, designed as a double row. The inner hot gas reversing chamber, which is completely surrounded by water, enables very low temperatures in the front reversing area from the second to the third pass. This significantly reduces the thermal load of the door.
- **Compact construction**
  The symmetrical secondary heating surfaces, arranged in a circle around the combustion chamber, enable the compact construction of these boilers. This means they have a low weight and require only a small floor area for installation. The burner door can close on the right hand or left hand side.
- **Environmentally responsible with low emissions**
  The 3-pass design and water-cooled combustion chamber offer ideal conditions for operation with low emissions, especially in conjunction with the advanced burners that are matched to the boilers. Meeting the highest demands regarding low emissions, especially with oil combustion, is no problem for the UNIMAT UT-L boiler with its particularly large combustion chambers.
- **Economic viability**
  Extremely high efficiency is possible, subject to the temperature of the heating medium and the boiler load. The radiation losses of the boiler are negligibly low and the full utilisation of the burner control range enables good efficiency at partial load.
- **Operational reliability**
  Due to the optimised design of the combustion chamber and the water guide system, the UNIMAT UT-L boiler is very reliable and safe in operation. The low water capacity enables a short heat-up time. This means the dew point range in the heat-up phase is quickly passed.
- **Even load distribution**
  For even load distribution, the boiler is equipped with a base frame of channel sections. If the floor of the boiler room is even, an additional boiler foundation is not required.
- **Simple maintenance**
  The front boiler door can be pivoted right out, and can be opened easily even when the burner is fitted. When the door is open, the combustion chamber and secondary heating surface are freely accessible, and can be cleaned quickly and easily. The reversing chamber is visible through the combustion chamber. As an option, an inspection port on the water side is available. This gives a better view of the heating

surfaces. It means the heating surfaces can be viewed from the water chamber.

- **Matching system technology**
  Numerous matching components are available for all boilers, which enable optimisation of the entire system.

2 Basic principles

2.1 Basic principles of condensing technology

2.1.1 Net and gross calorific values

The net calorific value H_i (formerly H_u) specifies the amount of heat that can be obtained from one cubic metre of gas or one kilogram of fuel oil. With this reference figure, the products of combustion are present in a gaseous state.

Compared to the net calorific value H_i, the gross calorific value H_s (formerly H_o) also contains the condensation heat from the water vapour as additional energy.

2.1.2 Boiler efficiency above 100 %

The condensing boiler or boiler with condensing heat exchanger utilises not only the net calorific value H_i in order to produce heat, but also the gross calorific value H_s of a fuel.

For all efficiency calculations in German and European standards, the net calorific value H_i is always selected at 100 % as a reference figure, meaning that a boiler efficiency of over 100 % can result. This is the only way of comparing conventional boilers and condensing boilers or boilers with condensing heat exchangers.

Boiler efficiency can be raised by up to 15 % in comparison with conventional boilers. Compared with older systems, it is even possible to save up to 40 % energy.

When comparing the energy utilisation of conventional boilers and condensing boilers or boilers with condensing heat exchangers, an energy statement such as the example shown in Fig. 3 can result.

Condensation heat (latent heat)

- The proportion of condensation heat in natural gas is approx. 11 %, relative to the net calorific value H_i.
  With low-sulphur fuel oil, the proportion of condensation heat is approx. 7 %, relative to the net calorific value H_i.
  This heat is unused in conventional boilers.
- By making use of the condensation in the water vapour, the condensing boiler or boiler with condensing heat exchanger enables considerable utilisation of this heat potential.

Flue loss (sensible heat)

- With the conventional boiler, the heat in the flue gas, which is at a relatively high temperature of 150 °C to 210 °C, escapes. This means an unused heat proportion of around 6 % to 9 % is lost.
- The dramatic reduction of the flue gas temperatures in a condensing boiler or boiler with condensing heat exchanger down to 30 °C makes use of the sensible heat in the hot gas and considerably reduces the flue loss.

Energy statement comparing conventional boilers and condensing boilers or boilers with condensing heat exchangers

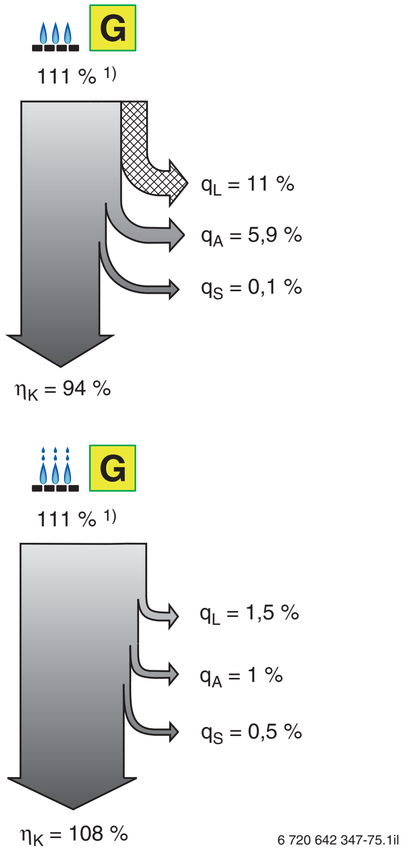

Fig. 3 Energy statement comparing conventional boilers and condensing boilers or boilers with condensing heat exchangers (example with natural gas)

G	Conventional boiler
G	Condensing boiler or boiler with condensing heat exchanger
η_K	Boiler efficiency
q_A	Flue losses (sensible heat)
q_L	Unused condensation heat (latent heat)
q_S	Radiation losses
1)	Relative to net calorific value H_i = 100 %

2.2 Making optimal use of condensing technology

2.2.1 Matching to the heating system

Condensing boilers or boilers with condensing heat exchangers can be installed in any heating system. However, the available proportion of condensation heat and the efficiency resulting from this type of operating mode depend on the design of the heating system.

To be able to use the condensation heat of the water vapour in the hot gas, the hot gas must be cooled to below the dew point. The utilisation rate of the condensation heat is therefore necessarily subject to the system design temperatures and the hours run in the condensation range. This is shown by the graphs in Fig. 4 and Fig. 5. The dew point is approx. 56° C for natural gas and approx. 47° C for low-sulphur fuel oil.

Heating system 40/30 °C

In this heating system, the benefits of the performance capacity of condensing technology can be seen throughout the heating season. The low return temperatures are always below the dew point, so condensation heat is always created (→ Fig. 4). This is achieved with low temperature area heaters or underfloor heating systems, which are ideal for condensing boilers or boilers with condensing heat exchangers.

Targeted utilisation of the condensing effect is possible with the condensing heat exchanger (ECO 6) connected separately to a low temperature heating circuit.

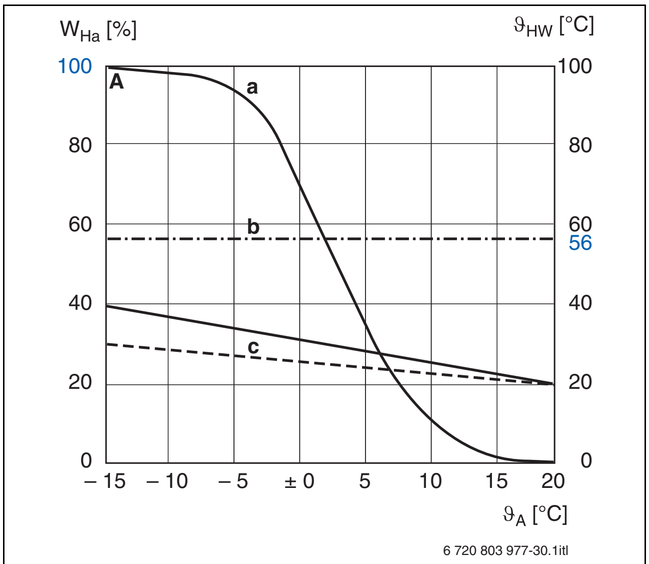

Fig. 4 Condensation heat utilisation at 40/30 °C (example with natural gas)

- A Proportion of operation with condensation heat utilisation
- a Annual heat load curve
- b Dew point temperature curve (example with natural gas)
- c System temperatures
- ϑ_A Outside temperature
- ϑ_{HW} Heating water temperature
- W_{Ha} Annual heat load

Heating system 75/60 °C

Even with a design temperature of 75/60 °C, it is possible to make above average utilisation of the condensation heat for around 95 % of the annual heat load. This applies for outside temperatures of −7 °C to +20 °C (→ Fig. 5).

Due to the safety supplements in the former DIN 4701 from 1959, older heating systems designed with 90/70 °C are nowadays to all intents and purposes operated as systems with 75/60 °C. Even if these systems were run with system temperatures of 90/70 °C and modulating, weather-compensated heating circuit temperatures, they would still use the condensation heat for 80 % of the annual heating load.

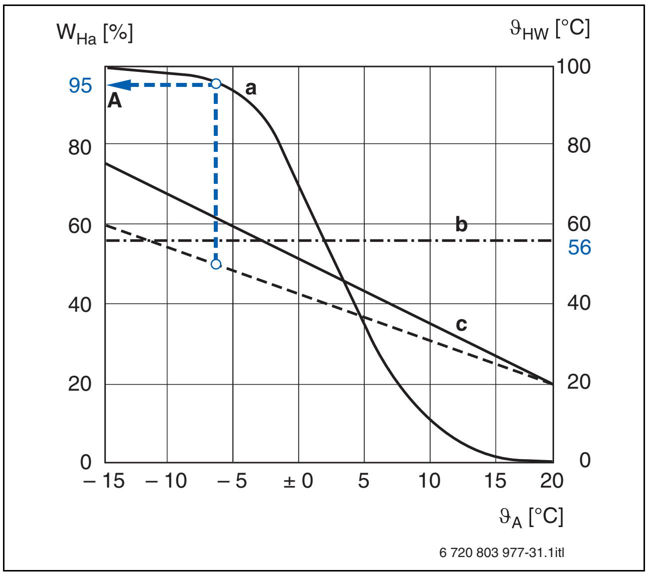

Fig. 5 Condensation heat utilisation at 75/60 °C (example with natural gas)

- A Proportion of operation with condensation heat utilisation
- a Annual heat load curve
- b Dew point temperature curve
- c System temperatures
- ϑ_A Outside temperature
- ϑ_{HW} Heating water temperature
- W_{Ha} Annual heat load

2.2.2 High standard seasonal efficiency [to DIN]

The graphs in Fig. 4 and Fig. 5 show that the varying proportion of condensation heat utilisation has a direct influence on the energy utilisation of the condensing boiler or boiler with condensing heat exchanger.

The high standard seasonal efficiency [to DIN] of gas condensing boilers is based on the following influences:

- Achievement of high CO_2 levels. The higher the CO_2 content, the higher the dew point of the hot gases.
- Lower system and return temperatures can be maintained. The lower the system and return temperatures, the higher the condensation rate and the lower the flue gas temperature.

The UNIMAT UT-L boilers can be matched individually to the prevailing system characteristics and requirements, subject to the individual project.

2.2.3 Design information

In new installations, every opportunity should be exploited to achieve optimum operation of the condensing boiler or boiler with condensing heat exchanger.

A high standard seasonal efficiency [to DIN] is achieved if the following criteria are satisfied:

- Limit the return temperature upstream of the condensing heat exchanger to a maximum of 50 °C, at least partially. In this connection, it is significant that the separate connections for the boiler and condensing heat exchanger mean a partial flow rate of 20 % with a low design temperature (e.g. 40/30 °C) is sufficient to achieve excellent condensing efficiency.
- Aim for a temperature spread between the flow and return of at least 20 K.
- Avoid installations for return temperature raising (e.g. 4-way mixers, bypass circuits, low loss headers, depressurised distributors, etc.).

For more detailed information on the hydraulic connection, see chapter 9 on page 47 ff.

2.3 Economic viability considerations

2.3.1 Simplified comparison of conventional boilers and condensing boilers or boilers with condensing heat exchangers

Fuel costs

- Given
  - Building heat demand $\dot{Q}_N$ = 2000 kW
  - Annual heating energy demand $\dot{Q}_A$ = 3400000 kWh/a
  - System design temperatures:
    Ventilation ϑ_V/ϑ_R = 90/70 °C (proportion 20 %)
    Radiators ϑ_V/ϑ_R = 75/60 °C (proportion 50 %)
    Underfloor heating system ϑ_V/ϑ_R = 40/30 °C (proportion 30 %)
  - Fuel costs K_B = 0.50 Euro/m^3
  - Conventional UNIMAT UT-L boiler, rated output 2000 kW, η_N = 94,9 %
  - UNIMAT UT-L boiler with condensing heat exchanger, rated output 2000 kW, η_N = 102,3 %

The efficiency levels η_N specified for the UNIMAT UT-L boiler with condensing heat exchanger apply if the underfloor heating systems are connected separately to the condensing heat exchanger.

- Sought
  - Fuel consumption
  - Fuel costs
- Calculation

$$B_V = \frac{Q_A}{\eta_N \times H_i}$$

F. 1 Calculation of annual fuel consumption

B_V Annual fuel consumption in m^3/a
η_N Standard seasonal efficiency [to DIN] in %
H_i Net calorific value; here natural gas simplified with 10 kWh/m^3
$\dot{Q}_A$ Net heating energy demand in kWh/a

$$K_{Ba} = B_V \times K_B$$

F. 2 Calculation of annual fuel costs

B_V Annual fuel consumption in m^3/a
K_B Fuel costs
K_{Ba} Annual fuel costs

- Result
  - UNIMAT UT-L boiler with rated output of 2000 kW:
    Fuel consumption B_V = 358272 m^3/a,
    Fuel costs K_{Ba} = 179136 Euro/a
  - UNIMAT UT-L boiler with condensing heat exchanger, with rated output of 2000 kW:
    Fuel consumption B_V = 332356 m^3/a,
    Fuel costs K_{Ba} = 166178 Euro/a

Central heating using the UNIMAT UT-L boiler with condensing heat exchanger results in fuel cost savings of approx. 11601 Euro per year.

Investment costs

Scope of investment[1)]	Unit	UNIMAT UT-L boiler with a rated output of 2000 kW	UNIMAT UT-L boiler with condensing heat exchanger with a rated output of 2000 kW
Total investment costs	**Euro**	**50000**	**63000**

Table 2 Investment costs for conventional boilers and boilers with condensing heat exchangers (values rounded off)

1) Incl. accessories

The investment costs are based on the costs of a boiler system. This includes the costs of the boiler, boiler circuit control unit, pressure-jet burner and flue system, as well as the costs of the safety equipment and return flow temperature safeguard. The costs of the UNIMAT UT-L boiler with condensing heat exchanger also include the neutralisation of the condensate. Costs for installation have not been taken into account.

Reflux of capital

Type of cost	Unit	UNIMAT UT-L boiler with a rated output of 2000 kW	UNIMAT UT-L boiler with condensing heat exchanger with a rated output of 2000 kW
Investment costs	Euro	50000	63000
Costs linked to capital[1)]	Euro/a	5220	6577
Fuel costs	Euro/a	179136	166178
Total costs	**Euro/a**	**184356**	**172755**

Table 3 Total costs for conventional boilers and boilers with condensing heat exchangers (values rounded off)

1) Annuity 9,44 %, interest 5 %, maintenance 1 %

In this example, the investment costs have been repaid due to the lower fuel costs after about one year. It is generally true that condensing technology pays for itself faster the greater the output and the higher the fuel costs. No subsidies have been taken into account in the calculations. With the UNIMAT UT-L boilers, it is possible to integrate further condensing heat exchangers. This results in higher efficiency and therefore lower fuel costs.

3 Technical description

3.1 UNIMAT UT-L boiler

3.1.1 Equipment overview

The UNIMAT UT-L boilers are oil/gas special boilers for positive pressure combustion to EN 303. These boilers are designed to produce low pressure hot water with no more than 110 °C (shutdown temperature of the high limit safety cut-out) for heating systems that correspond to the demands of DIN-EN 12828. The permissible overall pressure must not exceed the permissible pressure stage of the boiler. The modular design of the boiler and additional equipment enables universal application.

- Round boiler casing made of textured aluminium sheeting
- Visible parts of the boiler primed in anthracite grey and red
- Thermal insulation (100 mm) and extremely well insulated burner door
- Boiler pressure body with connections for flow, return, safety valve and drain
- As an option with inspection port on the water side
- Bottom rear inspection aperture on flue gas collector
- Boiler base frame for even load distribution and easy transportation
- Large burner door closing on the left hand side (can be changed to the right hand side if required)
- Air-cooled combustion chamber sight glass

The following options are possible:

- Control unit holder
- Also available as a unit version (with boiler and burner)
- Heat exchanger as integrated or stand-alone version with and without the use of condensing technology

3.1.2 Function principle

Boiler technology

All UNIMAT UT-L boilers boilers have a water guide element installed below the return connector. With this, the return water generates an injector effect through its velocity as it flows back, so hotter boiler water is added and mixes with the cooler return water. The targeted feed of the return water results in excellent flow across the entire boiler cross-section. Due to the flat temperature slope in the boiler block, the boiler overall provides an extremely even temperature distribution.

The flow through the boiler results in condensation-free and safe heating operation with a minimum return temperature as low as 50 °C.

The boiler is built using the 3-pass design and the countercurrent heat exchanger principle. Together with an effective heating surface design, these are the prerequisites for low emissions and high energy efficiency. Subject to the system, the UNIMAT UT-L boilers achieve very high standard seasonal efficiency [to DIN], which can be increased to up to 106 % with the boiler with condensing heat exchanger.

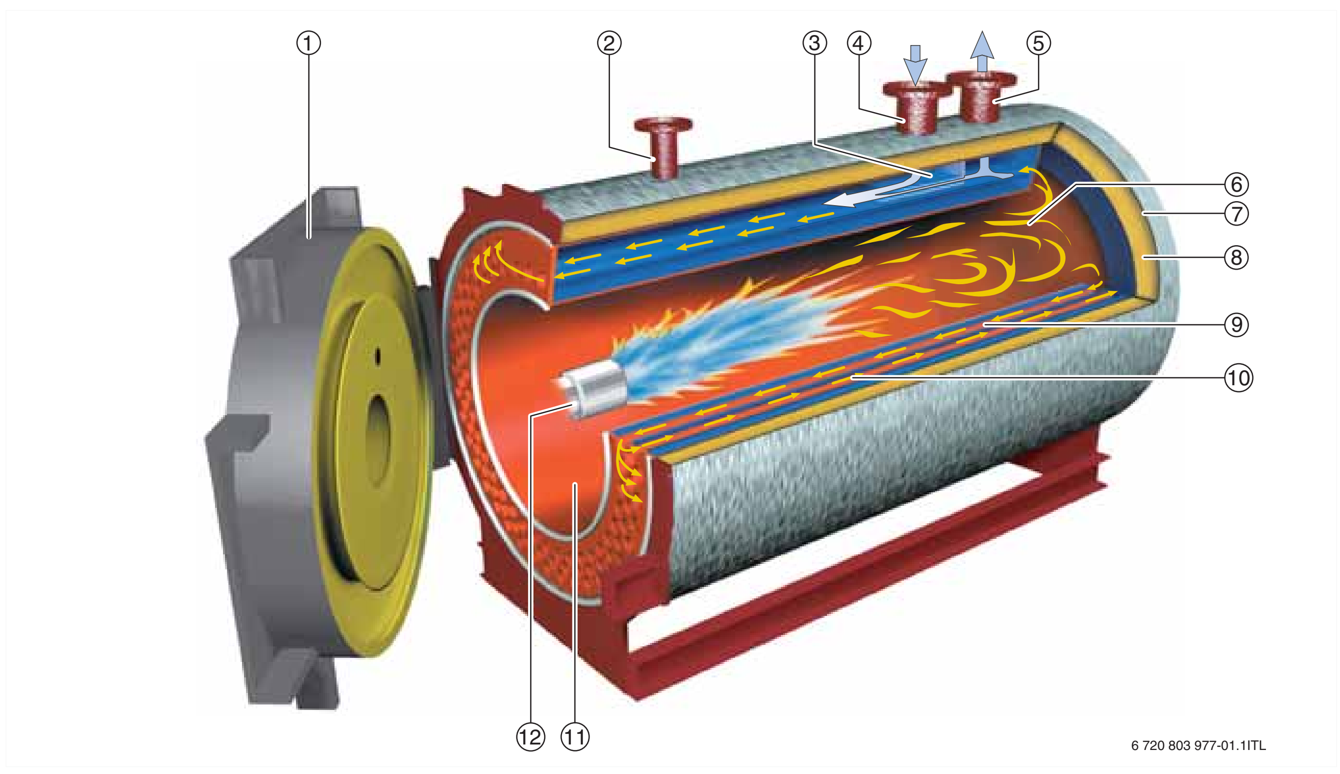

Fig. 6 Sectional view showing the function principle of the UNIMAT UT-L boiler

[1] Burner door
[2] Safety valve connector (→ Fig. 51, page 73)
[3] Water guide system
[4] Return (→ Fig. 50, page 72 and Fig. 53, page 76)
[5] Flow (→ Fig. 49, page 71)
[6] Hot gas reversing chamber
[7] Protective aluminium casing
[8] High grade insulation without thermal bridges
[9] First secondary heating surface (second pass) designed as a double row
[10] Second secondary heating surface (third pass)
[11] Combustion chamber (first pass)
[12] Blast tube

3.2 UNIMAT UT-L boiler

3.2.1 Version overview

The conventional UNIMAT UT-L boiler can be fitted with a flue gas heat exchanger to increase efficiency and reduce the fuel required. The flue gas heat exchanger can be supplied as an integrated version (integrated in the flue gas collector chamber) or as a stand-alone version (for installation downstream of the boiler). You can choose between a galvanised steel version of the heat exchanger bundle (ECO 7; without the use of condensing technology) and a version of the heat exchanger bundle in stainless steel (ECO 6; with the use of condensing technology). The heat exchanger is generally designed for modular construction. This means the most suitably sized heat exchanger, or number thereof, for the project in question can be chosen on an individual basis.

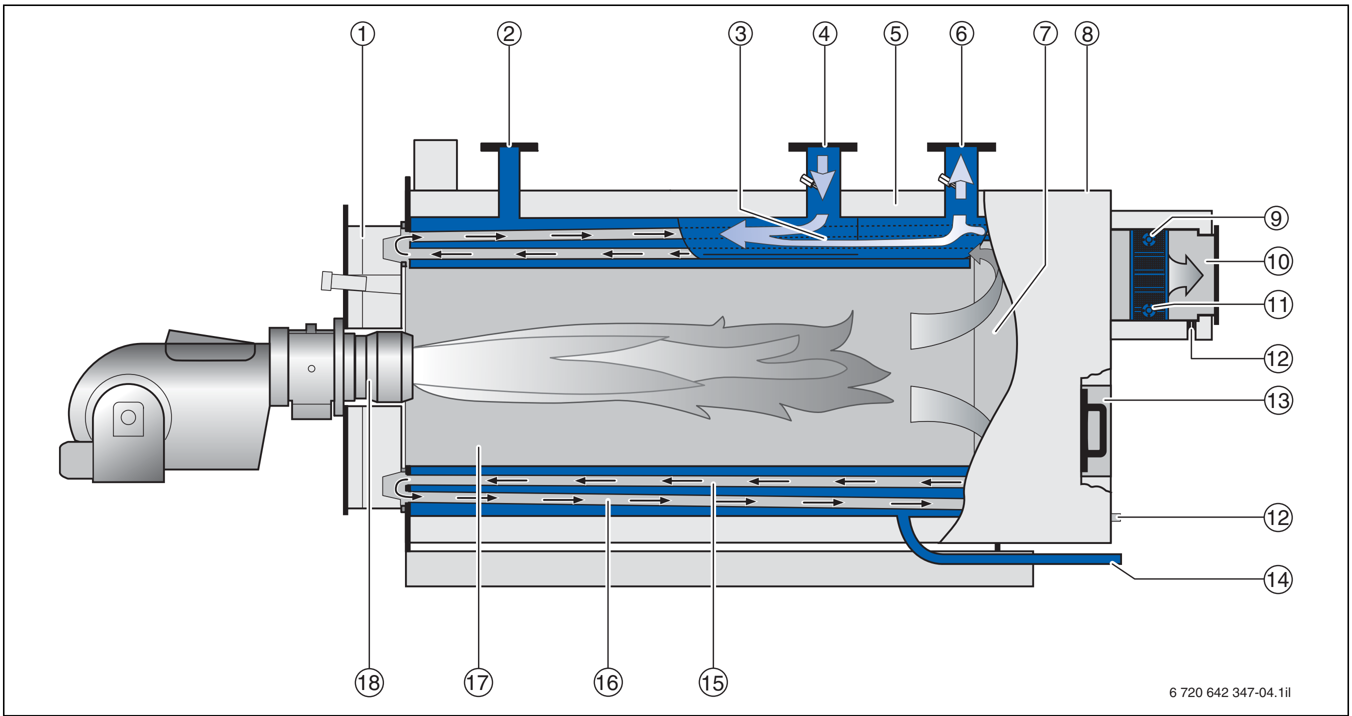

Fig. 7 Function principle of the UNIMAT UT-L boiler with flue gas heat exchanger

[1] Burner door
[2] Safety valve connector (→ Fig. 51, page 73)
[3] Water guide system
[4] Return (→ Fig. 50, page 72 and Fig. 53, page 76)
[5] High grade insulation without thermal bridges
[6] Flow (→ Fig. 49, page 71)
[7] Hot gas reversing chamber
[8] Protective aluminium casing
[9] Heat exchanger flow
[10] Heat exchanger
[11] Heat exchanger return
[12] Condensate connector
[13] inspection aperture
[14] Drain connection (→ Fig. 56, page 79)
[15] First secondary heating surface (second pass) designed as a double row
[16] Second secondary heating surface (third pass)
[17] Combustion chamber (first pass)
[18] Blast tube

Inspection aperture on the water side is optional.

3.2.2 Function principle

In the flue gas heat exchanger, heat is recovered from the hotter boiler flue gas by channelling cooler mains return water through the heat exchanger pipe to reduce the flue gas temperature. The energy gained in this way gives a higher boiler efficiency and therefore lower fuel consumption and lower flue gas emissions.

With the fuels gas and low sulphur fuel oil, aim for as low a water inlet temperature as possible at the flue gas heat exchanger. This deliberately creates operation with condensate (flue gas condensation), so that even higher efficiency can be achieved.

If the flue gas heat exchanger is operated with fuel oil (not low sulphur quality), ensure a corresponding minimum water inlet temperature at the flue gas heat exchanger of 60 °C to protect it from corrosion on the flue gas side. With oil operation, an optional control on the water side can be used to raise the water inlet temperature at the flue gas heat exchanger to the required minimum level by mixing in pre-heated water. With oil operation, for flue gas heat exchangers with an integral flue gas bypass, if the water inlet temperature cannot be raised to the minimum level, the entire flue gas flow from the boiler bypasses the flue gas heat exchanger, using the flue gas control valve. A flue gas temperature control unit is available as an option for an additional charge.

3.3 Dimensions and specification for the flue gas heat exchangers

3.3.1 UNIMAT UT-L boiler

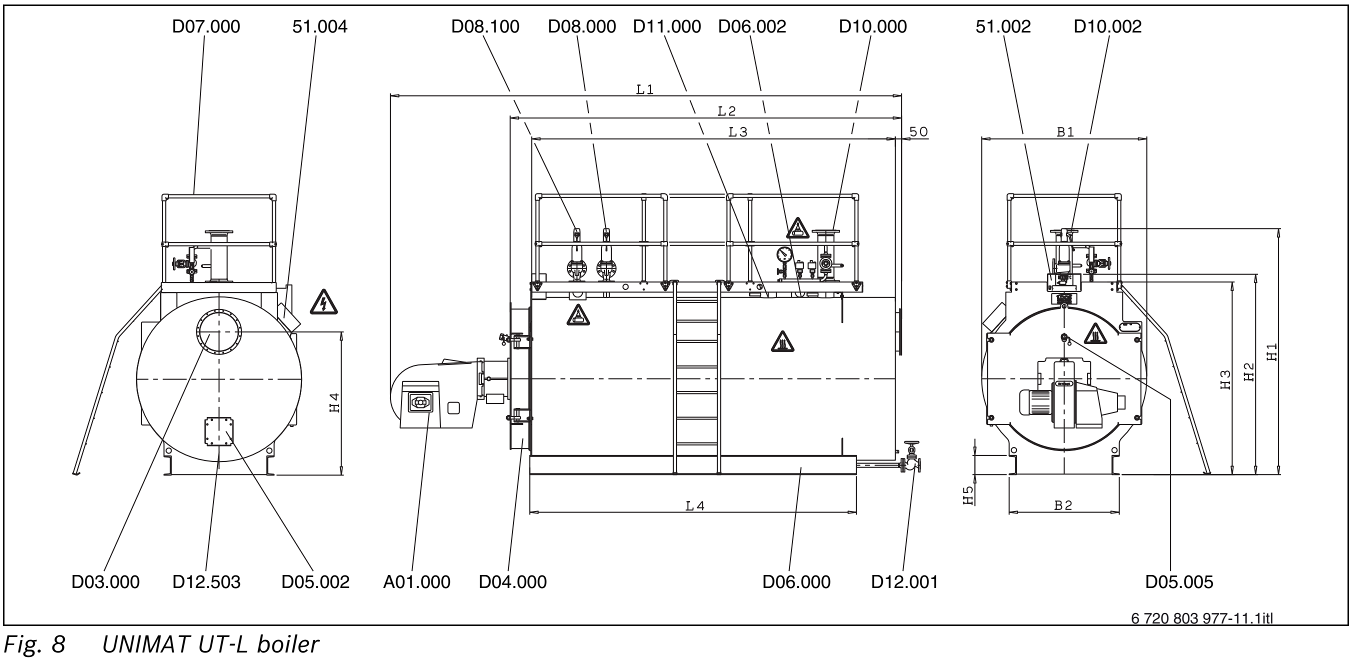

Fig. 8 UNIMAT UT-L boiler

- 51.002 Optional instrument housing
- 51.004 Optional terminal box
- A01.000 Optional burner
- D03.000 Flue gas connecting branch
- D04.000 Boiler front door
- D05.002 Inspection aperture on the flue gas side
- D05.005 Flame inspection hole
- D06.000 Base frame
- D06.002 Lifting lug
- D07.000 Optional maintenance platform
- D08.000 Optional positive pressure safety valve 1
- D08.100 Optional positive pressure safety valve 2
- D10.000 Flow
- D10.002 Optional intermediate flow piece
- D11.000 Return
- D12.001 Optional outlet shut-off valve
- D12.503 Connection for flue gas condensate drainage system

UNIMAT UT-L boiler	Output limit	Dimension(s)								Flue gas connection	Base frame		
		L1[1]	L2	L3	B1	H1[2]	H2	H3[3]	H4		L4	B2	H5 Channel section
Type	kW	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
UT-L 1	650	3135	2295	2040	1174	2152	1540	1460	1055	1750	710	120	1055
UT-L 2	750	3516	2680	2425	1324	2302	1695	1610	1180	2100	910	120	1180
UT-L 4	1000	3516	2680	2425	1324	2302	1695	1610	1180	2100	910	120	1180
UT-L 6	1000	3786	2950	2695	1424	2402	1795	1710	1240	2350	910	120	1240
UT-L 8	1250	4056	3220	2960	1524	2502	1895	1810	1340	2560	930	160	1340
UT-L 10	1350	3778	2950	2695	1424	2402	1795	1710	1240	2350	910	120	1240
UT-L 12	1500	4503	3675	3420	1574	2552	1950	1860	1350	3060	1130	160	1350
UT-L 14	1900	4092	3220	2960	1524	2502	1895	1810	1340	2560	930	160	1340
UT-L 16	2000	4597	3725	3465	1674	2652	2050	1960	1415	3060	1130	160	1415
UT-L 18	2500	4654	3675	3420	1574	2552	1950	1860	1350	3060	1130	160	1350
UT-L 20	2500	5054	4075	3820	1724	2702	2100	2010	1490	3410	1150	200	1490
UT-L 22	3000	5895	4570	4250	1824	2817	2200	2110	1500	3920	1260	220	1500
UT-L 24	3050	4916	3725	3465	1674	2667	2050	1960	1415	3060	1130	160	1415
UT-L 26	3500	6025	4700	4380	1924	2917	2300	2210	1600	3920	1510	220	1600
UT-L 28	3700	5266	4075	3820	1724	2717	2100	2010	1490	3410	1150	200	1490
UT-L 30	4200	5761	4570	4250	1824	2817	2200	2110	1500	3920	1260	220	1500
UT-L 32	4250	6419	5090	4770	2124	3117	2505	2410	1750	4280	1510	220	1750
UT-L 34	5200	6385	4700	4380	1924	3007	2300	2210	1600	3920	1510	220	1600

Table 4 Main dimensions

UNIMAT UT-L boiler	Output limit	Dimension(s)								Flue gas connection	Base frame		
		L1[1)]	L2	L3	B1	H1[2)]	H2	H3[3)]	H4		L4	B2	H5 Channel section
Type	kW	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
UT-L 36	5250	6655	5320	5000	2274	3357	2655	2560	1850	4480	1520	240	1850
UT-L 38[4)]	6000	6855	5520	5200	2424	3507	-	2710	2000	4650	1610	240	2000
UT-L 40	6500	6775	5090	4770	2124	3207	2505	2410	1750	4280	1510	220	1750
UT-L 42	7700	7235	5320	5000	2274	3462	2655	2560	1850	4480	1520	240	1850
UT-L 44[4)]	8000	7683	5980	5655	2574	3762	-	2875	2100	5050	1630	280	2100
UT-L 46[4)]	9300	7435	5520	5200	2424	3612	-	2710	2000	4650	1610	240	2000
UT-L 48[4)]	10000	8285	6315	5990	2724	3912	-	3010	2200	5320	1890	280	2200
UT-L 50[4)]	11200	8121	5980	5655	2574	3947	-	2875	2100	5050	1630	280	2100
UT-L 52[4)]	12000	9086	7050	6725	2924	4297	-	3239	2440	6000	1890	280	2440
UT-L 54[4)]	12600	7162	6315	5990	2724	4097	-	3010	2200	5320	1890	280	2200
UT-L 56[4)]	14000	8803	7530	7170	3224	4597	-	3542	2600	6390	2100	320	2600
UT-L 58[4)]	14700	9086	7050	6725	2924	4377	-	3239	2440	6000	1890	280	2440
UT-L 60[4)]	16400	9566	7530	7170	3224	4677	-	3542	2600	6390	2100	320	2600
UT-L 62[4)]	17500	9227	7980	7620	3424	4877	-	3770	2820	6790	2100	320	2820
UT-L 64[4)]	19200	9227	7980	7620	3424	4877	-	3770	2820	6790	2100	320	2820

Table 4 Main dimensions

1) The dimension L1 is a recommended dimension and is subject to the burner manufacturer, type and the actual output. If a flue gas heat exchanger is included in the standard delivery, the corresponding dimension of length in accordance with datasheet DA170/DA171 must be taken into account.

2) Minimum transport dimensions when valves, burner and terminal box have been removed (without cable conduit; with cable conduit + 75 mm on the right).

3) Maximum dimension above boiler connector, lifting lug or door mounting.

4) UNIMATIC positioned at the side.

- For information and instructions regarding the requirements for the boiler installation room, see chapter 10.2, page 67.
- Equipment and complete dimensions according to project-specific technical datasheet
- Dimensions given with ± 1 % tolerance
- These dimensions are designed for standard insulation:
  - 100-mm thick on back floor
  - 100-mm thick on casing
- Sizing for the entrance:
  - Transport height: additional clearance of at least 100 mm from dimension H1 or dimension H2 (valves fitted/not fitted)
  - Minimum door clearance: additional clearance of at least 200 mm from dimension B1 (valves fitted/not fitted)
- The height of the boiler room is determined by the system equipment. The clearance above the maintenance platform should be at least 2 m.

3.3.2 Integrated heat exchanger without condensing technology – ECO 7

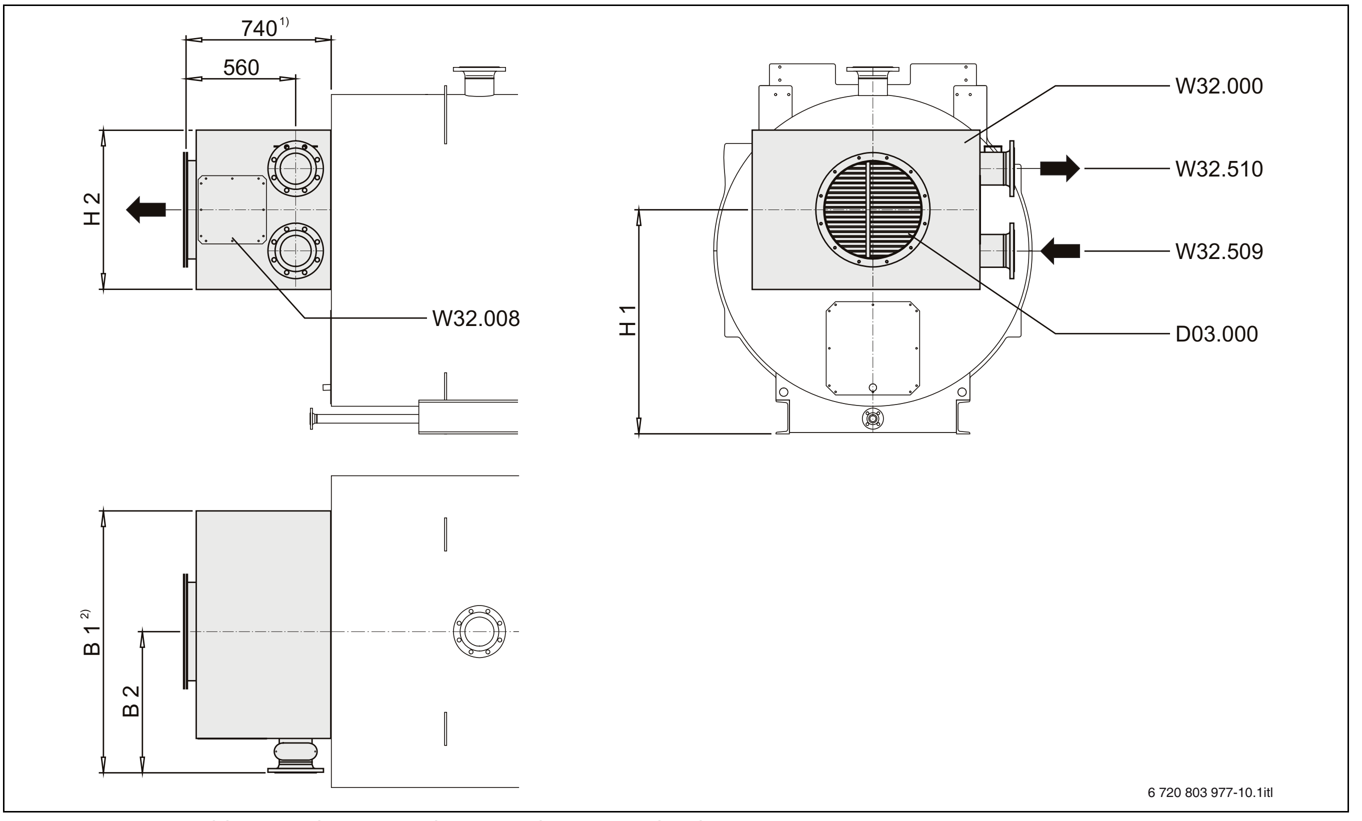

Fig. 9 Integrated heat exchanger without condensing technology – ECO 7

W32.000 Flue gas heat exchanger
W32.510 Connection for water outlet
W32.008 Inspection aperture on the flue gas side
W32.509 Connection for water inlet
D03.000 Flue gas connecting branch

1) If the heat exchanger is designed to have several bundle elements, the dimensions increase by 300 mm per bundle.

2) For heat exchangers having a water inlet/water outlet with an internal diameter of DN150, the dimensions increase by 50 mm.

Heat exchanger ECO 7	Shipping weight 1 bundle [~kg]	Shipping weight 2 bundle [~kg]	Water capacity [l]	Measurements B 1[2)] [mm]	Measurements B 2 [mm]	Measurements H 2 [mm]
390/245	90	140	10	809	490	459
510/325	110	180	15	929	550	539
600/378	140	220	20	1019	595	592
690/432	160	260	26	1109	640	646
750/485	190	310	29	1169	670	699
890/592	230	370	37	1309	740	806
930/618	250	400	42	1349	760	832
1000/672	280	440	46	1419	795	886
1110/752	300	480	52	1529	850	966
1300/885	350	550	64	1719	945	1099
1350/965	420	670	85	1769	970	1179
1550/1045	480	780	98	1969	1070	1259
1600/1072	540	890	119	2019	1095	1286
1750/1178	600	980	125	2169	1170	1392
1900/1258	660	1060	148	2319	1245	1472
2050/1365	760	1240	173	2469	1320	1579
2200/1472	850	1390	200	2619	1395	1686

Table 5 Main dimensions

UNIMAT UT-L	UT-L 1	UT-L 2	UT-L 4	UT-L 6	UT-L 8	UT-L 10	UT-L 12	UT-L 14	UT-L 16	UT-L 18	UT-L 20
H1 [mm]	950	1060	1060	1050	1150	1050	1205	1150	1215	1205	1240
UNIMAT UT-L	UT-L 22	UT-L 24	UT-L 26	UT-L 28	UT-L 30	UT-L 32	UT-L 34	UT-L 36	UT-L 38	UT-L 40	UT-L 42
H1 [mm]	1260	1215	1330	1240	1260	1360	1330	1495	1550	1360	1495
UNIMAT UT-L	UT-L 44	UT-L 46	UT-L 48	UT-L 50	UT-L 52	UT-L 54	UT-L 56	UT-L 58	UT-L 60	UT-L 62	UT-L 64
H1 [mm]	1705	1550	1750	1705	1900	1750	2030	1900	2030	2150	2150

Table 6 Dimension H1 depends on the boiler size

- For information and instructions regarding the requirements for the boiler installation room, see chapter 10.2, page 67.
- These dimensions are designed for 100-mm thick insulation.
- Connections W32.509 and W32.510 can be made on the right hand or left hand side.
- Dimensions given with ± 1 % tolerance; weights given with ± 3 % tolerance.

UNIMAT UT-L	UT-L 1	UT-L 2	UT-L 4	UT-L 6	UT-L 8	UT-L 10	UT-L 12	UT-L 14	UT-L 16	UT-L 18	UT-L 20
ECO 7 heat exchanger	510/325	510/325	510/325	510/325	600/378	600/378	600/378	690/432	690/432	750/485	750/485
	390/245				510/325			600/378		690/432	
										600/378	

UNIMAT UT-L	UT-L 22	UT-L 24	UT-L 26	UT-L 28	UT-L 30	UT-L 32	UT-L 34	UT-L 36	UT-L 38	UT-L 40	UT-L 42
ECO 7 heat exchanger	890/592	890/592	930/618	930/618	1000/672	1000/672	1110/752	1110/752	1300/885	1300/885	1350/985
		750/485		890/592	930/618		1000/672		1110/752	1110/752	1300/885
		690/432		750/485	890/592		930/618			1000/672	1110/752

UNIMAT UT-L	UT-L 44	UT-L 46	UT-L 48	UT-L 50	UT-L 52	UT-L 54	UT-L 56	UT-L 58	UT-L 60	UT-L 62	UT-L 64
ECO 7 heat exchanger	1350/965	1550/1045	1550/1045	1600/1072	1600/1072	1750/1178	1750/1178	1900/1258	2050/1365	2050/1365	2200/1472
	1300/885	1350/965		1550/1045		1600/1072	1600/1072	1750/1178	1900/1258	1900/1258	2050/1365
		1300/885		1350/965		1550/1045		1600/1072	1750/1185		1900/1258
		1110/752		1300/885					1600/1085		

Table 7 Assignment of heat exchanger ECO 7 to boiler size

The tube bundles highlighted in bold correspond to the assignment for the limit output of the UNIMAT UT-L.
If the boiler is operated with low heating output, a smaller flue gas heat exchanger can also be selected under certain circumstances.

3.3.3 Integrated heat exchanger with condensing technology – ECO6

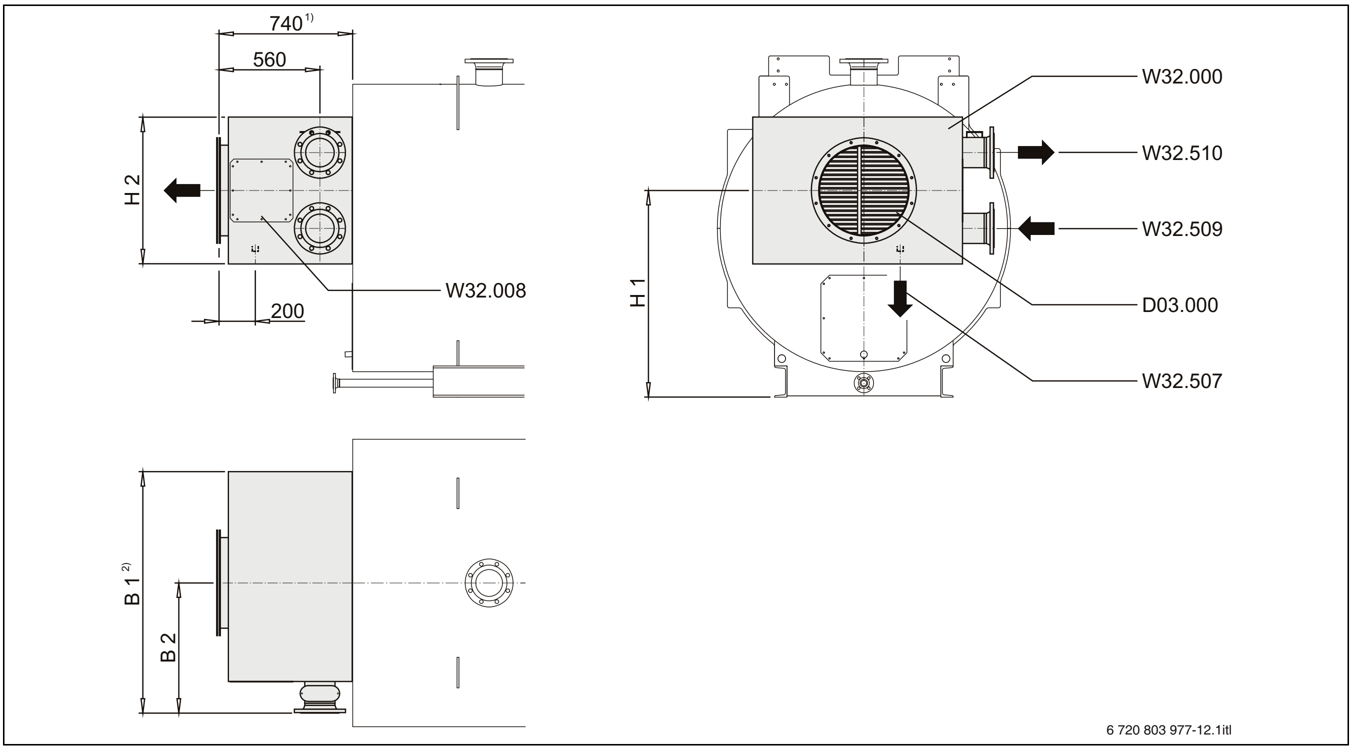

Fig. 10 Integrated heat exchanger with condensing technology – ECO 6

D03.000 Flue gas connecting branch
W32.000 Flue gas heat exchanger
W32.008 Inspection aperture on the flue gas side
W32.507 Connection for flue gas condensate
W32.509 Connection for water inlet
W32.510 Connection for water outlet

1) If the heat exchanger is designed to have several bundle elements, the dimensions increase by 300 mm per bundle.

2) For heat exchangers having a water inlet/water outlet with an internal diameter of DN150, the dimensions increase by 50 mm.

Heat exchanger ECO 6	Shipping weight 1 bundle [~kg]	Shipping weight 2 bundle [~kg]	Water capacity [mm]	Measurements B 1 [mm]	Measurements B 2 2) [mm]	Measurements H 2 [mm]	Port W32.506 [DN]
390 / 260	90	140	10	794	475	474	1"
510 / 335	110	180	15	914	535	549	1"
600 / 385	140	220	20	1004	580	599	1"
690 / 460	170	260	26	1094	625	674	1"
750 / 485	190	310	29	1154	655	699	1"
850 / 560	230	360	37	1254	705	774	1"
890 / 610	250	400	42	1294	725	824	1"
930 / 635	270	440	46	1334	745	849	1"
1000 / 685	290	470	52	1404	780	899	2"
1110 / 760	320	520	64	1514	835	974	2"
1300 / 885	400	650	85	1704	930	1099	2"
1350 / 985	460	750	98	1754	955	1199	2"
1550 / 1060	540	880	119	1954	1055	1274	2"
1600 / 1085	570	950	125	2004	1080	1299	2"
1750 / 1185	630	1040	148	2154	1155	1399	2"
1900 / 1285	730	1210	173	2304	1230	1499	2"
2050 / 1385	820	1360	200	2454	1305	1599	2"
2200 / 1485	930	1550	228	2604	1380	1699	2"

Table 8 Main dimensions

UNIMAT UT-L	UT-L 2	UT-L 4	UT-L 6	UT-L 8	UT-L 10	UT-L 12	UT-L 14	UT-L 16	UT-L 18	UT-L 20	UT-L 22
H1 [mm]	1060	1060	1050	1150	1050	1205	1150	1215	1205	1240	1260
UNIMAT UT-L	UT-L 24	UT-L 26	UT-L 28	UT-L 30	UT-L 32	UT-L 34	UT-L 36	UT-L 38	UT-L 40	UT-L 42	UT-L 44
H1 [mm]	1215	1330	1240	1260	1360	1330	1495	1550	1360	1495	1705
UNIMAT UT-L	UT-L 46	UT-L 48	UT-L 50	UT-L 52	UT-L 54	UT-L 56	UT-L 58	UT-L 60	UT-L 62	UT-L 64	
H1 [mm]	1550	1750	1705	1900	1750	2030	1900	2030	2150	2150	

Table 9 Dimension H1 depends on the boiler size

- For information and instructions regarding the requirements for the boiler installation room, see chapter 10.2, page 67.
- These dimensions are designed for 100-mm thick insulation.
- Connections W32.509 and W32.510 can be made on the right hand or left hand side.
- Dimensions given with ± 1 % tolerance; weights given with ± 3 % tolerance.
- Pipe thread to DIN 2999.

UNIMAT UT-L	UT-L 1	UT-L 2	UT-L 4	UT-L 6	UT-L 8	UT-L 10	UT-L 12	UT-L 14	UT-L 16	UT-L 18	UT-L 20
ECO 6 heat exchanger	510/335	510/335	600/385	600/385	690/460	690/460	690/460	750/485	750/485	850/560	890/610
	390/260		510/335	510/335	600/385	600/385		690/460		750/485	850/560
						510/335		600/385		690/460	
UNIMAT UT-L	**UT-L 22**	**UT-L 24**	**UT-L 26**	**UT-L 28**	**UT-L 30**	**UT-L 32**	**UT-L 34**	**UT-L 36**	**UT-L 38**	**UT-L 40**	**UT-L 42**
ECO 6 heat exchanger	890/610	890/610	930/635	930/635	1000/685	1000/685	1110/760	1110/760	1300/885	1300/885	1350/985
		850/560		890/610	930/635		1000/685		1110/760	1110/760	1300/885
		750/485		890/610	890/610		930/635			1000/685	1110/760
UNIMAT UT-L	**UT-L 44**	**UT-L 46**	**UT-L 48**	**UT-L 50**	**UT-L 52**	**UT-L 54**	**UT-L 56**	**UT-L 58**	**UT-L 60**	**UT-L 62**	**UT-L 64**
ECO 6 heat exchanger	1350/985	1550/1060	1550/1060	1600/1085	1600/1085	1750/1185	1750/1185	1900/1285	2050/1385	2050/1385	2200/1485
	1300/885	1350/985		1550/1060		1600/1085	1600/1085	1750/1185	1900/1285	1900/1285	2050/1385
		1300/885		1350/985		1550/1060		1600/1085	1750/1185		1900/1285
		1110/760		1300/885					1600/1085		

Table 10 Assignment of heat exchanger ECO 6 to boiler size

ℹ The tube bundles highlighted in bold correspond to the assignment for the limit output of the UNIMAT UT-L.
If the boiler is operated with low heating output, a smaller flue gas heat exchanger can also be selected under certain circumstances.

3.3.4 Stand-alone flue gas heat exchanger without condensing technology – ECO 7

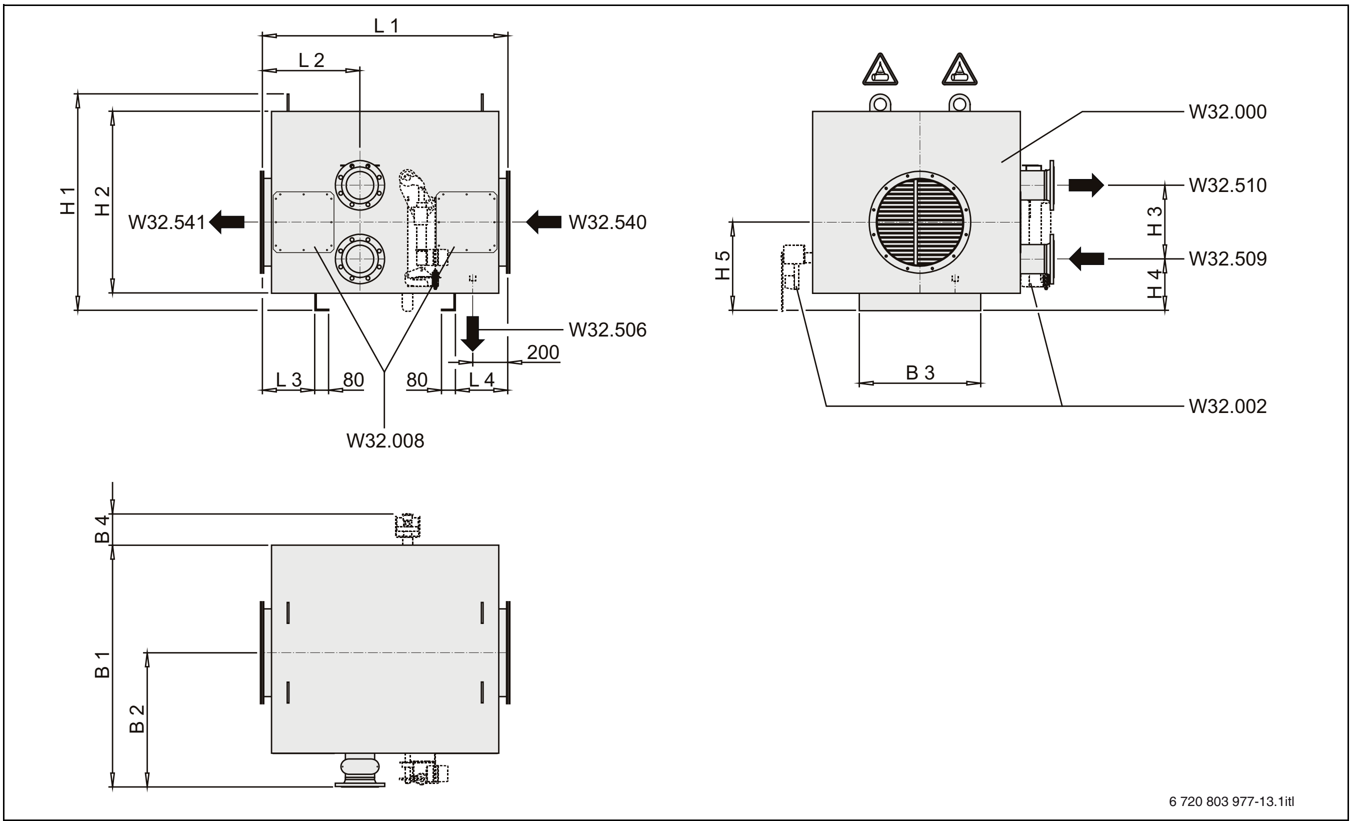

Fig. 11 Stand-alone flue gas heat exchanger without condensing technology – ECO 7

W32.000 Flue gas heat exchanger
W32.002 Optional flue gas control valve
W32.008 Inspection aperture on the flue gas side
W32.506 Connection for drainage system
W32.509 Connection for water inlet
W32.510 Connection for water outlet
W32.540 Connection for flue gas inlet
W32.541 Connection for flue outlet

1) If the heat exchanger is designed to have several bundle elements, the dimensions increase by 300 mm per bundle.

2) For heat exchangers having a water inlet/water outlet with an internal diameter of DN150, the dimensions increase by 50 mm.

Heat exchanger	Measurements												
	L 1[1]		L 2[1]		B 1[2]	B 2	B 3	B 4	H 1		H 2		H 3
	without bypass	with bypass	without bypass	with bypass					without bypass	with bypass	without bypass	with bypass	
ECO 7	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
390 / 245	1120	1235	560	600	809	490	300	0	859	1002	459	602	534
510 / 325	1120	1310	560	600	929	550	400	0	939	1117	539	717	572
600 / 378	1120	1360	560	600	1019	595	500	0	892	1060	592	760	497
690 / 432	1120	1435	560	600	1109	640	500	0	846	1072	646	872	434
750 / 485	1120	1460	560	600	1169	670	600	0	899	1097	699	897	447
890 / 592	1120	1623	560	638	1309	740	750	0	1006	1247	806	1047	509
930 / 618	1120	1648	560	638	1349	760	750	0	1032	1272	832	1072	522

Table 11 Main dimensions

Heat exchanger	Measurements												
	L 1[1)]		L 2[1)]		B 1[2)]	B 2	B 3	B 4	H 1		H 2		H 3
	without bypass	with bypass	without bypass	with bypass					without bypass	with bypass	without bypass	with bypass	
ECO 7	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
1000 / 672	1520	1840	760	780	1419	795	750	0	1086	1417	886	1217	547
1110 / 752	1520	1885	760	750	1529	850	900	0	1166	1472	966	1272	584
1300 / 885	1520	2025	760	765	1719	945	1100	0	1299	1607	1099	1407	647
1350 / 965	1520	2215	760	855	1769	970	1100	0	1379	1767	1179	1567	697
1550 / 1045	1520	2260	760	825	1969	1070	1350	0	1459	1832	1259	1632	734
1600 / 1072	1520	2230	760	900	2019	1095	1350	250	1486	1897	1286	1697	747
1750 / 1178	1920	2330	960	930	2169	1170	1550	250	1592	2017	1392	1817	797
1900 / 1258	1920	2270	960	930	2319	1245	1700	250	1672	2117	1472	1917	847
2050 / 1365	1920	2390	960	975	2469	1320	1700	250	1779	2247	1579	2047	897
2200 / 1472	1920	2470	960	1005	2619	1395	2000	250	1886	2367	1686	2167	947

Table 11 Main dimensions

Heat exchanger	Measurements				Port	Shipping weight			Water capacity per bundle
	L 3		L4					additional weight with bypass	
					W32.506	1 bundle	2 bundle		
ECO 7	[mm]	[mm]	[mm]		[DN]	[~kg]	[~kg]	[~kg]	[l]
390 / 245	353	380	353	285	1"	100	150	20	10
510 / 325	353	380	353	360	1"	130	200	40	15
600 / 378	353	380	353	410	1"	160	240	60	20
690 / 432	353	380	353	485	1"	190	290	80	26
750 / 485	353	380	353	510	1"	220	340	100	29
890 / 592	353	418	353	635	1"	270	410	150	37
930 / 618	353	418	353	660	1"	300	450	160	42
1000 / 672	553	560	553	710	1"	360	530	170	46
1110 / 752	553	530	553	785	1"	400	580	210	52
1300 / 885	553	545	553	910	1"	480	680	290	64
1350 / 965	553	635	553	1010	1"	550	800	380	85
1550 / 1045	553	605	553	1085	1"	650	940	440	98
1600 / 1072	553	680	553	660	1"	710	1050	420	119
1750 / 1178	753	710	753	690	1"	850	1230	810	125
1900 / 1258	753	710	753	690	1"	940	1340	860	148
2050 / 1365	753	755	753	735	1"	1070	1550	960	173
2200 / 1472	753	785	753	753	1"	1200	1740	1090	200

Table 12 Main dimensions

- For information and instructions regarding the requirements for the boiler installation room, see chapter 10.2, page 67.
- These dimensions are designed for 100-mm thick insulation.
- Connections W32.509 and W32.510 can be made on the right hand or left hand side.
- Dimensions given with ± 1 % tolerance; weights given with ± 3 % tolerance.
- Pipe thread to DIN 2999.

i For the allocation of the ECO 7 stand-alone heat exchanger to the boiler size, see chapter 3.3.2, Tab. 7, page 15.

3.3.5 Stand-alone flue gas heat exchanger with condensing technology – ECO 6

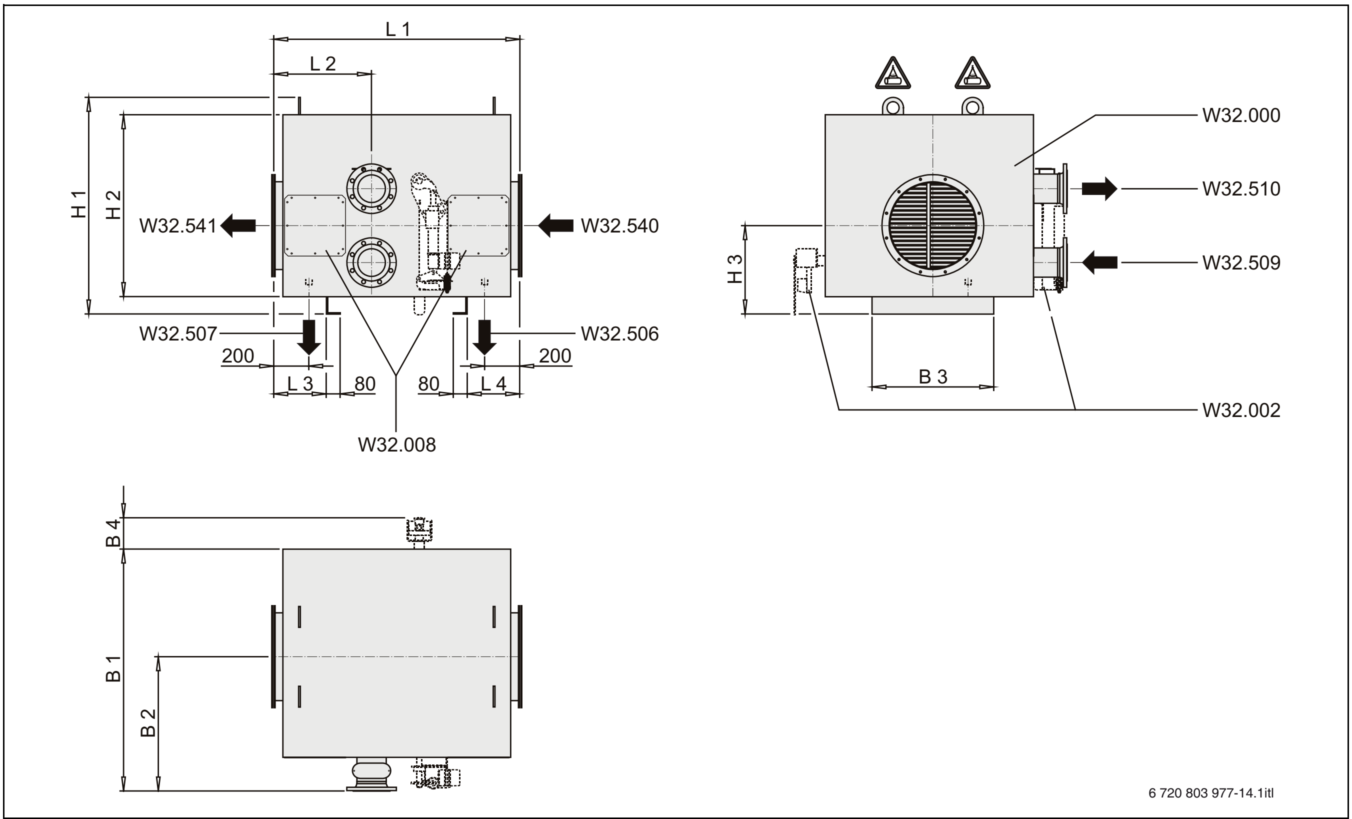

Fig. 12 Stand-alone flue gas heat exchanger with condensing technology – ECO 6

W32.000 Flue gas heat exchanger
W32.002 Flue gas control valve
W32.008 Inspection aperture on the flue gas side
W32.506 Connection for drainage system
W32.509 Connection for water inlet
W32.510 Connection for water outlet
W32.540 Connection for flue gas inlet
W32.541 Connection for flue outlet

- For information and instructions regarding the requirements for the boiler installation room, see chapter 10.2, page 67.
- These dimensions are designed for 100-mm thick insulation.
- Connections W32.509 and W32.510 can be made on the right hand or left hand side.
- Dimensions given with ± 1 % tolerance; weights given with ± 3 % tolerance.
- Pipe thread to DIN 2999.

Heat exchanger	Measurements												
	L 1 [1)]		L 2 [1)]		B 1 [2)]	B 2	B 3	B 4	H 1		H 2		H 3
	without bypass	with bypass	without bypass	with bypass					without bypass	with bypass	without bypass	with bypass	
ECO 6	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
390 / 260	1120	1235	560	600	794	475	300	0	874	1002	474	602	534
510 / 335	1120	1310	560	600	914	535	400	0	949	1117	549	717	572
600 / 385	1120	1360	560	600	1004	580	500	0	899	1067	599	767	497
690 / 460	1120	1435	560	600	1094	625	500	0	874	1072	674	872	434
750 / 485	1120	1460	560	600	1154	655	600	0	899	1097	699	897	447
850 / 560	1120	1685	560	750	1254	705	750	0	974	1197	774	997	484
890 / 610	1120	1623	560	638	1294	725	750	0	1024	1247	824	1047	509
930 / 635	1120	1648	560	638	1334	745	750	0	1049	1272	849	1072	522
1000 / 685	1520	1840	760	780	1404	780	750	0	1099	1417	899	1217	547

Table 13 Main dimensions

Heat exchanger	Measurements												
	L 1[1)]		L 2[1)]		B 1[2)]	B 2	B 3	B 4	H 1		H 2		H 3
	without bypass	with bypass	without bypass	with bypass					without bypass	with bypass	without bypass	with bypass	
ECO 6	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
1110 / 760	1520	1885	760	750	1514	830	900	0	1174	1472	974	1272	584
1300 / 885	1520	2025	760	765	1704	930	1100	0	1299	1607	1099	1407	647
1350 / 985	1520	2215	760	855	1754	955	1100	0	1399	1767	1199	1567	697
1550 / 1060	1520	2260	760	825	1954	1055	1350	0	1474	1832	1274	1632	734
1600 / 1085	1520	2230	760	900	2004	1080	1350	250	1499	1897	1299	1697	747
1750 / 1185	1920	2330	960	930	2154	1155	1550	250	1599	2017	1399	1817	797
1900 / 1285	1920	2270	960	930	2304	1230	1700	250	1699	2117	1499	1917	847
2050 / 1385	1920	2390	960	975	2454	1305	1700	250	1799	2247	1599	2047	897
2200 / 1485	1920	2470	960	1005	2604	1380	2000	250	1899	2367	1699	2167	947
2400 / 1630	1920	2980	960	1260	2804	1480	2200	250	2044	2562	1844	2362	1019

Table 13 Main dimensions

Heat exchanger	Measurements				Port		Shipping weight without bypass			
	L 3		L 4		W32.506	W32.507			additional weight with bypass	Water capacity per bundle
	without bypass	with bypass	without bypass	with bypass	W32.506	W32.507	1 bundle	2 bundle		
ECO 6	[mm]	[mm]	[mm]	[mm]	[DN]	[DN]	[~kg]	[~kg]	[~kg]	[~kg]
390/260	353	380	353	285	1"	1"	100	150	20	10
510/335	353	380	353	360	1"	1"	130	200	40	15
600/385	353	380	353	410	1"	1"	160	240	60	20
690/460	353	380	353	485	1"	1"	190	290	80	26
750/485	353	380	353	510	1"	1"	220	340	100	29
850/560	353	530	353	585	1"	1"	260	400	140	37
890/610	353	418	353	635	1"	1"	290	440	160	42
930/635	353	418	353	660	1"	1"	310	480	170	46
1000/685	553	560	553	710	1"	2"	370	550	180	52
1110/760	553	530	553	785	1"	2"	420	620	220	64
1300/885	553	545	553	910	1"	2"	530	780	300	85
1350/985	553	635	553	1010	1"	2"	600	890	380	98
1550/ 1060	553	605	553	1085	1"	2"	700	1040	450	119
1600/ 1085	553	680	553	660	1"	2"	740	1120	800	125
1750/ 1185	753	710	753	690	1"	2"	890	1290	870	148
1900/ 1285	753	710	753	690	1"	2"	1020	1490	890	173
2050/ 1385	753	755	753	735	1"	2"	1140	1680	1030	200
2200/ 1485	753	785	753	765	1"	2"	1290	1900	1160	228
2400/ 1630	753	1040	753	940	1"	2"	1530	2300	1410	250

Table 14 Main dimensions

1) If the heat exchanger is designed to have several bundle elements, the dimensions increase by 300 mm per bundle.

2) For heat exchangers having a water inlet/water outlet with an internal diameter of DN150, the dimensions increase by 50 mm.

i For the allocation of the ECO 6 stand-alone heat exchanger to the boiler size, see chapter 3.3.3, Tab. 10, page 17.

3.4 Connections

3.4.1 Flow and return

At design spread and rated output				Suggested internal diameter[1]
ΔT = 15 K [kW]	ΔT = 20 K [kW]	ΔT = 30 K [kW]	ΔT = 40 K [kW]	
> 175 ≤ 275	> 235 ≤ 367	> 352 ≤ 550	> 470 ≤ 734	DN50
> 275 ≤ 465	> 367 ≤ 620	> 550 ≤ 931	> 734 ≤ 1241	DN65
> 465 ≤ 705	> 620 ≤ 940	> 931 ≤ 1410	> 1241 ≤ 1881	DN80
> 705 ≤ 1102	> 940 ≤ 1469	> 1410 ≤ 2204	> 1881 ≤ 2938	DN100
> 1102 ≤ 1722	> 1469 ≤ 2296	> 2204 ≤ 3444	> 2938 ≤ 4592	DN125
> 1722 ≤ 2479	> 2296 ≤ 3306	> 3444 ≤ 4959	> 4592 ≤ 6612	DN150
> 2479 ≤ 4408	> 3306 ≤ 5877	> 4959 ≤ 8816	> 6612 ≤ 11755	DN200
> 4408 ≤ 6887	> 5877 ≤ 9183	> 8816 ≤ 13775	> 11755 ≤ 18367	DN250
> 6887 ≤ 9918	> 9183 ≤ 13224	> 13775 ≤ 19200	> 18367 ≤ 19200	DN300
> 9918 ≤ 13500	> 13224 ≤ 18000	–	–	DN350
> 13500 ≤ 17633	> 18000 ≤ 19200	–	–	DN400

Table 15 Internal diameters of flow and return connections subject to design spread and rated output

1) Flanged connections designed as PN16 to DIN 2633; the internal diameters given should be taken as suggestions but can be determined individually. Depending on the design, the flow and return connectors are restricted for certain boiler sizes.

3.4.2 Flue outlet connection

Rated output[1] [kW]	Flue outlet internal diameter[2)3)] D_1 –	Flue outlet D_1 (external)[3] [mm]
≤ 827	DN200	213
> 827 ≤ 1350	DN250	256
> 1350 ≤ 2050	DN315	322
> 2051 ≤ 3307	DN400	400
> 3308 ≤ 5167	DN500	503
> 5168 ≤ 8203	DN630	634
> 8204 ≤ 10403	DN710	711
> 10404 ≤ 13227	DN800	797
> 13228 ≤ 16712	DN900	894
> 16713 ≤ 19200	DN1000	1003

Table 16 Flue outlet connection subject to the rated output

1) Actual output (according to type plate)

2) Dimensions to EN 12220

3) Recommended values; exact diameter is calculated for each specific project.

3.4.3 Connector

All UNIMAT UT-L boilers boilers are factory-fitted with suitable flow and return connectors.

A temperature sensor and temperature control unit can be connected to them.

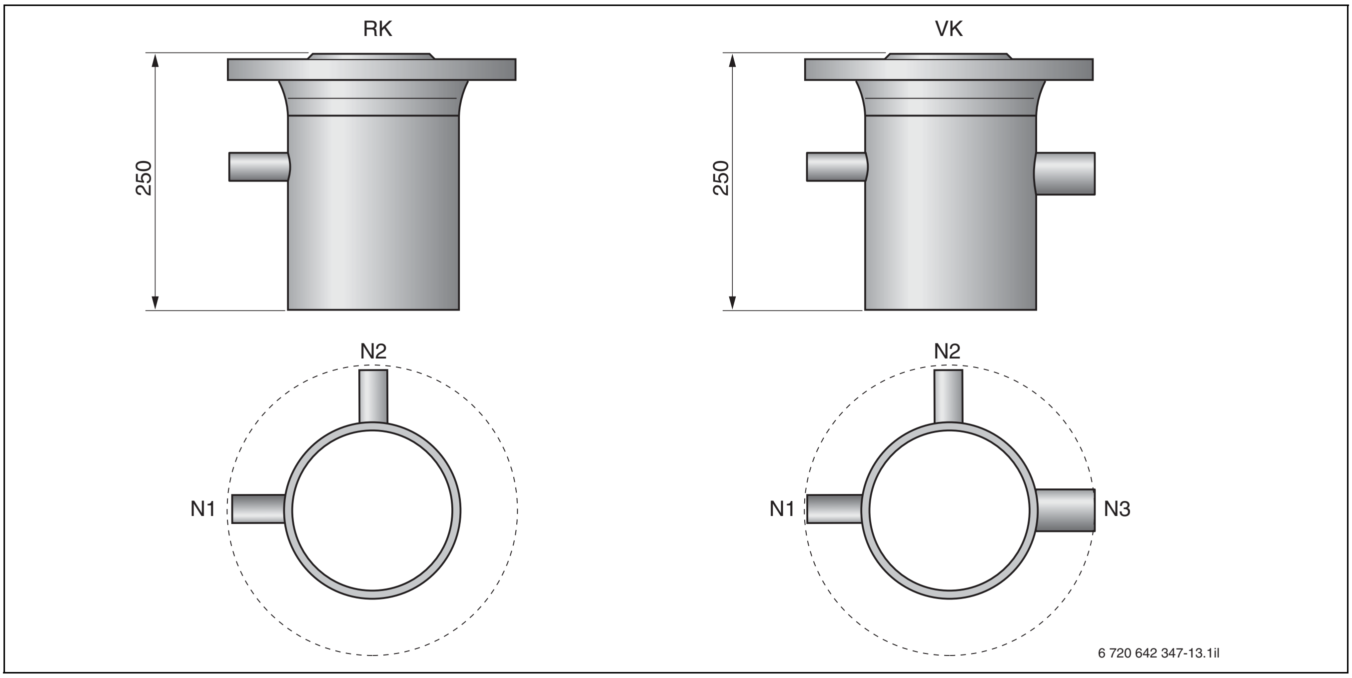

Fig. 13 Connectors for UNIMAT UT-L boilers with test points for safety equipment (dimensions in mm; internal diameters → Tab. 15, page 22, Tab. 38, page 75 and Tab. 39, page 78)

N1 Female connections with cylindrical female thread R½ , 120 mm long (with DN 32–150 connectors)
Female connections with cylindrical female thread R½ , 60 mm long (with DN 200–400 connectors)

N2 Female connections with cylindrical female thread R½ , 60 mm long (with DN 65–80 connectors)
Female connections with cylindrical female thread R½ , 75 mm long (with DN 32–50 connectors)
Female connections with cylindrical female thread R½ , 40 mm long (with DN 100–400 connectors)

N3 Female connections with cylindrical female thread R¾ , 75 mm long (with DN 32–150 connectors)
Female connections with cylindrical female thread R¾ , 50 mm long (with DN 200–400 connectors)

RK Return

VK Flow

3.5 Characteristics

3.5.1 Pressure loss on the water side

The pressure loss on the water side is the pressure differential between the boiler flow and return connections. It depends on the boiler size (and the internal diameter of the connectors) and the flow rate. The graph in Fig. 14 shows the pressure loss on the water side for the UNIMAT UT-L boilers.

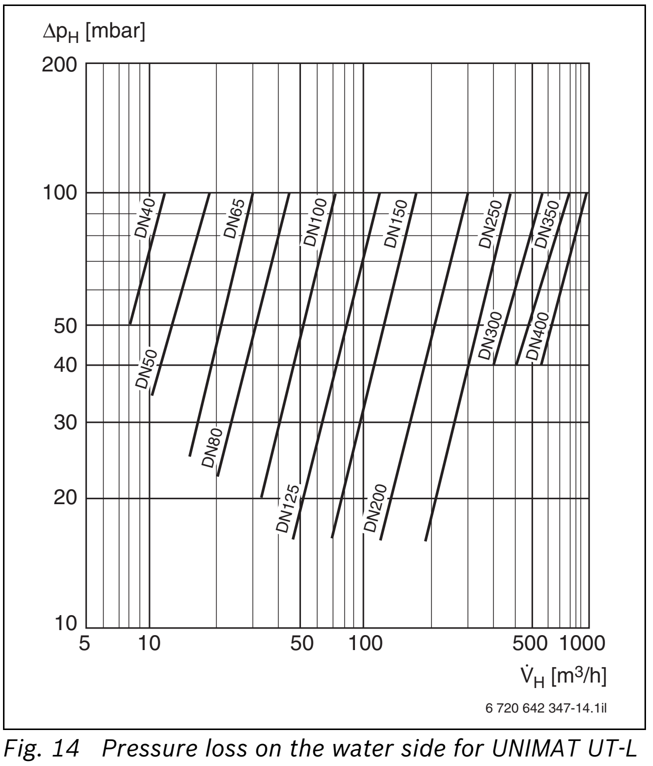

Fig. 14 Pressure loss on the water side for UNIMAT UT-L boilers (for internal diameters of flow and return connections → page 22)

Δp_H pressure loss on the heating water side
$\dot{V}_H$ Flow rate

3.5.2 Pressure loss on the hot gas side

UNIMAT UT-L boiler

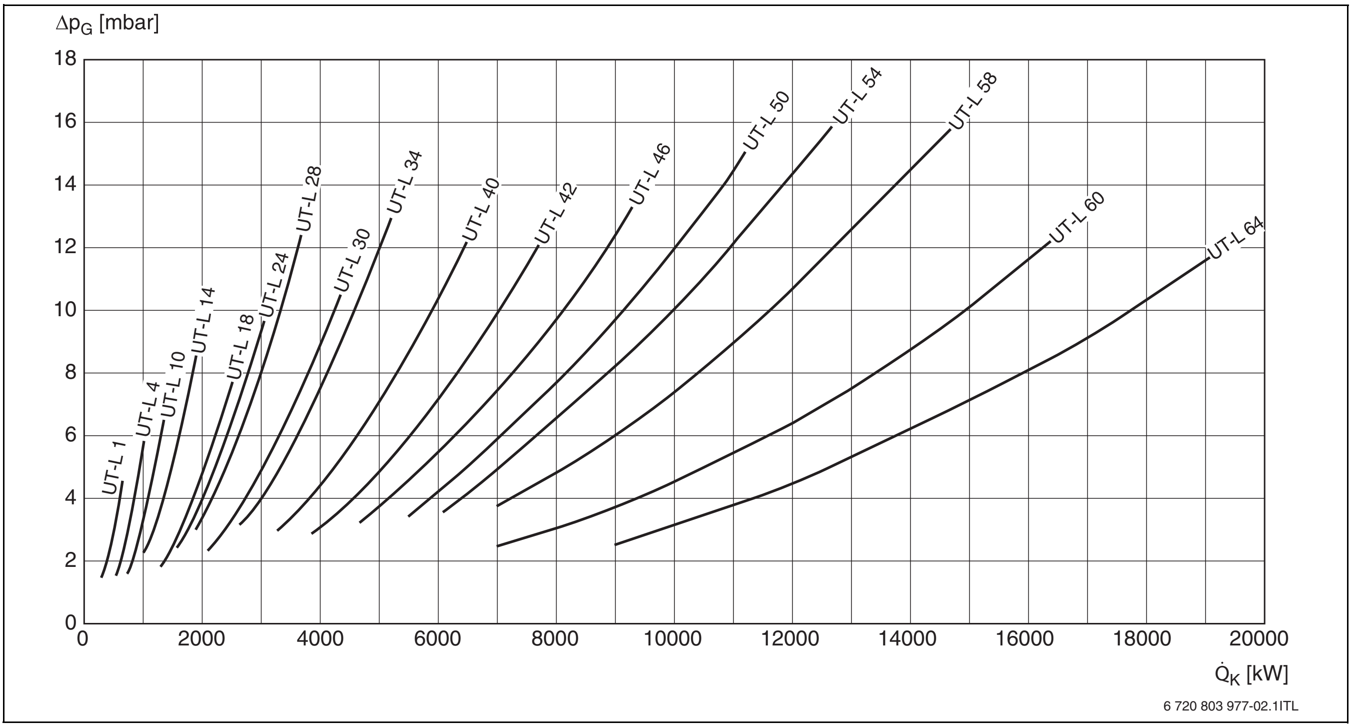

Fig. 15 Pressure loss on the hot gas side — overview 1

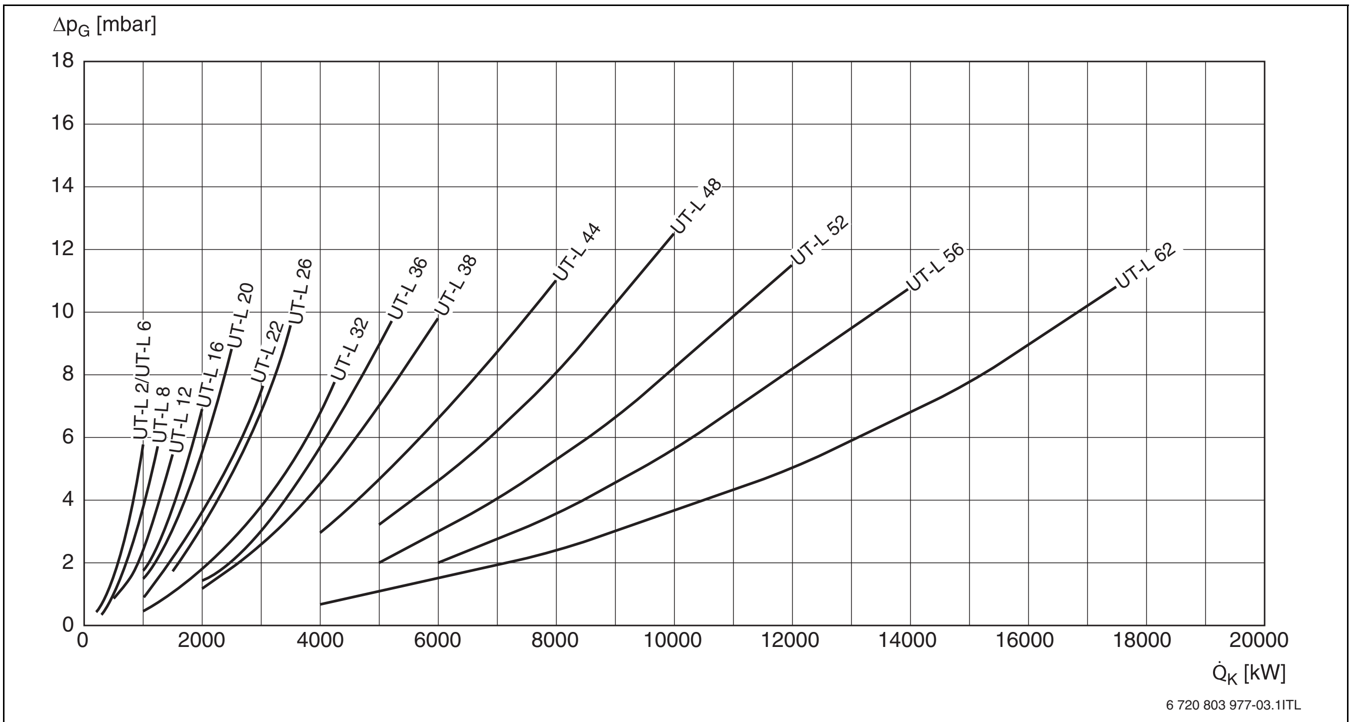

Fig. 16 Pressure loss on the hot gas side — overview 2

Δp_G Pressure loss on the hot gas side
$\dot{Q}_K$ Rated heating output

UNIMAT UT-L boiler with condensing heat exchanger

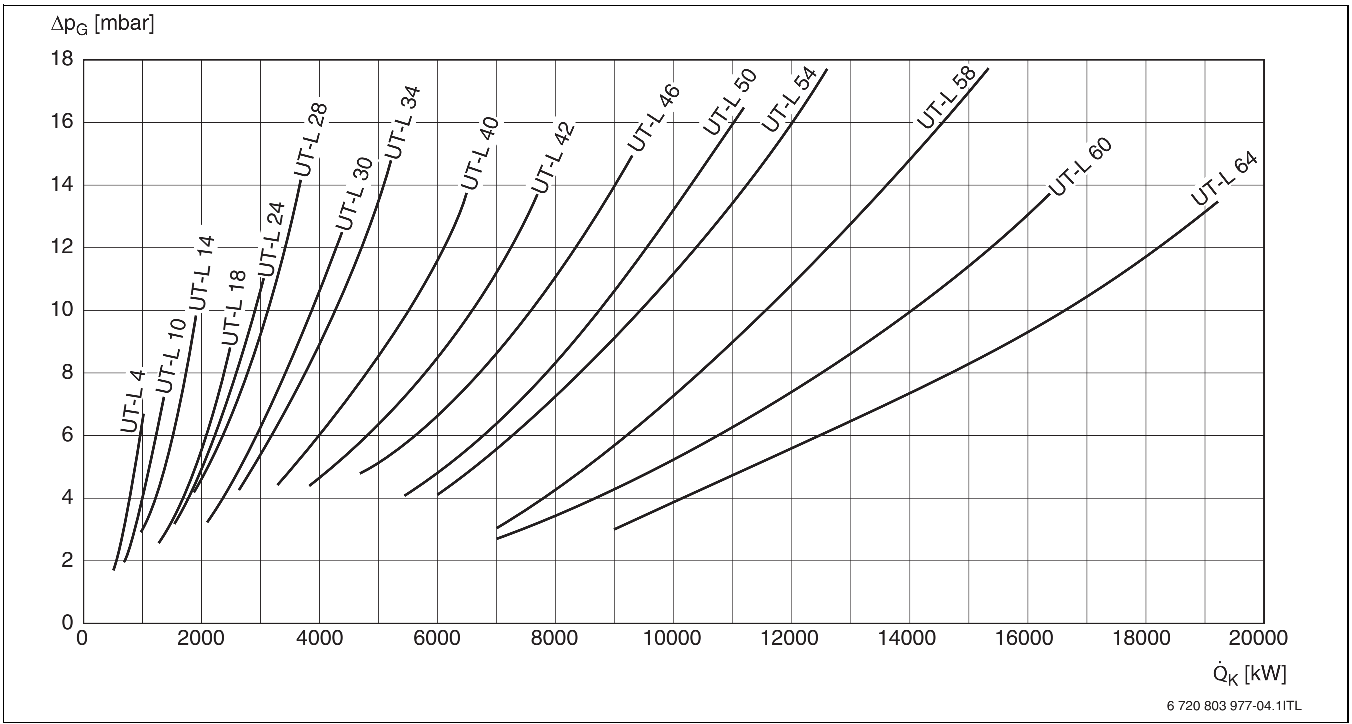

Fig. 17 Pressure loss on the hot gas side — overview 1

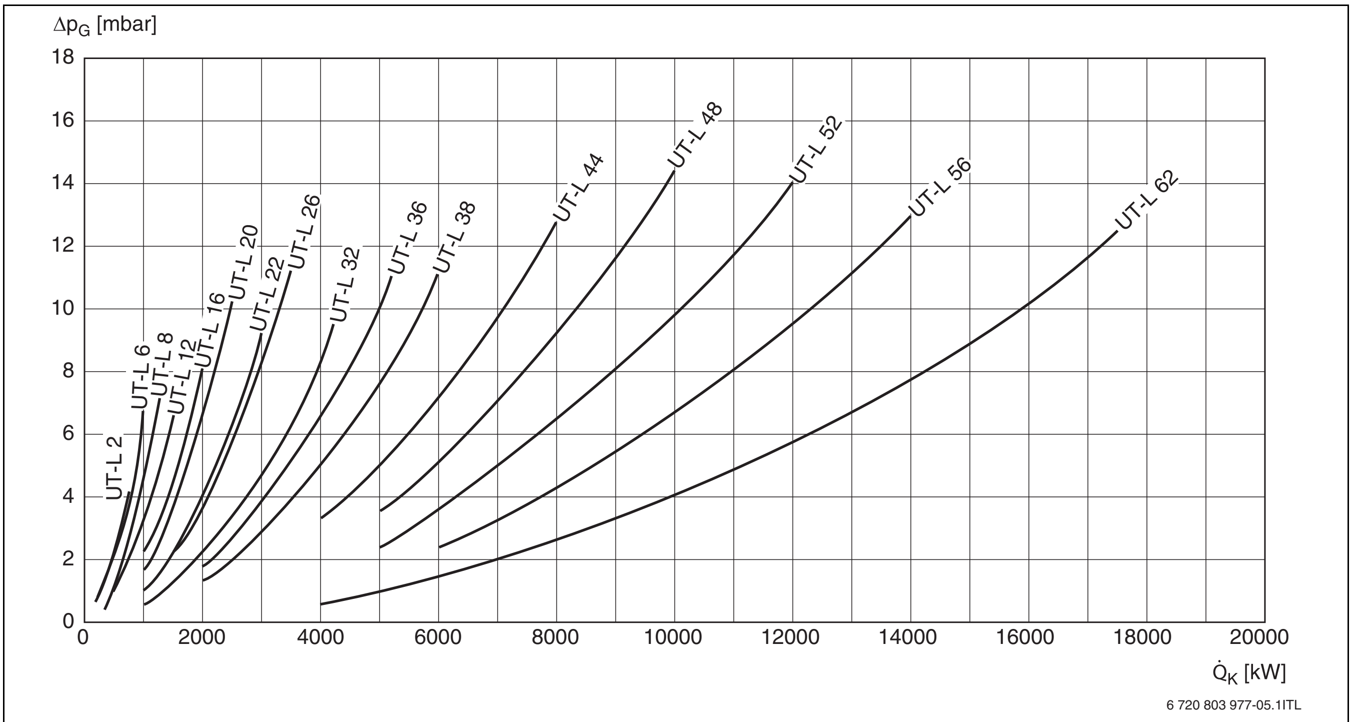

Fig. 18 Pressure loss on the hot gas side — overview 2

Δp_G Pressure loss on the hot gas side
$\dot{Q}K$ Rated heating output

3.5.3 Combustion chamber volume load

To guarantee emissions values, some burner manufacturers define aspects such as a maximum combustion chamber volume load. Using the graphs in Fig. 19 and Fig. 20, the most suitable boiler size for a given combustion chamber volume load can be selected for the UNIMAT UT-L boilers.

UNIMAT UT-L boiler

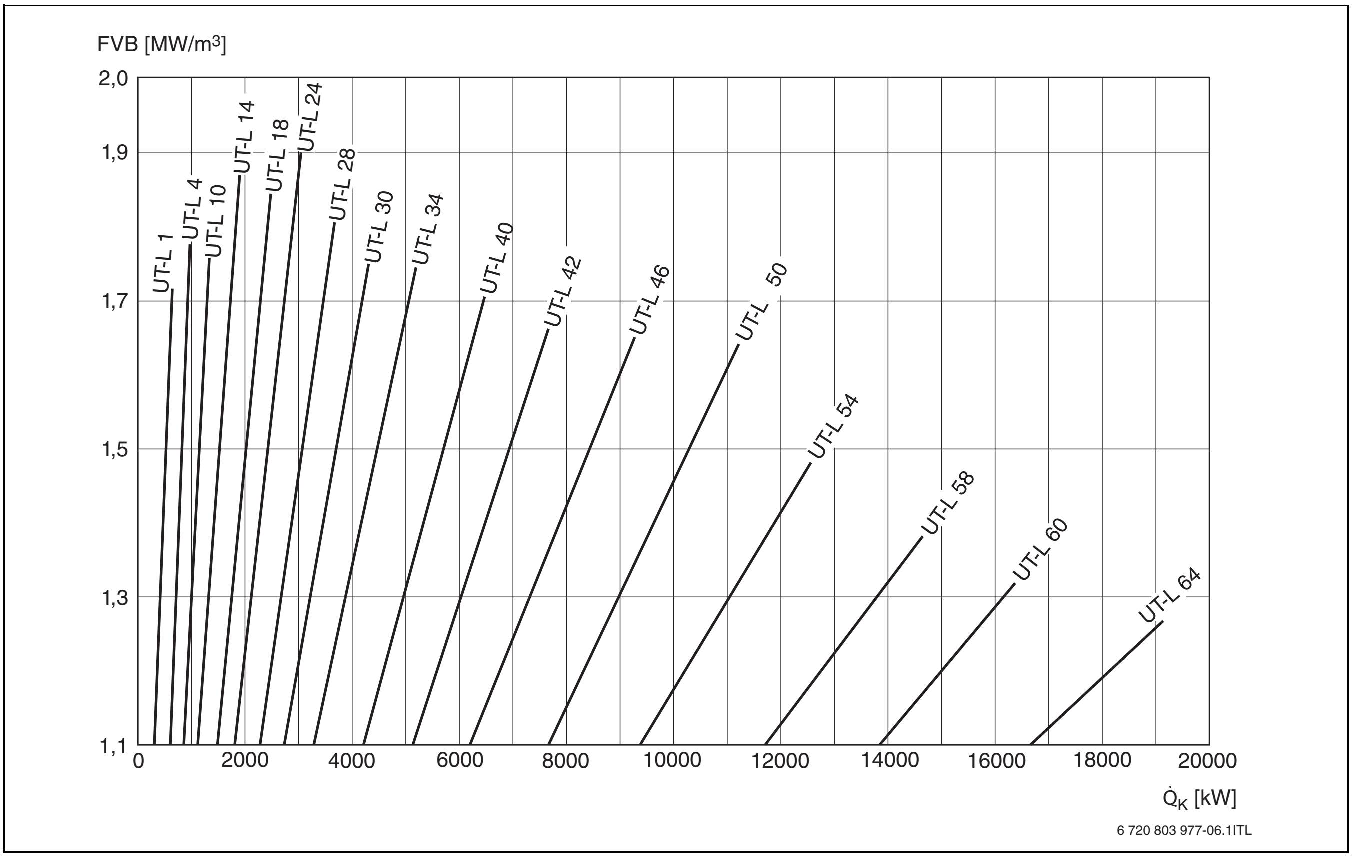

Fig. 19 Combustion chamber volume load for UNIMAT UT-L boiler, subject to the boiler output — overview 1

FVB Combustion chamber volume load
$\dot{Q}_B$ Rated heating output

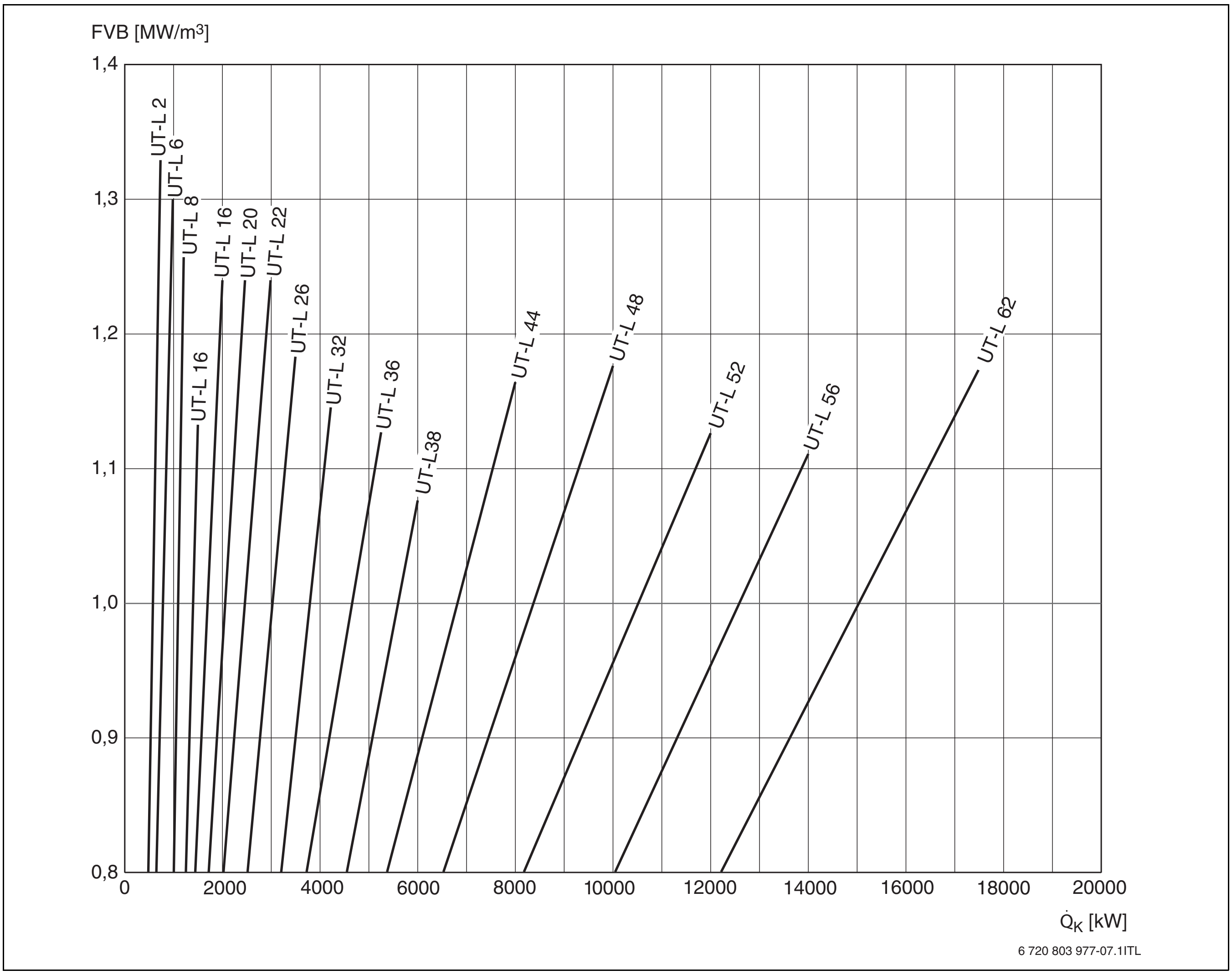

Fig. 20 Combustion chamber volume load for UNIMAT UT-L boiler, subject to the boiler output – overview 2

FVB Combustion chamber volume load
$\dot{Q}_B$ Rated heating output

3.5.4 Boiler efficiency, standard seasonal efficiency [to DIN] and standby loss

Boiler efficiency and standard seasonal efficiency [to DIN]

The **boiler efficiency** denotes the ratio of generated output compared to rated heat input, subject to the boiler load and system temperature.

$$\eta_K = \frac{\dot{Q}}{\dot{Q}_B}$$

η_K Boiler efficiency
$\dot{Q}$ Generated output in kW
$\dot{Q}_B$ Rated heat input in kW

The **standard seasonal efficiency** (to DIN 4702, part 8) is measured from the partial load efficiency levels at five fixed points in the relative boiler output ratings. The values measured for efficiency at partial load subject to the relative boiler output ratings should be entered accordingly. The standard seasonal efficiency [to DIN] for heating operation is calculated from the values derived in this way using the following equation:

$$\eta_N = \frac{5}{\sum_{i=1}^{5} \frac{1}{\eta_{\varphi i}}}$$

η_N Standard seasonal efficiency [to DIN]
φ_i Relative boiler output

For boiler efficiency and standard seasonal efficiency [to DIN] for the various sizes of UNIMAT UT-L boilers, see also Tab. 17 on page 29.

Boiler type	Boiler size	Max. rated output [kw]	Boiler efficiency η_K 1)2)	Standard seasonal efficiency [to DIN] η_N 1) 2)
UNIMAT boiler UT-L	UT-L 1	650	92.2	94.9
	UT-L 2	750	92.4	95.2
	UT-L 4	1000	91.8	94.9
	UT-L 6	1000	93.3	95.7
	UT-L 8	1250	92.4	95.3
	UT-L 10	1350	92.9	95.6
	UT-L 12	1500	92.6	95.5
	UT-L 14	1900	91.4	94.8
	UT-L 16	2000	92.3	95.3
	UT-L 18	2500	91.7	95.0
	UT-L 20	2500	93.1	95.8
	UT-L 22	3000	92.7	95.6
	UT-L 24	3050	91.3	94.8
	UT-L 26	3500	92.7	95.6
	UT-L 28	3700	92.3	95.4
	UT-L 30	4200	92.0	95.2
	UT-L 32	4250	92.0	95.2
	UT-L 34	5200	91.9	95.2
	UT-L 36	5250	92.6	95.6
	UT-L 38	6000	93.0	95.8
	UT-L 40	6500	91.3	94.9
	UT-L 42	7700	92.0	95.2
	UT-L 44	8000	92.8	95.6
	UT-L 46	9300	92.2	95.4
	UT-L 48	10000	93.1	95.8
	UT-L 50	11200	92.2	95.4
	UT-L 52	12000	92.6	95.6
	UT-L 54	12600	92.7	95.6
	UT-L 56	14000	93.5	96.0
	UT-L 58	14700	92.2	95.4
	UT-L 60	16400	93.4	96.0
	UT-L 62	17500	92.9	95.7
	UT-L 64	19200	92.8	95.7

Table 17 Boiler efficiency and standard seasonal efficiency [to DIN] for UNIMAT boilers UT-L

1) Relative to a system temperature of 80/60 °C. At other system temperatures, the boiler efficiency changes.

2) Relative to the maximum rated output; for reduced rated output levels, the boiler efficiency rises accordingly.

Standby loss

The **standby loss** is part of the rated heat input that is required to achieve the specified boiler water temperature. The cause of this loss is the cooling down of the boiler through radiation and convection during the standby time (burner idle time).

Boiler type	Boiler size	Max. rated output [kw]	Standby loss q_B 1) [kW]	% 2)
UNIMAT UT-L boiler	UT-L 1	650	2.16	0.333
	UT-L 2	750	2.36	0.314
	UT-L 4	1000	2.80	0.28
	UT-L 6	1000	2.80	0.28
	UT-L 8	1250	3.20	0.256
	UT-L 10	1350	3.35	0.248
	UT-L 12	1500	3.57	0.238
	UT-L 14	1900	4.12	0.217
	UT-L 16	2000	4.24	0.212
	UT-L 18	2500	4.85	0.194
	UT-L 20	2500	4.85	0.194
	UT-L 22	3000	5.41	0.18
	UT-L 24	3050	5.47	0.179
	UT-L 26	3500	5.94	0.17
	UT-L 28	3700	6.14	0.166
	UT-L 30	4200	6.62	0.158
	UT-L 32	4250	6.67	0.157
	UT-L 34	5200	7.53	0.145
	UT-L 36	5250	7.57	0.144
	UT-L 38	6000	8.20	0.137
	UT-L 40	6500	8.61	0.132
	UT-L 42	7700	9.53	0.124
	UT-L 44	8000	9.75	0.122
	UT-L 46	9300	10.67	0.115
	UT-L 48	10000	11.15	0.111
	UT-L 50	11200	11.93	0.107
	UT-L 52	12000	12.44	0.104
	UT-L 54	12600	12.81	0.102
	UT-L 56	14000	13.64	0.097
	UT-L 58	14700	14.05	0.096
	UT-L 60	16400	15.00	0.091
	UT-L 62	17500	15.59	0.089
	UT-L 64	19200	16.49	0.086

Table 18 Standby loss for UNIMAT UT-L boilers

1) Relative to a system temperature of 80/60 °C

2) Relative to the maximum rated output

3.5.5 Flue gas temperature

The flue gas temperature is the temperature measured inside the flue pipe, specifically at the boiler flue outlet. It depends on the boiler load and the system temperature (→ Fig. 21 to Fig. 23). The minimum possible flue gas temperature should generally be used to calculate the chimney size. This will be approx. 7.5 K below the specified flue gas temperature, relative to an average boiler water temperature of 70 °C.

Change in the flue gas temperature

The flue gas temperature depends on the average boiler water temperature. The flue gas temperatures in the graphs in Fig. 21 to Fig. 23 are relative to a temperature pair of 80/60 °C in accordance with EN 303, i.e. the average boiler temperature is 70 °C (for conversion to other temperature pairs → Tab. 19).

Average boiler water temperature [°C]	Change in the flue gas temperature [K]
60	−7.5
70	0
80	7.5
90	15
100	22.5

Table 19 Change in the flue gas temperature subject to the average boiler temperature

Example

- Given
  - UNIMAT UT-L boiler
  - Rated output $\dot{Q}_K$ = 6000 kW
  - System temperatures 100/80 °C
- Check
  - Change of 15 K in the flue gas temperature (→ Tab. 19)
  - Flue gas temperature read off ϑ_A = 198 °C (→ Fig. 21)
- Result
  - Flue gas temperature at full boiler load = 198 °C + 15 K = 213 °C

UNIMAT UT-L boiler

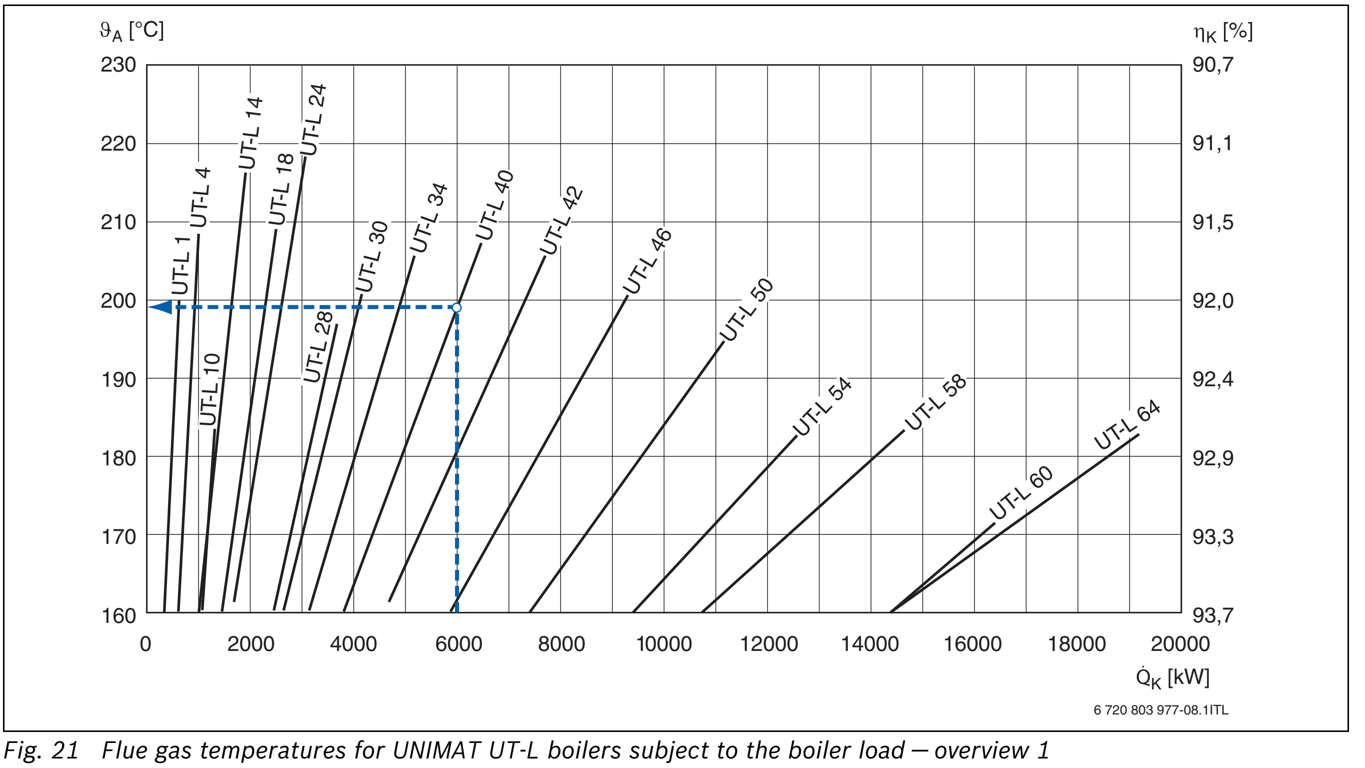

Fig. 21 Flue gas temperatures for UNIMAT UT-L boilers subject to the boiler load — overview 1

η_K Boiler efficiency
ϑ_A Flue gas temperature
φ_K Boiler load
$\dot{Q}_K$ Rated heating output

UNIMAT UT-L boiler with condensing heat exchanger

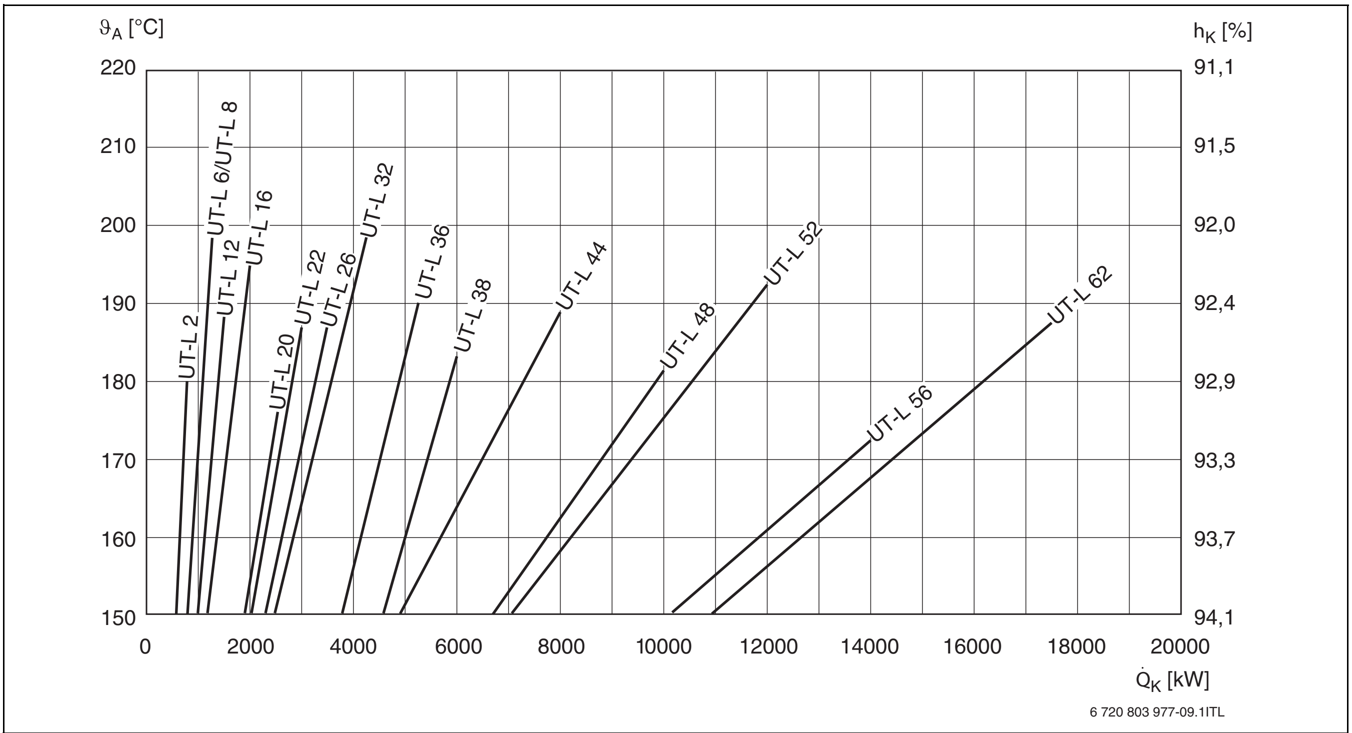

Fig. 22 Flue gas temperatures for UNIMAT UT-L boilers subject to the boiler load — overview 2

η_K Boiler efficiency
ϑ_A Flue gas temperature
$\dot{Q}_B$ Rated heating output

UNIMAT UT-L boiler

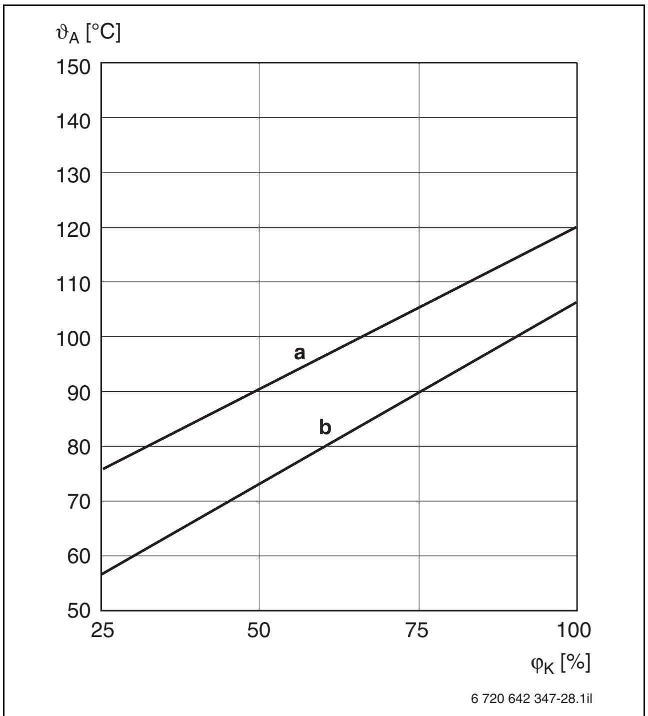

Fig. 23 Flue gas temperatures for UNIMAT UT-L boilers subject to the boiler load and the water inlet temperature into the condensing heat exchanger (averages for the series)

a Water inlet temperature into the condensing heat exchanger of 60 °C
b Water inlet temperature into the condensing heat exchanger of 30 °C
ϑ_A Flue gas temperature
φ_K Boiler load

4 Burner

4.1 General requirements

The UNIMAT UT-L boilers can be operated with any tested pressure-jet oil or gas burner. The pressure-jet oil burners must be type-tested in accordance with the requirements of DIN-EN 267; the pressure-jet gas burners in accordance with DIN-EN 676. Observe the requirements for oil and gas combustion equipment, as well as the applicable guidelines and regulations.

4.2 Information on burner selection

The burner must reliably overcome the pressure loss on the hot gas side of the boiler (→ page 25 ff.). With gas combustion, ensure that the local gas network can provide the required supply pressure for the burner.

The burner fixing equipment and door lining are prepared for the relevant burner at the factory.

Fill the gap between the door lining and blast tube with fireproof, flexible material.

The burner door must be able to be opened and pivoted out unimpeded. In the case of oil combustion, size the oil hoses and cables accordingly.

In the case of gas combustion, provide a gas line compensator in the longitudinal direction of the boiler. With this, the gas train can be separated at this point when the door is opened, and the door can be pivoted out together with the burner.

The burner head is equipped subject to the burner manufacturer's stipulations. The blast tube should protrude into the combustion chamber. Observe the burner manufacturer's installation instructions.

4.3 Matched pressure-jet burners

Optimum combustion requires the boiler and burner to be individually matched. Together with suitable burners, the UNIMAT UT-L boilers are suitable for systems where lower emissions are required.

You can use the product configurator to select an optimum burner.

4.4 Combustion details for the UNIMAT UT-L boilers

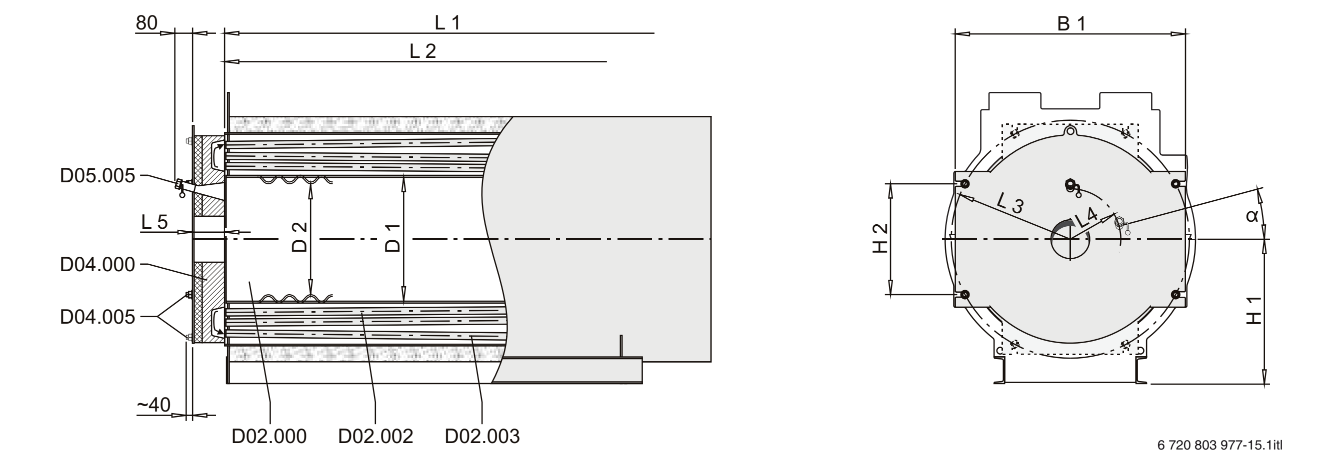

Fig. 24 Combustion chamber dimensions

D02.000 Flue
D02.002 Flue tube bundle for 2nd pass
D02.003 Flue tube bundle for 3rd pass
D04.000 Front reversing chamber (door) (left door hinge)
D04.005 Reversing chamber screw fitting
D05.005 Flame inspection hole (≥ UT-L 30 on the side)

UNIMAT Heating boiler		Output limit	Combustion chamber dimension(s)					
					Bare tube		Corrugated pipe	
UT-L Type		kW	L 1 [mm]	L 2 [mm]	Max. permitted operating pressure [bar]	D 1 [mm]	Max. permitted operating pressure [bar]	D 2 / D 1 [mm]
UT-L	1	650	1821	1570	6	534	-	-
UT-L	2	750	2200	1930	16	600	-	-
UT-L	4	1000	2200	1930	16	600	-	-
UT-L	6	1000	2470	2180	16	660	-	-
UT-L	8	1250	2667	2378	16	726	-	-
UT-L	10	1350	2470	2180	16	660	-	-
UT-L	12	1500	3148	2850	16	776	-	-
UT-L	14	1900	2667	2378	16	726	-	-
UT-L	16	2000	3195	2878	16	842	-	-
UT-L	18	2500	3148	2850	16	776	-	-
UT-L	20	2500	3552	3235	16	894	-	-
UT-L	22	3000	3986	3650	16	927	-	-
UT-L	24	3050	3195	2878	16	842	-	-
UT-L	26	3500	4105	3750	16	1007	-	-
UT-L	28	3700	3552	3235	16	897	-	-
UT-L	30	4200	3986	3650	16	927	-	-
UT-L	32	4250	4483	4100	16	1084	-	-
UT-L	34	5200	4105	3750	16	1007	-	-
UT-L	36	5250	4712	4300	16	1174	-	-
UT-L	38	6000	4911	4500	16	1260	-	-
UT-L	40	6500	4483	4100	16	1084	-	-
UT-L	42	7700	4712	4300	16	1174	-	-
UT-L	44	8000	5360	4930	16	1336	-	-

Table 20 Main dimensions

UNIMAT Heating boiler		Output limit	Combustion chamber dimension(s)						
					Bare tube		Corrugated pipe	
UT-L Type		kW	L 1 [mm]	L 2 [mm]	Max. permitted operating pressure [bar]	D 1 [mm]	Max. permitted operating pressure [bar]	D 2 / D 1 [mm]
UT-L	46	9300	4911	4500	16	1260	-	-
UT-L	48	10000	5658	5200	16	1446	-	-
UT-L	50	11200	5360	4930	16	1336	-	-
UT-L	52	12000	6396	5900	13	1550	16	1470/1570
UT-L	54	12600	5658	5200	16	1446	-	-
UT-L	56	14000	6825	6300	13	1600	16	1530/1630
UT-L	58	14700	6396	5900	13	1550	16	1470/1570
UT-L	60	16400	6825	6300	13	1600	16	1530/1630
UT-L	62	17500	7263	6700	13	1750	16	1620/1770
UT-L	64	19200	7263	6700	13	1750	16	1620/1770

Table 20 Main dimensions

UNIMAT Heating boiler Type		Burner attachment limit						
		Maximum permissible torque for the burner fixing equipment [Nm]	L 3 [mm]	L 4 [mm]	L 5 [mm]	B 1 [mm]	H 1 [mm]	H 2 [°]
UT-L	1	2200	535	190	225	1050	725	460
UT-L	2	2200	625	260	190	1200	800	560
UT-L	4	2200	625	260	190	1200	800	560
UT-L	6	2200	685	290	190	1300	850	620
UT-L	8	2200	745	325	190	1400	900	685
UT-L	10	2200	685	290	190	1300	850	620
UT-L	12	2200	775	350	190	1450	925	720
UT-L	14	2400	745	325	190	1400	900	685
UT-L	16	2400	835	385	190	1550	975	785
UT-L	18	3600	775	350	190	1450	925	720
UT-L	20	3600	860	412	190	1600	1000	815
UT-L	22	3600	900	430	257	1700	1050	795
UT-L	24	3800	835	385	190	1550	975	785
UT-L	26	3800	960	470	257	1800	1100	855
UT-L	28	5500	860	412	190	1600	1000	815
UT-L	30	6000	900	430	257	1700	1050	795
UT-L	32	6000	1075	510	257	2000	1200	975
UT-L	34	8200	960	470	257	1800	1100	855
UT-L	36	8200	1165	560	257	2150	1275	1065
UT-L	38	8200	1250	600	257	2300	1350	1150
UT-L	40	16500	1075	510	257	2000	1200	975
UT-L	42	16500	1165	560	257	2150	1275	1065
UT-L	44	16500	1340	640	259	2450	1425	1250
UT-L	46	16500	1250	600	257	2300	1350	1150
UT-L	48	17500	1425	695	259	2600	1500	1330
UT-L	50	17500	1340	640	259	2450	1425	1250
UT-L	52	17500	1540	735	259	2800	1600	1450
UT-L	54	17500	1425	695	259	2600	1500	1330
UT-L	56	17500	1715	775	294	3100	1750	1630
UT-L	58	17500	1540	735	259	2800	1600	1450
UT-L	60	17500	1715	775	294	3100	1750	1630
UT-L	62	17500	1830	825	294	3300	1850	1745
UT-L	64	17500	1830	825	294	3300	1850	1745

Table 21 Main dimensions

5 Regulations and operating conditions

5.1 Extracts from the regulations

The UNIMAT UT-L boilers are built in accordance with EN 303 and with reference to the relevant TRD 300. They are approved for an operating pressure of 6 bar, 10 bar, 13 bar or 16 bar and for heating systems compliant with the requirements of DIN-EN 12828.

Observe the following regarding installation and operation of the system

- Technical building regulations
- Legal regulations **and**
- Local regulations.

Installation, gas connection, flue gas connection, commissioning, power supply, maintenance and repair work must only be carried out by authorised contractors.

Notification and permit obligations

Subject to the Building Regulations of each country, boiler systems may require notification to or approval from appropriate authorities. Observe country-specific requirements.

Service

We recommend having the system serviced regularly and cleaned as required. As part of this, it should be checked that the entire system is working properly.

We recommend that system users enter into a maintenance and inspection contract. Regular annual maintenance is the prerequisite for safe and economical operation. The product warranty shall become void in the event of defects that arise as a result of a lack of or insufficient maintenance.

COMMISSIONING

We recommend having the commissioning carried out by a system specialist (boiler, burner, control and hydraulics), e.g. the Bosch industrial service.

Emissions regulations

Observe country-specific emissions regulations.

5.2 German Immissions Act (BImSchG)

5.2.1 Table extracted from the 1st BImSchV "Small and medium-sized combustion systems"

Combustion equipment is to be operated in such a way that the limits specified in the 1st BImSchV and the TA Luft are not exceeded.

Fuels	Natural gas, LPG, hydrogen gas, gases from the public mains supply	Sewer gas, biogas, coke oven gas, marsh gas, furnace gas, refinery gas, synthetic gas	Fuel oil EL, vegetable oil, vegetable methyl ester, methanol, ethanol	Heavy oil
Rated heat input of the system Q_{FA}	< 20 MW	< 10 MW	< 20 MW	not permitted
Flue via chimney	Derived conditions acc. to 1st BImSchV para. 18 for $Q_{FA} \geq 1$ MW			
Soot value	–	–	RZ ≤ 1	
Nitrogen oxides NO_X under test conditions for boiler[1)2)] $\dot{Q}_K < 120$ kW $120 \text{ kW} \leq Q_K < 400$ kW $400 \text{ kW} \leq Q_K < 10000$ kW	 60 mg/m^3_n 80 mg/m^3_n 120 mg/m^3_n	 60 mg/m^3_n 80 mg/m^3_n 120 mg/m^3_n	 110 mg/m^3_n 120 mg/m^3_n 185 mg/m^3_n	
With dual combustion, if oil operation is ≤ 300 h/a, the following NO_X limit applies	–	–	250 mg/m^3_n	
Nitrogen oxides NO_X in steam boilers	Keep to a minimum, no fixed stipulations, "latest available technology"			
Efficiency at rated boiler output[2)] $\dot{Q}_K > 400$ kW	≥ 94 %			
Flue losses $4 \text{ kW} \leq Q_{FA} \leq 25$ kW $25 \text{ kW} < Q_{FA}$ 50 kW $Q_{FA} > 50$ kW	 11 % 10% 9 %			
Repeat tests as per para. 15 regarding soot value, CO emissions, flue loss	Newer systems[3)]: every 3 years; older systems[4)]: every 2 years			
Emissions monitored by	Flue gas inspector			

Emissions specifications for individual combustion output ≥ 10 MW < 20 MW

Fuels	Natural gas, LPG, gases from the public mains supply	Hydrogen gas	Fuel oil EL, vegetable oil, vegetable methyl ester, methanol, ethanol
Rated heat input of the individual combustion Q_{FE}	≥ 10 < 20 MW		
Flue via chimney	Derived conditions acc. to TA Luft		
Carbon monoxide CO[5)]	80 mg/m^3_n		
Nitrogen oxides NO_X at boiler operating temperature[4)6)] < 110 °C (< 0.5 bar) ≥ 110 °C ≤ 210 °C (≥ 0.5 bar ≤ 18 bar) > 210 °C (> 18 bar)	 100 mg/m^3_n 110 mg/m^3_n 150 mg/m^3_n	 200 mg/m^3_n 200 mg/m^3_n 200 mg/m^3_n	 180 mg/m^3_n 200 mg/m^3_n 250 mg/m^3_n
With dual combustion, if oil operation is ≤ 300 h/a, the following NO_X limit applies for all boiler temperatures	–	–	250 mg/m^3_n
Repeat test acc. to para. 18 (1)–(3)	–	–	Flue gas opacity
First test acc. to para. 18(4)[7)]	No sooner than 3 months and no later than 6 months after commissioning		

1) Emissions calculation to EN 267
2) Boiler definition: heat transfer medium water; used for heating buildings and rooms
3) Systems that were commissioned or that underwent major modifications (boiler replacement or fuel conversion) 12 years ago or less
4) Systems that were commissioned or that underwent major modifications (boiler replacement or fuel conversion) more than 12 years ago

5) CO and NO_X levels relative to 3 % O_2 content. Half hour average acc. to para. §11(1). Three individual tests (low/medium and full) are to be carried out in acc. with para. 18(4). With fuel oil EL, the NO_X levels are relative to a nitrogen content of 140 mg/kg in acc. with para.11(1).

6) The relevant saturated steam operating pressure levels are given in brackets

7) The tests must be carried out by a test body recognised by para. 26 of the BImSchG.

5.2.2 Information on flue gas tests pursuant to BImSchV/TA Luft

First tests or system tests following major modifications

In the case of systems that have not yet been tested, have not been tested successfully or have been modified since testing, we recommend conducting sample tests at least two months before the planned inspection date.

This procedure should enable any necessary action to be taken with regard to the combustion equipment in order to adhere to the specified emissions levels. A Bosch customer service engineer can be requested to perform these advance tests; based on the test results, this engineer will also be able to make suggestions on how to adhere to the legal levels.

Repeat tests on systems

In the case of systems on which a test has already been carried out in accordance with BImSchV/TA Luft, depending on the size and controllability of the combustion system, it is generally sufficient to make adjustments either on the day of the official test in the presence of the testing engineer, or for larger and more complex systems with several fuel types, one or two days before this test.

Preparing the system

For the tests to be conducted successfully, it is necessary to ensure sufficient load reduction, so that constant operation under steady conditions is possible. If this cannot be guaranteed, for example due to the weather in the case of heating systems, we recommend postponing the test until it can be carried out without interruption.

Fuels

The fuels to be burned must comply with the notice of approval and be available in the quality determined for the system. Since the level of nitrogen in light fuel oil has a significant effect on the formation of NO_x, the nitrogen content of light fuel oil must be known in order to assess the NO_x test levels. The fuel oil supplier may be able to provide this information for the relevant deliveries. To calculate this value precisely, take an oil sample (1 litre) from the tank in question at the time of the emissions test. A test lab can determine the nitrogen content of the fuel.

Cleaning the boiler

We recommend cleaning the boiler combustion chamber thoroughly at least one or two days before the test.

Conducting the test

A Bosch customer service engineer should be requested to conduct the test. If levels exceeding the limits are registered during the test, it may be possible to modify the combustion settings so that the test can be conducted again with success.

Support personnel should be available to assist.

A table and chair should be prepared in the boiler room for the testing engineer to complete the test reports.

5.3 Operating requirements

The operating conditions given in table 22 are part of the **warranty conditions** for the UNIMAT UT-L boilers.

These operating conditions are ensured through an appropriate hydraulic circuit and boiler circuit control (hydraulic connection → page 48).

Operating conditions for special applications are available on request.

The requirements of boiler water quality are also part of the warranty conditions (→ page 39).

5.3.1 Operating conditions

Boiler type	Operating conditions (warranty conditions)			
	Minimum flow rate [m^3/h]	Minimum return temperature [°C]	Minimum boiler water temperature [°C]	Maximum design temperature spread [K]
UNIMAT UT-L boiler	–1)2)	50	70	15–50

Table 22 Operating conditions for UNIMAT UT-L boilers

1) Sizing the boiler circuit pump → page 53; in burner mode, you must ensure that flow is enabled in the boiler.

2) The heat exchanger pump must also be put into operation for burner mode.

5.3.2 Fuel

The UNIMAT UT-L boilers can be operated with natural gas E, EL and LPG. The gas quality must comply with the requirements of the DVGW Code of Practice G 260. To be able to adjust the gas throughput install a gas meter that can be checked even in the lower load range of the burner.

Combustion with fuel oil EL to DIN 51603 is also possible. Only low-sulphur fuel oil is permitted for boilers with condensing heat exchangers.

Route away the condensate that occurs in the flue separately and neutralise it.

5.3.3 Corrosion protection in heating systems

Corrosion protection on the boiler water side

Corrosion in the heating system can be the result of poor water quality or air-borne oxygen in the system. Negative pressure allows oxygen to enter the heating system. Possible causes of oxygen ingress include leaks in the heating system, regions of negative pressure, an inadequately sized expansion vessel or plastic pipes with no oxygen barrier.

If the ingress of oxygen into the heating system cannot be prevented, we recommend separating the heating circuit by means of a heat exchanger.

Protecting the heating surfaces against corrosion

The combustion chamber and secondary heating surfaces can be damaged by heavy dust loads or halogenated hydrocarbons in the combustion air. Halogenated hydrocarbons have a highly corrosive effect. They are contained, for example, in spray cans, thinners, cleaning & degreasing agents and in solvents. Design the combustion air supply so that, for example, no extract air is drawn in from chemical cleaners or paint shops.

Prevention of corrosion damage

Corrosion damage has occurred if the function of the heating system is impaired by corrosion. This may become apparent through blockages, boiling noises, poor circulation, rust perforations, reduced output or the formation of cracks. This usually only occurs if oxygen continually enters the heating water. In order to prevent this, design the heating system as a sealed system from a corrosion point of view. If the system is sealed from a corrosion point of view, the selection of materials used becomes less significant.

If the system cannot be sealed from a corrosion point of view, special corrosion protection measures must be provided by treating the heating water. Alongside the option of filling the heating system with desalinated water, the heating water can also have chemicals added to it. These chemicals either bind the free oxygen or form a corrosion-resistant coating on the surface of the material.

The pH value of the heating water should be between 8.2 and 9.5 (→ Tab. 23, page 40). If the heating system does not contain any aluminium components, we recommend adding chemicals (e.g. trisodium phosphate) to the heating water to alkalinise it.

Regular maintenance is required to give the heating system a long, damage-free service life. As well as checking the pressure, check the pH value of the heating water and adjust it if required. If corrosion protection agents are used, check the heating water in accordance with the manufacturer's instructions.

The use of antifreeze must be authorised by the manufacturer.

Always observe the following:

- The max. rated output of the boiler is reduced when antifreeze is used (individual design).
- Use tested types of antifreeze that are approved for use in hot water systems.
- Antifreeze must contain corrosion inhibitors so that the addition of antifreeze does not increase the system's susceptibility to corrosion.
- Ratio of antifreeze to water: maximum 50 %
- Use desalinated water with a conductivity of < 10 µS/cm as fill and top-up water.
- Do not use additional dosing agents. Prevent corrosion from occurring as a result of reactions between these additional agents and the antifreeze.
- In the first year of operation, perform a quarterly inspection on the water side of the boiler. In the event of a positive result, the inspection periods can be increased to the legal limits.

5.3.4 Corrosion protection if system out of use for long periods

Airborne oxygen that enters the system causes corrosion in a cooled and depressurised boiler. Suitable preventive measures should therefore be taken. Suitable protective measures should be taken whenever a boiler has been idle for longer than three days. Bosch recommends the following options:

1. Preservation on the water side through pressure maintenance (any time period)

If one or more boilers in a boiler system are shut down and it is ensured that one boiler or at least the pressure maintaining system remains operational, no further preservation measures on the water side are required. Ensure that the boiler remains connected to the mains via the open flow shut-off device so that the gas supply pressure builds up. This prevents oxygen entering the boiler as a result of positive pressure.

As an alternative, the return shut-off device can also be opened. However, do not have both shut-off devices open at the same time as this can result in heat losses due to unwanted circulation.

2. Wet preservation on the water side for shutdowns of up to 3 months

The boiler is completely filled with water, an excess of oxygen binders is added and the boiler water capacity is circulated at defined intervals. For more information on wet preservation, please see the operating instructions “G012 Wet and dry preservation”.

Carrying out preservation

Regular circulation is necessary to ensure the metered additive is evenly mixed with the boiler water. For this, install a pump that is connected to the outlet connection downstream of the outlet shut-off valve via a tee on the inlet side, and to the return between the boiler and return shut-off device on the pressure side. The additive can be topped up via the dosing station on the pressure side of the pump. After this, tightly seal all boiler valves to prevent the ingress of airborne oxygen during the idle time. To ensure the preservative solution is thoroughly mixed in, the water must be circulated 5 times every 3 days using the pump.

For more information, please see the operating instructions “G012 Wet and dry preservation”.

3. Dry preservation on the water side for shutdowns of longer than 3 months

The system is fully drained, filled with a special drying agent, and then resealed. Compared to wet preservation, it takes around 1-2 days to prepare the system for operation. We recommend involving a Bosch service engineer.
For precise information on carrying out dry preservation, please see the operating instructions “G012 Wet and dry preservation”.

5.3.5 Guidelines for water quality

Chemical additives in the heating water

If plastic pipes that are permeable to oxygen are installed in an underfloor heating system, the corrosion process can be prevented by adding chemical additives to the heating water. In this case, request certification from the manufacturer of the chemical additives as to the effectiveness and harmlessness to other system components and materials in the heating system.

i Chemical additives that are not certified as harmless by the manufacturer must not be used.

Water treatment

Boiler operators must take account of the fact that there is no such thing as pure water as a heat transfer medium. For this reason, particular attention should be paid to the water quality. Constant monitoring of the water quality is an important factor in achieving economical and trouble-free operation of the heating system. Water treatment also makes a contribution to energy savings and to preserving the value of the entire system. It is an essential factor for increasing the economic viability, functional reliability, service life and, last but not least, the maintenance of the constant operational availability of the heating system.

Prevention of damage through limescale formation

Scaling means that stubborn calcium carbonate deposits occur in the boiler. These deposits can cause local overheating and a limited formation of cracks in the boiler. The impaired heat transfer caused by scaling can lead to a significant drop in boiler output and to an increase in flue gas loss. Boiling noises may also occur under certain circumstances.

Minimum requirements of water analyses for designing a water treatment system → page 41.

For the UNIMAT UT-L boilers, adhere to the requirements of the latest VdTÜV Directive (VdTÜV 1466).

Low pressure hot water boilers with operating temperatures up to 110 °C

Subject to the total boiler output, the requirements of water quality from Tab. 23 are to be followed. If these requirements are not maintained, water treatment is necessary.

In systems with a total boiler output of above 100 kW, the volume of fill and top-up water should be measured. Furthermore, records should be kept when top-up water is added. The concentration of calcium hydrogen carbonate in the top-up water should also be noted.

UNIMAT UT-L boiler		**Boilers in Group II**		
Water-chemical operating mode[1]		Low salt content	Low salt content	Saline
Electrical conductivity of the circulating water	µS/cm	10–30	> 30–100	> 100–1500
Fill and top-up water				
General requirements		Colourless, clear and free of undissolved substances		
pH value at 25 °C		8–10	8–10.5	8.5–10.5
Alkaline earths (total hardness)	mmol/l dH	< 0.02 < 0.1	< 0.02 < 0.1	< 0.02 < 0.1
Oxygen (O_2)	mg/l	< 0.1	< 0.1	< 0.1
Circulating water				
General requirements		Colourless, clear and free of undissolved substances		
pH value[2] at 25 °C		9–10	9–10.5	9.5–10.5
Acidic capacity $K_{S\ 8.2}$[2] (p value)	mmol/l	–	0.1–0.5	0.5–5
Alkaline earths (total hardness)	mmol/l dH	< 0.02 < 0.1	< 0.02 < 0.1	< 0.02 < 0.1
Oxygen[3] (O_2)	mg/l	< 0.1	< 0.05	< 0.02
Phosphate[2)3] (PO_4)	mg/l	3–6	5–10	5–15
Electrical conductivity at 25 °C	µS/cm	10–30	> 30–100	> 100–1500
Diamide[3] (N_2H_4)	mg/l	0.2–1	0.2–2	0.3–3
Sodium sulphite[3] (Na_2SO_3)	mg/l	–	–	5–10

Table 23 Water quality requirements for UNIMAT UT-L boilers

1) Systems with heavily branched pipework, i.e. in industrial and district heating systems, those with longer stagnation periods (even for parts of the heating network), those operating at strongly fluctuating pressures and temperatures as well as systems with components made from diverse materials, should ideally be operated with water of a low salt content.

2) For operation with a low salt content, adjust the pH value or the p value with trisodium phosphate. For saline operation, the alkalinity usually adjusts itself by the composition of the fill water. If this is not the case, adjust the pH value with trisodium phosphate and, if required, by adding sodium hydroxide. Never use ammonia. If copper components are installed in the hot water network, the pH value of the circulating water must not be above 9.5.

3) In constant heating operation, the limits are usually maintained automatically. If this is the case, oxygen binders are not obligatory. If the limits are exceeded, a range of physical and chemical processes are available. Typical chemical agents are diamide and sodium sulphite. Amines that form a film are not oxygen binders. Establish the application and type of oxygen binder for each specific system.

5.3.6 Minimum requirements of water analyses for designing a water treatment system

When enquiring about water treatment, as a minimum the information in sections 1 and 2.1 should be provided. For a detailed design of a reverse osmosis system, a full analysis corresponding to section 2.2 is required no later than when the order is placed.

If a detailed water analysis with the specified parameters is available, the form does not need to be completely filled out again, as long as the information in section 1 is provided.

1. System details			
Project number/name			
Specification for performance of the water treatment (will be checked)			
Boiler type			
Steam output			
Average operating pressure			
Condensation rate			
Special features (e.g. sterile steam, existing treatment system, other on-site consumers, etc.)			
2. Details of untreated water analysis			
2.1 Minimum details for designing a water softener unit			
Total hardness	mmol/l or °dH	Electrical conductivity Or salt content (TDS)	µS/cm mg/l
Or calcium Ca^{2+} And magnesium Mg^{2+}	mg/l mg/l	Carbonate hardness Or $K_{S4.3}$ figure Or alkalinity Or HCO_3^-	°dH mmol/l mmol/l mg/l
Iron Fe total	mg/l		
Manganese Mn^{2+}	mg/l		
Silicate SiO_2 or Si	mg/l		
Chloride Cl^-	mg/l		
2.2 Further details for designing/ordering a reverse osmosis system			
Cations		**Anions**	
Ca^{2+}	mg/l	SO_4^{2-}	mg/l
Mg^{2+}	mg/l	Cl^-	mg/l
K^+	mg/l	NO_3^-	mg/l
Na^+	mg/l	HCO_3^-	mg/l
Fe^{2+}	mg/l	F^-	mg/l
Ba^{2+}	mg/l	CO_3^-	mg/l
Sr^{2+}	mg/l	SiO_2^-	mg/l
NH_4^+	mg/l	PO_4^-	mg/l
		CO_2^-	mg/l

Table 24

6 Sound pressure level from noise in the boiler system

6.1 Sound emissions from the boiler system

The noise in the installation room caused by a boiler system and the noise transmitted to the surrounding area are subject to regional regulations which must be taken into account when designing a boiler system.

The overall sound emissions from a boiler system are influenced by a range of sources. The various noises include:

- Machine noise (e.g. burner, fan, pumps, drive motors for valves)
- Flow and combustion noises caused by hot flue gas created during combustion, which is routed by the boiler through the flue system to the chimney. From an acoustic point of view, the heat source itself is not a source of sound, but acts as a resonating body for noise that comes from the combustion reactions within the combustion chamber.

There can be a range of other sound sources (structure-borne noise due to rotational movement of machines, flow noises in valves, etc.) which must also be taken into account.

6.2 Noise in the installation room

Individual sound pressure levels can be specified for machine noises that are the main cause of sound impact in the installation room. The individual sound pressure level of a machine can only be specified for "free field" conditions at a distance of 1 m (without any influence from other sound emitters). When calculating the overall sound pressure level in the installation room, take the reciprocal influence of the various sound sources and local conditions (e.g. sound absorption characteristics of the installation room wall) into account.

Machine noise can be reduced by encasing the machines, e.g. with a burner silencer hood or a silencer housing for the fan.

6.3 Noise at the chimney outlet

A significant proportion of the noise development in the combustion chamber is transmitted along the flue system to the chimney. This sound is emitted via the surface of the flue system as airborne noise and escapes at the chimney. The noise from a boiler system predominantly contains low frequency sound.

These sound emissions can be effectively reduced with a flue gas silencer. To design a flue gas silencer (to maintain the prescribed sound immissions levels), the frequency spectrum of the sound at the chimney outlet from the boiler system must be known.

The graph in Fig. 25 shows the average sound pressure level of a boiler system, measured at the chimney outlet at a distance of 1 m and an angle of 45°, with no flue gas silencer in the flue system. As the combustion system (e.g. due to the burner construction or the flow profile that occurs in the combustion chamber) and flue system (e.g. due to the numbers of bends, length and diameter of the flue) have a considerable influence on the values that occur, only averages can be given here for the sound pressure level. The sound levels calculated in the flue pipe, directly downstream of the boiler, are up to 15 % higher than the sound levels at the chimney head.

Giving the levels directly in the flue pipe and directly downstream of the boiler is not helpful as the influences mentioned above as well as sound reflection and resonance (e.g. standing waves) mean a correct calculation is not possible, or is very difficult to achieve. Furthermore, a flue gas silencer is designed for the boiler system using the sound levels that occur at the chimney head.

Due to the complexity of the subject of sound, we recommend involving an acoustician or sound expert to design the flue gas silencer.

If possible, the sound levels that actually occur in the boiler system should be calculated first. These values can be used to design a flue gas silencer which can be retrofitted to the boiler system. The pressure loss of the silencer (approx. 1 mbar to 3 mbar) should initially be taken into account when sizing the burner.

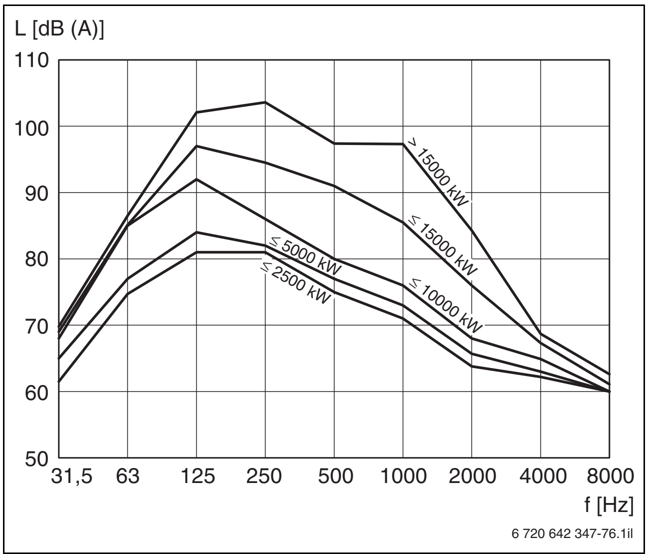

Fig. 25 Frequency analysis of noise at the chimney outlet, subject to the boiler output

f Frequency
L Sound pressure level

The following comments apply to the values specified:

- Sound pressure level measured in accordance with DIN-EN 60804, DIN-EN 60651 and DIN 45635
- Frequency assessment curve A to DIN-EN 60561
- Flue system routed with favourable flow characteristics
- Suitable anti-vibration mounts installed in the boiler system

The values specified are only a guide and approximate values. They depend on the fuel, burner manufacturer, burner construction and design of the entire flue system.

7 Boiler control and control system

A boiler control is required to operate the UNIMAT UT-L boilers.

Depending on the requirements and structure of the heating system, the following boiler controls are available:

- CFB 810 control unit
- CFB 9xx control unit
- BCO boiler control incl. control panel and safety chain

The Bosch CFB control units are of modular design. This enables the selection of well-matching and economical units for all applications and stages of development in the proposed heating system. An additional control unit is required to provide the electrical connection to the burner for the burner power contactors controlled by the control units.

7.1 CFB 810 control unit with CME 930 auxiliary module

Brief description of possible applications

The CFB 810 analogue control unit is suitable for controlling a floor standing oil or gas boiler with constant boiler temperature, without operating conditions, or in conjunction with an overriding control system (e.g. DDC/GLT). The CFB 810 analogue control unit can control single stage, 2-stage or modulating burners.

The CME 930 auxiliary module is only intended for use in the CFB 810 analogue control unit and is suitable for safeguarding boiler operating conditions in conventionally operated boilers. Only one can be fitted in each control unit.

Boiler safety functions

By actuating a boiler circuit pump and an actuator (3-way mixer), the CME 930 auxiliary module safeguards the required boiler operating conditions for boilers with a minimum return temperature.

In conjunction with the appropriate plumbing configuration, compliance with the required boiler operating conditions is guaranteed. When the boiler circuit is in automatic mode, appropriate adjustments should be made on the CME 930 auxiliary module PCB (service level). The CME 930 can also be used to hydraulically shut off lag boilers in multi boiler systems, by actuating the actuator.

Burner control

The CME 930 auxiliary module controls single stage, 2-stage, modulating or 2 × single stage burners.

There are two ways to control the burner which can be adjusted via manual mode level:

- Direct, potential-free enabling of stages in an overriding control system (AUT), e.g. DDC/GLT **or**
- Enabling of all burner stages by the control unit via the hand or full load symbol, in which case burner modulation may also be manually adjustable

According to the Energy Savings Order (EnEV, para. 12), the CFB 810 control unit must be operated in conjunction with an automatic device for weather-compensated or room temperature-dependent mode with time programs.

Return temperature control

With return temperature control mode, the boiler is operated with a fixed figure for the return temperature. This return temperature can be set on the PCB (service level) of the module with potentiometer P1 to 50–60 °C.

Return temperature control is constantly active:

- Via a separate actuator (3-way mixer) and with bypass pump (without hydraulic separation)
- Via a separate actuator (3-way mixer) with a boiler circuit pump (with hydraulic separation via low loss header)

When the burner starts, the boiler circuit pump PK is switched on. After the burner has shut down, the boiler circuit pump PK is stopped after a delay. This pump run-on time can be set with potentiometer P2 to between 30 and 60 minutes for the lead boiler or to 5 minutes (potentiometer limit) for the lag boiler in a multi boiler system. The SR actuator for the lag boiler closes.

7.2 CFB 930 and CFB 910 control units

Brief description of possible applications

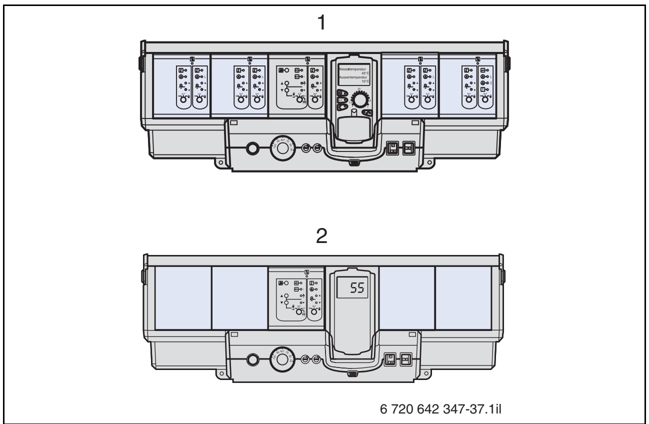

Fig. 26 CFB 930 and CFB 910 control units

[1] CFB 930 (optional full equipment level); blue: additional equipment
[2] CFB 910 (standard equipment level); blue: slots for additional equipment

The CFB 930 and CFB 910 digital control units can control a floor standing Bosch oil or gas boiler with a single stage, 2-stage or modulating burner. They also support operation of dual fuel burners. These control units may be extended with up to four function modules to provide an optimum match to an individual heating system. Multi boiler systems can be controlled with the CMC 930 strategy module in the CFB 930 control unit.

Boiler safety functions

Boilers and gas condensing boilers with optional boiler protection functions can be adjusted at the service level of the Programmer programming unit to safeguard the operating conditions.
The correct settings in conjunction with the appropriate plumbing configuration guarantee that the required boiler operating conditions are maintained.

Burner control

The central module in the control unit control single stage, 2-stage or modulating burners subject to output. With dual fuel burners, it can switch between oil and gas.

They are generally controlled via burner cable stage 1 and burner cable stage 2.
Alternatively the burner can be controlled via a 0-10 V signal, in which case the burner cable stage 2 is no longer required.

Multi boiler systems

Fitting the CMC 930 function module to the CFB 930 control unit (maximum of two per system) enables up to eight boilers to be controlled according to a strategy. One CFB 910 control unit is required per lag boiler.

Special functions for single and multi stage boiler systems

- Separate boiler curve can be adjusted with third party control of the consumers
- Control of a boiler circuit pump for systems with depressurised headers or low-loss headers
- Output-dependent control of a boiler circuit pump via a 0-10 V signal in conjunction with modulating burners
- Application of a potential-free signal for an external fault display or for switching between gas and oil operation in the case of dual fuel burners

Special functions for multi stage boiler systems in conjunction with the CMC 930 strategy module

- Parallel or serial operation can be set
- Automatic sequence reversal, can be daily, by hours run, by outside temperature or via a floating contact
- Freely configurable load limit subject to the outside temperature or via a floating input
- Definable boiler sequences
- Lag boilers can be hydraulically shut off, taking account of automatic sequence reversal
- Adjustable boiler circuit pump run-on to utilise residual heat in the lag boilers
- 0-10 V input for external set value hook-up as set temperature value or output specification (heat demand) with third party heating circuit control units
- 0-10 V or 0-20 mA output for issuing an external set temperature value (heat demand) to an overriding control system (DDC/GLT)
- Indication of status of individual boilers
- Floating output for central fault message
- Floating input for hooking up an external heat meter
- Outside temperature sensor FA (only CFB 930)
- Boiler water temperature sensor FK
- Additional temperature sensor FZ for low loss header or as return temperature sensor
- Burner cable, stage 2

Boiler safety functions

Heating boiler

- If the minimum boiler water temperature is not reached, the boiler circuit pump, heating circuit pumps and cylinder primary pump are shut down and restarted with a switching differential when the boiler temperature rises. This boiler protection function is designated “pump logic”. The switching threshold depends on the burner type and is preset at the factory.
- The following boiler protection functions are available to control the operating flow temperature:
  – Overriding control of the heating circuit actuators for single boiler systems:
    The heating circuit actuators are closed if the operating flow temperature is not reached, independent of the heat demand of the heating circuits. For this setting, all heating circuits must

be fitted with an actuator and controlled by the CFB control unit.
- Control of a separate actuator:
  If the operating flow temperature of the boiler is not reached, the actuator (3-way mixer) is closed. This setting is advisable when supplying heat to externally controlled heating circuits or for heating circuits without actuator.
- Relevant function of a third party control unit:
  Condition: during burner mode, an operating flow temperature of 50 °C must be reached within 10 minutes and maintained as the minimum temperature, e.g. by limiting the flow rate.

Boiler with minimum return temperature

- For this boiler type, a factory-set minimum return temperature for the boiler is ensured. If this minimum return temperature (captured at the return temperature sensor FR or in multi boiler systems at the strategy return temperature sensor FRS), the flow rate is automatically reduced via actuators. To support this control function, the boiler circuit pump, heating circuit pumps and cylinder primary pumps are shut down if high load conditions suddenly occur. The following options are possible for controlling the minimum return temperature:
  - Overriding control of the heating circuit actuators: The heating circuit actuators are closed if the minimum return temperature is not reached, independent of the heat demand of the heating circuits. For this setting, all heating circuits must be fitted with an actuator and controlled by the CFB control unit.
  - Control of a separate actuator:
    If the minimum return temperature of the boiler (sensor FR) is not reached, the actuator (3-way mixer) is closed. This setting is advisable when supplying heat to externally controlled heating circuits or for heating circuits without actuator.

7.3 Side control unit holder

For UNIMAT UT-L boilers, in conjunction with CFB control units, the side control unit holder is required as an accessory. It enables convenient operation of the CFB 810, CFB 910 and CFB 930 control units at eye level. The side holder can be fitted on the right hand or left hand side of the boiler block. Mount the control unit on an adaptor plate on the side control unit holder (→ Fig. 27).

To install the CFB 810, CFB 910 and CFB 30 control units, the following additional equipment will be required:

- Burner cable
- Sensor well

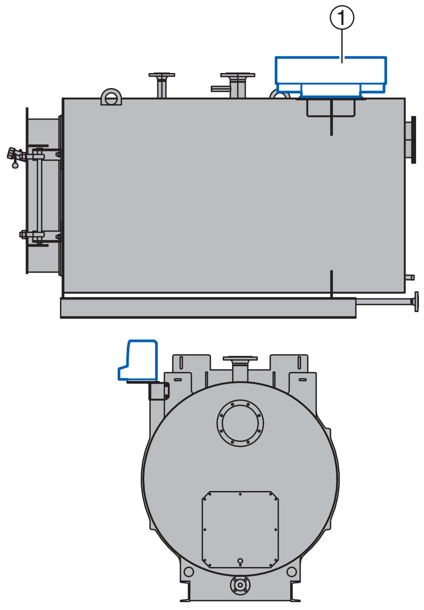

Fig. 27 Side control unit holder for UNIMAT UT-L (example illustration)

[1] Side control unit holder

7.4 UNIMATIC display units and control units

With the standard equipment level of the UNIMATIC display units and control units, the digital display shows the flow, return or flue gas temperature with an accuracy level of ± 2 K. LEDs indicate which temperature is currently being shown. The measured values can be passed on via three outputs for 4 to 20 mA. The keypad enables temperature limits to be set. If a limit is exceeded, the associated diode flashes and a signal is issued to one of the three floating outputs. The control unit with the standard equipment level (display module A) is therefore an ideal supplement to the CFB control units.

The B, C and D measuring and control modules also enable constant control of the boiler. They can be used instead of the CFB 810 control unit.

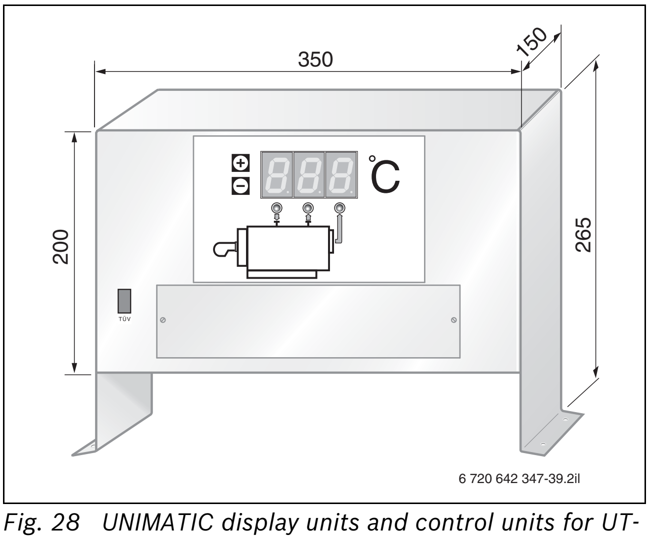

Fig. 28 UNIMATIC display units and control units for UT-L boilers (dimensions in mm)

Component	Type of instrument casing			
	A	B	C	D
Temperature indicator	+	+	+	+
Temperature monitor	–	+	+	+
Burner control (stages)	–	2	1)	3
High limit safety cut-out	–	+	+	+
Temperature control unit	–	+	–	+
Stage II	–	+	–	+
Stage III	–	–	–	+

Table 25 Equipment level of the UNIMATIC display units and control units

1) Excess temperature protection for modulating burner

+ Available
– Not available

7.5 BCO boiler control

The intuitive BCO boiler control based on a PLC offers maximum operating data transparency for optimum boiler operation and also provides comprehensive control solutions for medium and large-scale systems. The touchscreen display allows a wide range of information such as operating conditions, operating data and measured values to be displayed. It is easy to connect to overriding visualisation and control systems and is teleservice-ready.

8 DHW heating

8.1 Systems for DHW heating

The UNIMAT UT-L boilers can be used for central DHW heating. They can be combined with any Bosch DHW cylinder. The WST cylinders are available as horizontal or vertical versions in different sizes with up to 6000 l capacity. Subject to application, they are equipped with an internal indirect coil or external heat exchanger.

The DHW cylinders can be used singly or in combination with other cylinders. With the primary store system, different cylinder sizes and different heat exchanger sets can be combined. This means system solutions are available for any demand and many applications.

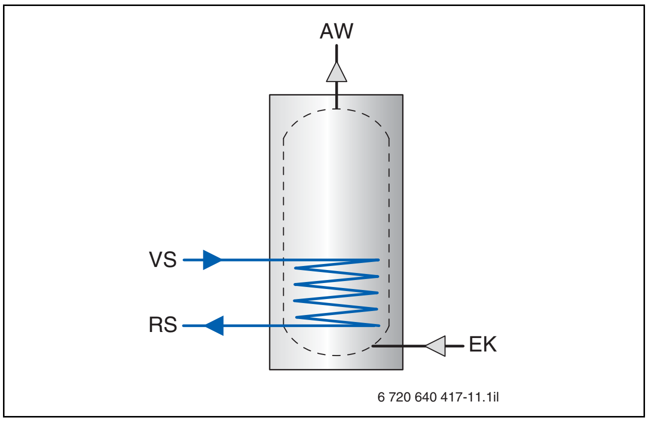

Fig. 29 DHW heating according to the cylinder principle with an internal indirect coil

AW Hot water outlet
EK Cold water inlet
RS Cylinder return
VS Cylinder flow

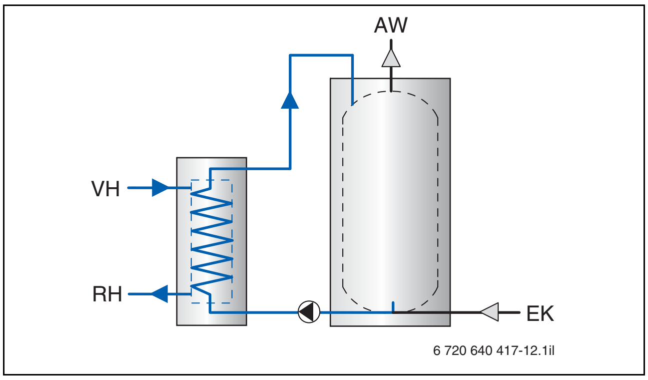

Fig. 30 DHW heating according to the primary store principle with an external heat exchanger

AW Hot water outlet
EK Cold water inlet
RH Fuel return (to boiler)
VH Fuel flow (from boiler)

8.2 DHW temperature control

The DHW temperature is adjusted and controlled by the CFB control system for DHW heating. Both versions are matched to the heating circuit control unit and offer many application options.

9 System examples

9.1 Information regarding all system examples

The system examples in this chapter show options for the hydraulic connection of the UNIMAT UT-L boilers. In addition, the examples show important control and electrical connections for the relevant application.

Detailed information regarding the number, controls, equipment level and design of further heating circuits, as well as the installation of DHW cylinders and other consumers, can be found in the relevant technical guides.

Information regarding further options for system layout and engineering aids are available from Bosch technical consultants. Specialists at your local sales office can create a control panel layout tailored to your needs. In this way, Bosch offers an entire matching concept right through to commissioning the heating system.

The diagrams and associated design information for the system examples with the UNIMAT UT-L boilers offer non-binding information regarding a possible hydraulic connection. No claim is made as to their completeness.

Each system example is a non-binding recommendation for a certain version of the heating system. Practical implementation is subject to currently applicable technical rules.

List of abbreviations

Abbr.	Meaning
BR / BRII	Burner (stage I / stage II)
DDC	Direct Digital Control (overriding control unit)
GLT	Building management control (overriding control unit)
FK	Boiler water temperature sensor
FR	Return temperature sensor
FRS	Strategy return temperature sensor
FV	Flow temperature sensor
FVS	Strategy flow temperature sensor
FZ	Additional sensor for the return temperature
HK	Heating circuit
HB	High temperature heating circuit
KR	Flow-check valve
LT	Low temperature heating circuit
PH	Heating pump
PK	Boiler circuit pump
PWT	Heat exchanger pump
RK	Boiler return

Table 26 Summary of frequently used abbreviations

Abbr.	Meaning
RWT	Condensing heat exchanger return
SH	Motorised blending valve
SR	Actuator, return temperature raising facility
SRWT	Actuator, return temperature raising facility for condensing heat exchanger
THV	Thermostatic valve
VK	Boiler flow
VR	Return distributor
VV	Flow distributor
VWT	Condensing heat exchanger flow
WH	Low loss header (hydraulic balancing line)

Table 26 Summary of frequently used abbreviations

9.1.1 Hydraulic connection

Heating circuit pumps

Size pumps in central heating systems in accordance with current technical rules.

Temperature sensor

A strategy flow temperature sensor (FVS) should be positioned as close as possible to the boiler system. This stipulation does not apply if hydraulic balancing has been provided via a low loss header. Long distances between the boiler system and the strategy flow temperature sensor have a negative effect on the control characteristics, especially in the case of boilers with modulating burners.

Allow for the temperature sensors required for raising the return temperature as immersion sensors.

Dirt traps

Deposits in the heating system can lead to local overheating, noise and corrosion. Any resulting boiler damage falls outside the warranty obligations.

To remove dirt and sludge, flush an existing heating system thoroughly prior to installing and commissioning a boiler. In addition, we recommend the installation of dirt traps or a dirt separator.

Dirt traps retain contaminants and thereby prevent faults in control devices, pipework and boilers. Fit these near the lowest point of the heating system in an easily accessible position. Clean the dirt traps every time the heating system is serviced.

i The function of a dirt trap can be fulfilled by a hydraulic balancing line (low loss header) (→ page 56).

9.1.2 Control system

The operating temperatures should be controlled with the Bosch CFB control unit in weather-compensated mode. It is also possible to control individual heating circuits in room temperature-dependent mode (with a room temperature sensor in a reference room). For this, the actuators and heating circuit pumps are constantly actuated by the CFB control unit. The number and version of heating circuits that can be controlled depend on the boiler control.

The CFB control unit can also actuate the burners, whether they are 2-stage or modulating pressure-jet burners. Different types of burners can also be combined in multi burner systems.

The electrical connection of 3-phase burners and 3-phase pumps must be made on site. These are switched by the CFB control unit (230 V).

For more detailed information, see the technical guides to the control units.

9.1.3 DHW heating

If the DHW temperature is controlled with a CFB control unit and it is designed accordingly, special functions are possible, such as the actuation of a DHW circulation pump or thermal disinfection to prevent the growth of legionella.

i For more detailed information on this subject, see the technical guide “Sizing and selecting DHW cylinders”.

9.1.4 Pipework schemes

Temperature maintaining: version with RTS return flow temperature safeguard using return temperature maintaining

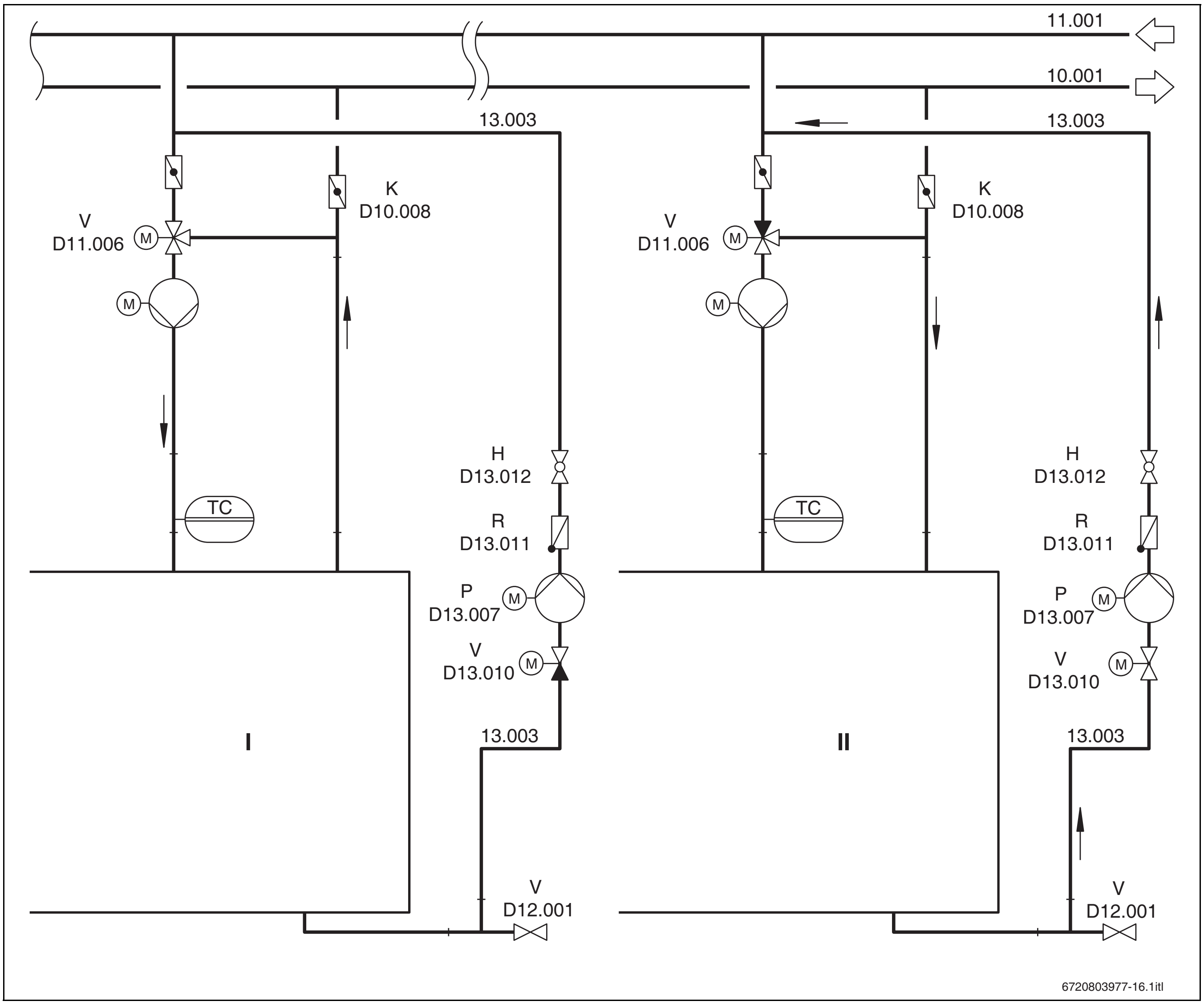

Fig. 31 RTS return flow temperature safeguard - maintaining

D10.008 Shut-off valve
D11.006 3-way control valve
D12.001 Outlet shut-off valve
D13.007 Temperature maintaining pump
D13.010 Shut-off valve (motorised)
D13.011 Non-return valve
D13.012 Shut-off valve
10.001 Hot water flow line
11.001 Hot water return line
13.003 Shut-off valve

In temperature maintaining mode, the shut-off valve (D10.008) in the hot water flow is open and the 3-way control valve (D11.006) in the hot water return is closed.

In boiler mode, the temperature maintaining pump (D13.007) is stopped and the shut-off valve on the inlet side (D13.010) is closed.

A, B, AB: flow direction marking indicated on the 3-way control valve.

Temperature maintaining: version with RTS return flow temperature safeguard using return temperature raising

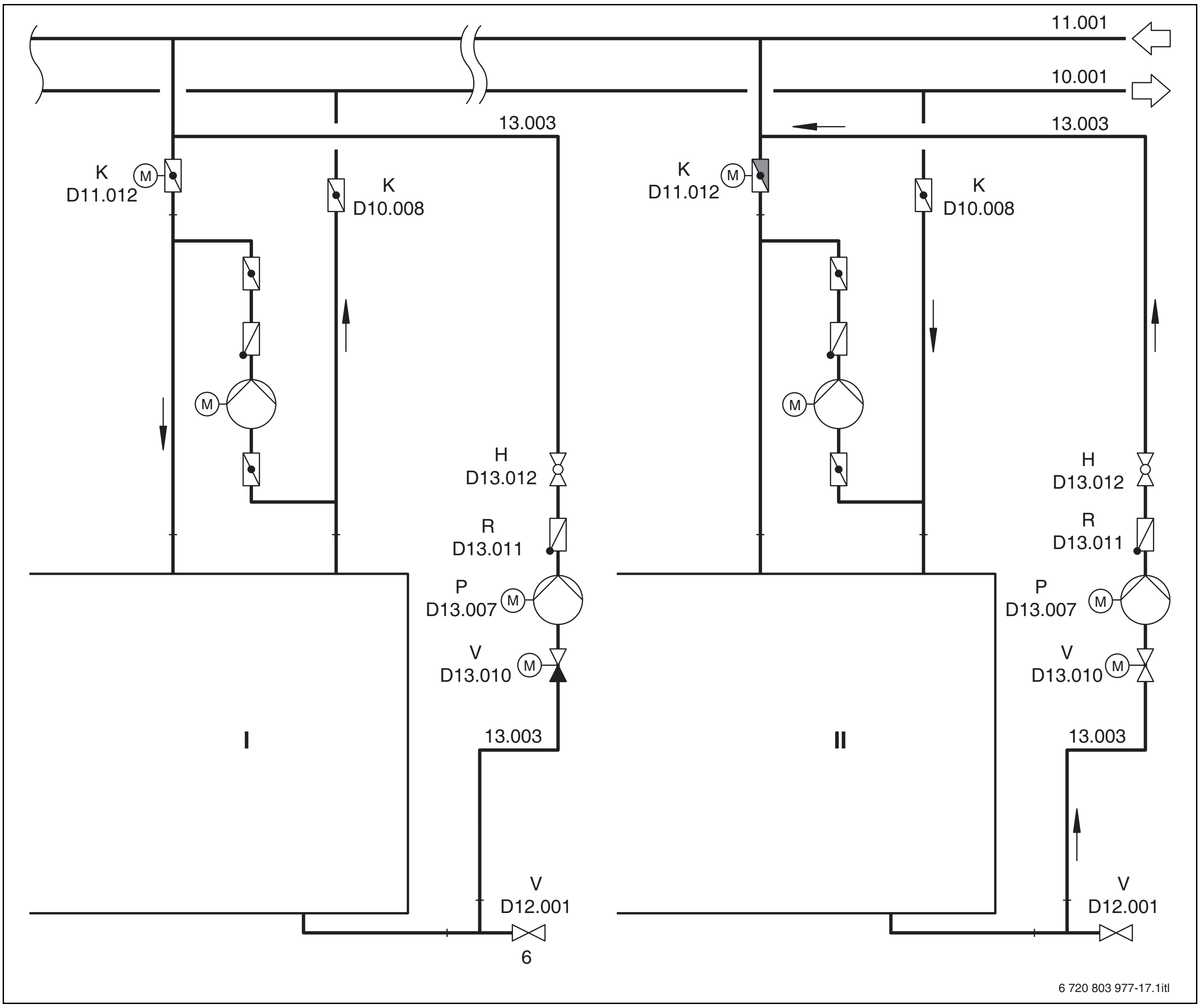

Fig. 32 RTS return flow temperature safeguard - raising

D10.008 Shut-off valve
D11.006 3-way control valve
D12.001 Outlet shut-off valve
D13.007 Temperature maintaining pump
D13.010 Shut-off valve (motorised)
D13.011 Non-return valve
D13.012 Shut-off valve
10.001 Hot water flow line
11.001 Hot water return line
13.003 Shut-off valve

In temperature maintaining mode, the shut-off valve (D10.008) in the hot water flow is open and the 3-way control valve (D11.006) in the hot water return is closed.

In boiler mode, the temperature maintaining pump (D13.007) is stopped and the shut-off valve on the inlet side (D13.010) is closed.

High-pressure temperature maintaining: gas supply pressure ≤ 10 bar; DHW temperature ≤ 110 °C

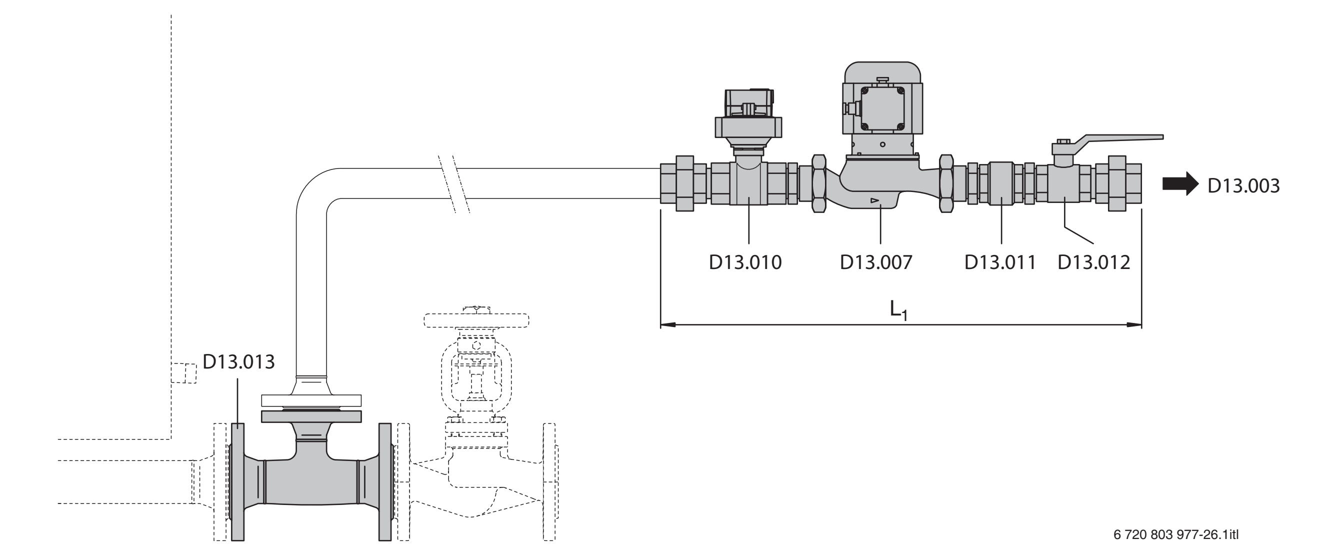

Fig. 33 Temperature maintenance

D13.013 Tee at outlet
D13.010 Shut-off valve (motorised)
D13.007 Temperature maintaining pump
D13.011 Non-return valve
D13.012 Shut-off valve
13.003 Temperature maintaining line

Temperature maintenance	Can be used up to boiler output limit	Motorised output of temperature maintaining pump	Nominal diameter					Measure ments	Shipping weight
			D13.007[1]	D13.010[1]	D13.011[1]	D13.012[1]	D13.013[2]	L_1	
Type	[kW]	[kW]	[DN]	[DN]	[DN]	[DN]	[DN]	[mm]	[kg]
HD 1	1000	0.06	40	20	20	20	25 / 20	579	8
HD 2	5200	0.07	40	25	25	25	32 / 25	631	10
HD 3	12600	0.19	50	32	32	32	50 / 32	676	16
HD 4	19200	0.40	50	40	40	40	50 / 40	721	20

Table 27 Specification for temperature maintenance

1) Pipe thread to DIN 2999

2) Internal diameter for flanges to DIN 2633, DIN 2634 and DIN 2635

i Dimensions given with ± 1 % tolerance; Transport weights given with ± 3 % tolerance

9.2 Safety equipment to DIN-EN 12828

9.2.1 Requirements

No claim is made as to the completeness of the diagrams or the corresponding design information for the system examples. Each system example is a non-binding recommendation for certain versions of the heating system. The practical implementation is subject to currently applicable technical rules. Safety equipment should be installed in accordance with local regulations.

DIN EN 12828 determines the safety equipment level.

The schematic illustration in Fig. 34 can be referred to as an engineering aid.

9.2.2 Layout of safety components to DIN-EN 12828

Boiler > 300 kW; operating temperature ≤ 105 °C; shutdown temperature (high limit safety cut-out) ≤ 110 °C – direct heating

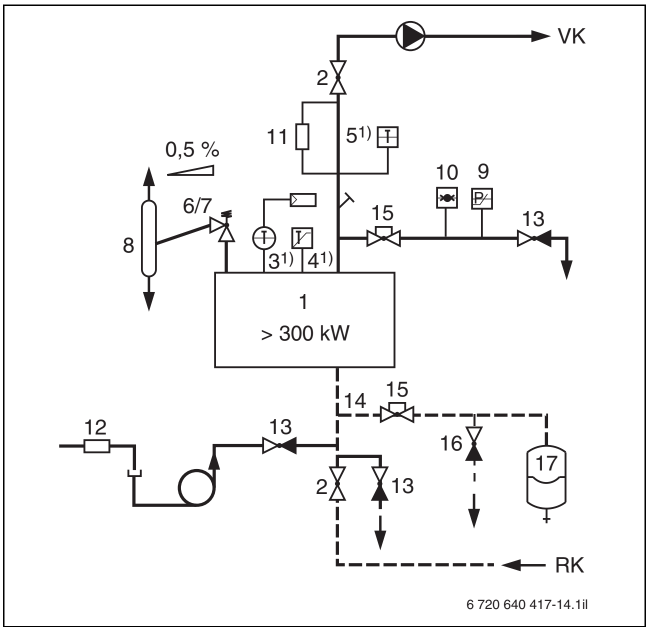

Fig. 34 Safety equipment to DIN-EN 12828 with direct heating

[RK] Return
[VK] Flow
[1] Heat sources
[2] Shut-off valve, flow/return
[3] Temperature control unit
[4] High limit safety cut-out (STB)
[5] Temperature capturing facility
[6] Diaphragm safety valve MSV 2.5 bar/3.0 bar
[7] Lift spring safety valve HFS ≥ 2.5 bar
[8] Flash trap (ET); not required if a high limit safety cut-out with a limit ≤ 110 °C and a maximum pressure limiter are additionally provided for each boiler.
[9] Maximum pressure limiter
[10] Pressure gauge
[11] Low water indicator (WMS) or a minimum pressure limiter
[12] Non-return valve
[13] Boiler drain & fill valve (KFE)
[14] Expansion line
[15] Shut-off valve – protected against unintentional closure, e.g. by sealed cap valve
[16] Drain upstream of the expansion vessel
[17] Expansion vessel (DIN-EN 13831)

[1)] The maximum achievable flow temperature in combination with CFB control units is approx. 18 K below the shutdown temperature (high limit safety cut-out).

9.2.3 Safety equipment for the flue gas heat exchanger

The flue gas heat exchanger requires an additional safety valve with pressure gauge and venting facility if a shut-off device is installed between the boiler and flue gas heat exchanger. If the heat exchanger is connected to the boiler without a shut-off device, there is no need for additional safety equipment.

9.2.4 Maximum operating flow temperatures

In combination with the various boiler controls, the boilers can reach different, maximum possible operating flow temperatures (maximum setting value of the control unit). When these temperatures are reached, the burner is shut down by the control unit. The (re)start temperature is higher by the specific hysteresis. In general, this results in the maximum achievable average operating flow temperatures, according to table.

The boiler temperature must be at least 70 °C. It can be modulating or kept constant.

Control unit	Maximum setting value of the control unit [°C]	Maximum achievable flow temperature at high limit safety cut-out 110 °C [°C]
CFB 810	105 / 95	92
CFB 910 / 930[1)]	105 / 95	92
UNIMAT B.C & D	110 / 100	100

Table 28 Achievable temperatures subject to control unit

1) Applies only for boiler circuit control unit. Heating circuits can only be operated up to a maximum of 90 °C

9.3 Sizing and installation information

9.3.1 Boiler circuit pump in the bypass as shunt pump

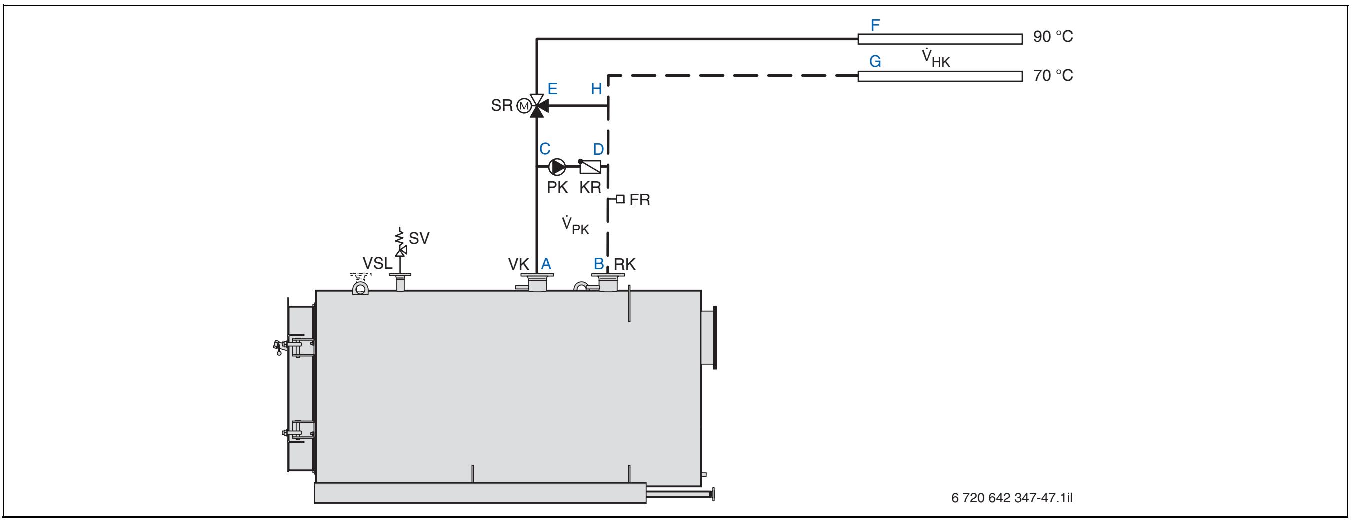

Fig. 35 Sample hydraulic circuit for a 1-boiler system with boiler circuit pump in the bypass

FR Return temperature sensor
KR Flow-check valve
PK Boiler circuit pump
RK Boiler return
SR Actuator, return temperature raising facility
SV Safety valve
VK Boiler flow
VSL Safety valve connector

Boiler circuit pump flow rate $\dot{V}_{PK}$

The boiler circuit pump, also known as a shunt pump, is required to control the return temperature (flow past the sensor). The control characteristics can also be optimised using the boiler circuit pump. This makes it possible to minimise switching during the heat-up phase. This results in lower emissions.

$$V_{PK} = \frac{Q_K}{\Delta\upsilon_K \times c}$$

F. 3 Calculating the flow rate of the boiler circuit pump

c Specific heat capacity
c = 1.16 × 10^{-3} kWh/(l × K) = 1/860 kWh/(l × K)
$\Delta\vartheta_K$ Temperature differential for sizing the boiler circuit pump 30 to 50 K (30 K for optimised heat-up characteristics)
$\dot{Q}_K$ Rated output in kW
$\dot{V}_{PK}$ Flow rate of the boiler circuit pump in l/h

Heating circuit flow rate $\dot{V}_{HK}$

$$V_{HK} = \frac{Q_{HK}}{(\vartheta_V - \vartheta_R) \times c}$$

F. 4 Calculating the flow rate of the heating circuits

c Specific heat capacity
c = 1.16 × 10^{-3} kWh/(l × K) = 1/860 kWh/(l × K)
ϑ_R/ϑ_V Return/flow temperature of the heating circuits in °C
$\dot{Q}_{HK}$ Heat demand of the heating circuits in kW
$\dot{V}_{HK}$ Flow rate of the heating circuits in l/h

Total boiler flow rate $\dot{V}_{Kges}$

The head of the boiler circuit pump is the result of:

- The pressure loss of the boiler at the selected flow rate $\dot{V}_{PK}$
- The pressure loss in the pipework **and**
- All individual pressure loss levels in the boiler circuit (path: A–C–D–B, → Fig. 35).

Due to the pump and system curves, the total flow rate via the boiler cannot be calculated simply by adding up the individual flow rates. However, as an initial estimate, the simple addition is adequate for a rough calculation.

i Base the sizing of the pipework in the boiler circuit on a flow velocity of 1 m/s to 2.3 m/s.

$$V_{Kges} \leq V_{PK} + V_{HK}$$

F. 5 Calculating the total flow rate of the boiler

$\dot{V}_{HK}$ Flow rate of the heating circuits in l/h
$\dot{V}_{Kges}$ Maximum total flow rate through the boiler in l/h (estimate)
$\dot{V}_{PK}$ Flow rate of the boiler circuit pump in l/h

Example

Given

- Rated output $\dot{Q}_K$ = 2500 kW
- Heating system flow temperature ϑ_V = 90 °C
- Heating system return temperature ϑ_R = 70 °C
- Temperature differential (selected) $\Delta\vartheta_K$ = 50 K

Result

- $\dot{V}_{PK}$ = 43000 l/h (path: C–D, → Fig. 35)
- $\dot{V}_{HK}$ = 107500 l/h
(paths: C–F, D–G and E–H, → Fig. 35)
- $\dot{V}_{Kges}$ ≈ 150500 l/h
(paths: A–C and B–D, → Fig. 35)

9.3.2 Boiler circuit pump as primary circuit pump

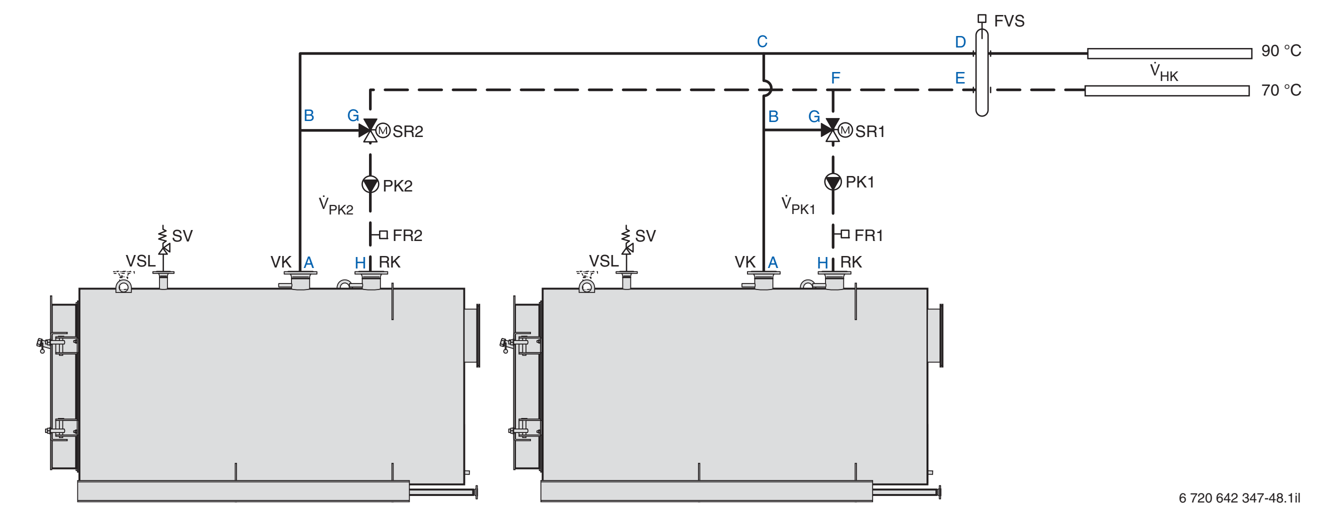

Fig. 36 Sample hydraulic circuit for a 2-boiler system with boiler circuit pump as primary circuit pump

FVS Strategy flow temperature sensor
FR Return temperature sensor
PK Boiler circuit pump
RK Boiler return
SR Actuator for return temperature raising facility
SV Safety valve
VK Boiler flow
VSL Safety flow

Boiler circuit pump flow rate $\dot{V}_{PK}$

In systems with primary circuit pumps (e.g. with hydraulic balancing lines or depressurised distributors), we recommend installing the boiler circuit pump in the heating return.

$$V_{Kges,\,1} = V_{HK} \times (1{,}0...1{,}2)$$

F. 6 Formula with sizing factor for estimating the flow rate of the boiler circuit pump in a single boiler system

$\dot{V}_{HK}$ Flow rate of the heating circuits in l/h
$\dot{V}_{Kges}$ Total boiler circuit flow rate in l/h

$$V_{Kges,\,1} = V_{HK} \times (1{,}2...1{,}5)$$

F. 7 Formula with sizing factor for estimating the flow rate of the boiler circuit pump in a 2-boiler system

$\dot{V}_{HK}$ Flow rate of the heating circuits in l/h
$\dot{V}_{Kges}$ Total boiler circuit flow rate in l/h

In 2-boiler systems, distribute the pump rates of the boiler circuit pumps according to the boiler outputs. If several heating circuits are constantly operated with high flow temperatures and the maximum flow rate, the flow rate of every boiler circuit pump should correspond to the flow rate of the heating circuit pumps. For systems with gas condensing boilers, there are special requirements to be followed, e.g. maintaining as low a return temperature as possible. The pump rate of the boiler circuit pump may then need to be matched to the pump rate of the heating circuits.

Sizing the 3-way valve

Size the 3-way valve for the flow rate that has been calculated. When doing so, observe the pressure loss when the valve is fully open, as the control quality is influenced by the proportional pressure loss.

Head of the primary circuit pump

The head of the boiler circuit pump is the result of:
- The pressure loss of the boiler at the selected flow rate $\dot{V}_{PK}$
- The pressure loss in the pipework **and**
- All individual pressure loss levels in the boiler circuit (path: A–D–E–H, → Fig. 36).

Example

Given
- Heat demand of the heating circuits $\Sigma\dot{Q}_{HK}$ = 4000 kW
- Heating system flow temperature ϑ_V = 90 °C
- Heating system return temperature ϑ_R = 70 °C
- Total flow rate with selected sizing factor (→ formula 7) $\dot{V}_{Kges} = \dot{V}_{HK} \times 1.3$

Result
- $\dot{V}_{HK}$ = 172000 l/h (→ formula 4)
- $\dot{V}_{Kges}$ = 223600 l/h (paths: C–D and E–F, → Fig. 36)

Divide the total flow rate calculated for the boiler circuit side according to the rated outputs (here 50/50 %):
- $\dot{V}_{PK}$ = 111800 l/h (paths: A–C, B–G and F–H, → Fig. 36)

9.3.3 Hydraulic balancing line

A hydraulic balancing line (low loss header) is used to hydraulically separate the boiler circuit and the heating circuits.

Installing a hydraulic balancing line has many advantages:

- Trouble-free sizing of the boiler circuit pump and actuators
- Prevention of mutual influence of the flow rates in the heat source and heat consumer circuits
- Heat sources and heat consumers are only supplied with the allocated flow rates.
- Can be used in single and multi boiler systems, independent of the heating circuit control system
- Actuators on both sides of the hydraulic balancing line work best when correctly sized.
- The hydraulic balancing line can also be used as a dirt separator if sized accordingly (→ page 48).
- Divided into primary and secondary sides if there is a large pressure loss on the water side and long distances between the boiler and heating circuits

Sizing the low loss header

Correct sizing is very important if the hydraulic balancing line is to function correctly. To ensure good separation with the simultaneous function as a dirt separator, size the line in such a way that there is virtually no pressure loss between the flow and return. With the nominal water volume, flow velocities of 0.1 m/s to 0.2 m/s can be expected. This makes simultaneous usage as a dirt separator possible. In order that the heating circuit flow temperature can be captured, provide a sensor well, 200 mm to 300 mm long, in the upper area of the hydraulic balancing line on the heating circuit side.

$$D = \sqrt{\frac{V_{Kges}}{v} \times \frac{1}{2827}}$$

F. 8 Formula for sizing the low loss header

D Diameter of the hydraulic balancing line in m
$\dot{V}_{Kges}$ Total boiler circuit flow rate in m^3/h
v Total boiler circuit flow rate in m/s

Example

Given

- Total flow rate $\dot{V}_{Kges}$ = 223.6 m^3/h
- Flow velocity (assumed) v = 0.2 m/s

Result

- Diameter of the hydraulic balancing line D ≈ 0.63 m

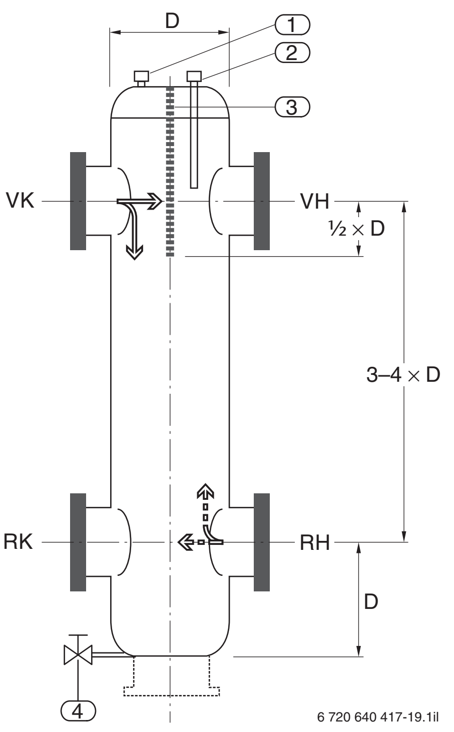

Fig. 37 Schematic diagram of a hydraulic balancing line

[RH] Heating return
[RK] Boiler return
[VH] Heating circuit flow
[VK] Boiler flow
[1] Female connection for an automatic air vent valve
[2] Female connection for a sensor well ½ "
[3] Perforated partition
[4] Quick-acting valve

9.4 1-boiler system with UNIMAT UT-L boiler: boiler and heating circuit control unit

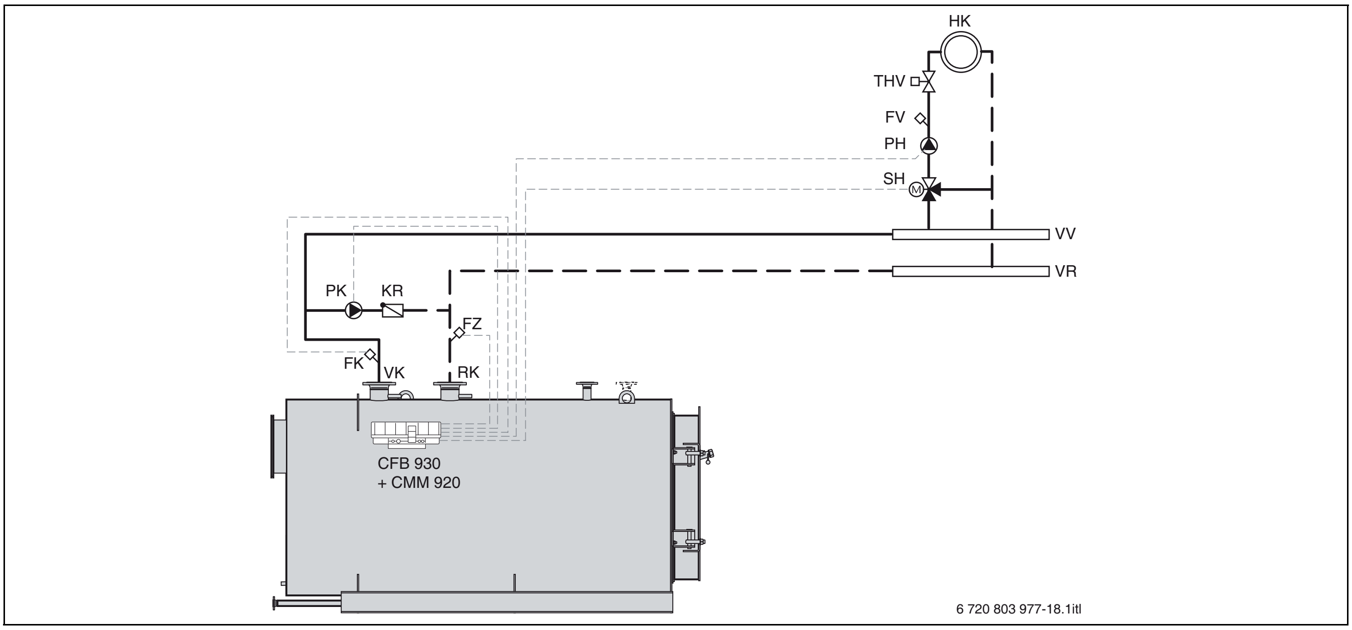

Fig. 38 System example for UNIMAT UT-L boiler CFB control unit for boiler and heating circuit control unit (list of abbreviations → page 47)

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler
- boiler **and** heating circuit control unit

Brief description of the system

- Control of the minimum return temperature by overriding the heating circuit actuators
- 2-stage or modulating burner mode
- Simple layout

Function description

The heating circuits are controlled via the mixer modules. The boiler circuit pump provides hot flow water to the return. This increases the boiler return temperature. To raise the return temperature, the heating circuit actuators are regulated with overriding control. The flow rate to the boiler is restricted until the set value for return temperature control has been reached by mixing in flow water. Once the set value for the return temperature has been reached, heating circuit control is re-enabled.

Special design information

- If a check valve is installed, the boiler circuit pump run-on time should be five minutes. If no check valve is installed, set a run-on time of 60 minutes.
- In conjunction with the CFB control unit, the maximum possible flow temperature of a heating circuit with mixer is 90 °C.

9.5 1-boiler system with UNIMAT UT-Lboiler: boiler and heating circuit control unit with hydraulic separation

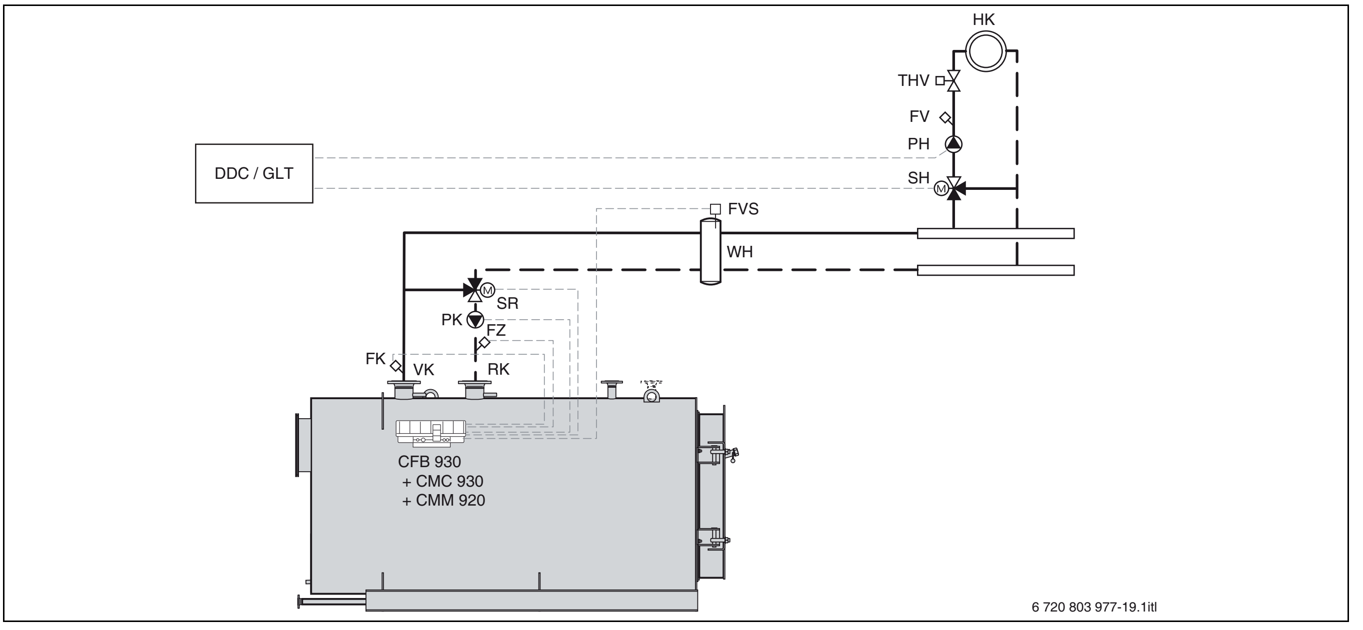

Fig. 39 System example with boiler and heating circuit control unit and hydraulic separation (list of abbreviations → page 47)

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler
- boiler **and** heating circuit control unit
- Hydraulic separation
- System structure in this form if a feed pump is required, e.g. through sizing the heating circuit pumps, or if several distributor stations are required, or if the distributor stations are installed far apart

Brief description of the system

- Minimum return temperature controlled via a separate actuator in the boiler circuit and a boiler circuit pump
- 2-stage or modulating burner mode
- Automatic or weather-compensated load limitation
- Control of heating circuit using CFB control unit

Function description

The 3-way valve is actuated to control the return temperature. The return temperature sensor measures the boiler return temperature. If this falls below the set value, the flow rate to the heating return is constantly restricted by actuating the 3-way valve. If the return temperature rises above the set value, the 3-way valve is reopened and the flow rate to the heating circuit increases.

Special design information

- Size the boiler circuit pump for the maximum calculated flow rate and the pressure loss in the boiler circuit. Switch it to constant mode or set a run-on time of 60 minutes.
- Allow for a low loss header or a distributor with bypass and non-return valve.
- In conjunction with the CFB control unit, the maximum possible flow temperature of a heating circuit with mixer is 90 °C.

9.6 1-boiler system with UNIMAT UT-L boiler: boiler circuit control unit

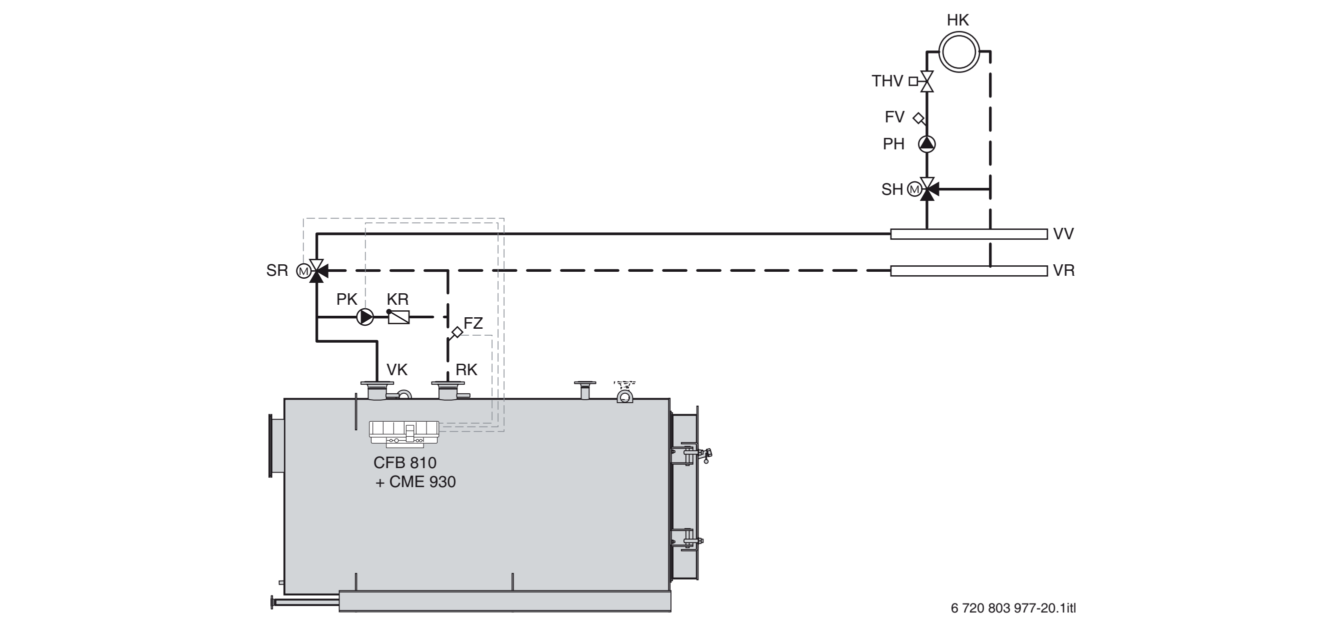

Fig. 40 System example with boiler circuit control unit (list of abbreviations → page 47)

[1)] Enabling (potential-free)
→ Burner stage I
→ Burner stage II or modulation

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler
- boiler circuit control unit
  - Maintaining the operating conditions
  - Enabling of burner stages

Brief description of the system

- Minimum return temperature controlled via a separate actuator in the boiler circuit and a boiler circuit pump as shunt pump
- 2-stage or modulating burner mode
- Control of heating circuit using CFB control unit or on-site control unit

Function description

To control the return temperature, the 3-way valve is actuated, as is the boiler circuit pump which is installed in the bypass line to the boiler. The return temperature sensor measures the boiler return temperature. If this falls below the set value, the flow rate to the return is constantly restricted and the bypass from the heating return to the heating flow is opened. The heating circuit flow rate remains almost constant even during this operating phase. The boiler circuit pump safeguards the optimum flow rate in the boiler circuit.

Special design information

- If a check valve is installed, the boiler circuit pump run-on time should be five minutes. If no check valve is installed, set a run-on time of 60 minutes.

9.7 1-boiler system with UNIMAT UT-L boiler: boiler circuit control unit with hydraulic separation

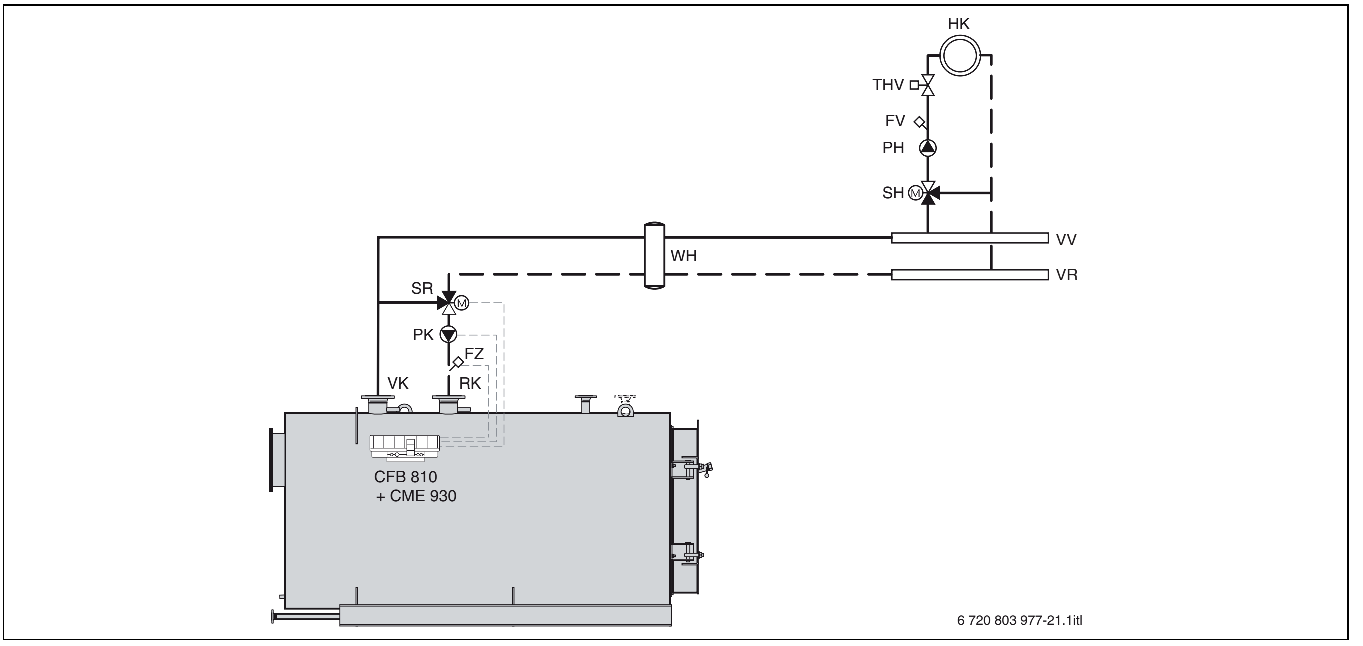

Fig. 41 System example with boiler circuit control unit and hydraulic separation (list of abbreviations → page 47)

[1)] Enabling (potential-free)
→ Burner stage I
→ Burner stage II or modulation

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler
- boiler circuit control unit
  - Maintaining the operating conditions
  - Enabling of burner stages
- Hydraulic separation
- System structure in this form if a feed pump is required, e.g. through sizing the heating circuit pumps, or if several distributor stations are required, or if the distributor stations are installed far apart

Brief description of the system

- Minimum return temperature controlled via a separate actuator in the boiler circuit and a boiler circuit pump as primary circuit pump
- 2-stage or modulating burner mode
- Control of heating circuit using CFB control unit or on-site control unit

Function description

The 3-way valve is actuated to control the return temperature. The return temperature sensor measures the boiler return temperature. If this falls below the set value, the flow rate to the return is constantly restricted by actuating the 3-way valve. If the return temperature rises above the set value, the 3-way valve is reopened and the flow rate to the heating circuit increases.

Special design information

- Allow for a low loss header.
- Switch the boiler circuit pump to constant mode or set a run-on time of 60 minutes.

9.8 2-boiler system with two UNIMAT UT-L boilers: boiler circuit control unit with hydraulic separation

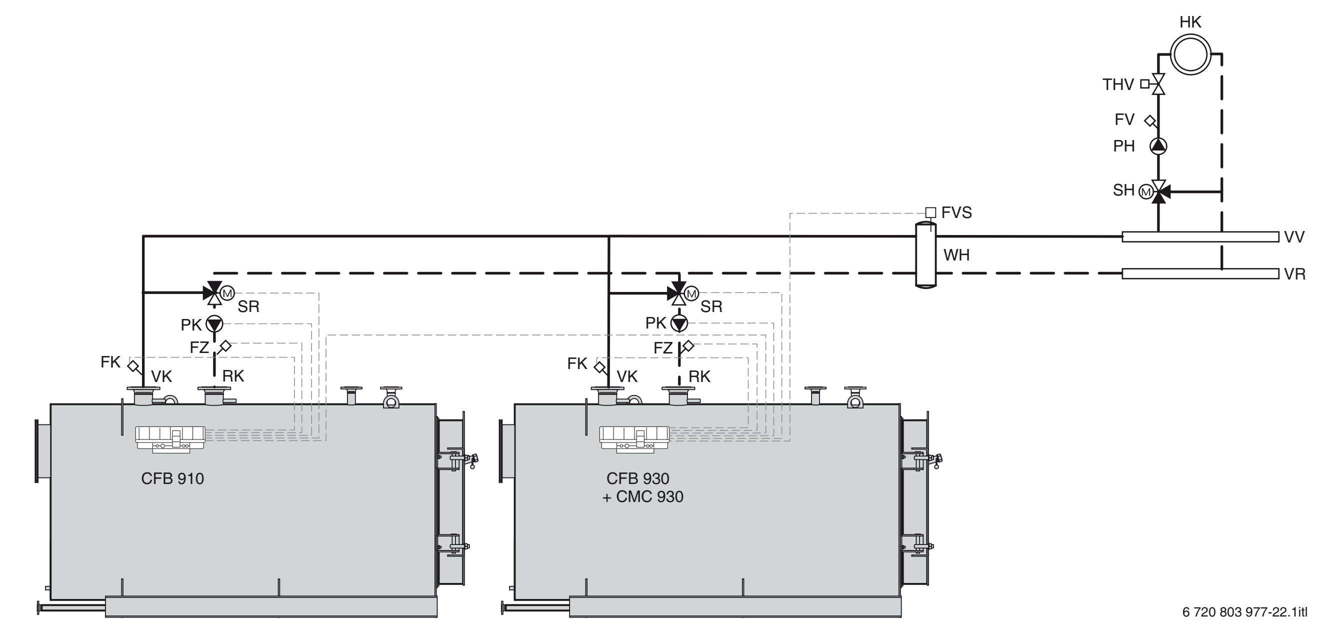

Fig. 42 System example for a 2-boiler system with boiler circuit control unit and hydraulic separation (list of abbreviations → page 47)

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler
- boiler circuit control unit
  - Maintaining the operating conditions
  - Enabling of burner stages
- Hydraulic separation

Brief description of the system

- Minimum return temperature controlled via a separate actuator in the boiler circuit and a boiler circuit pump
- Either serial or parallel operating mode
- 2-stage or modulating burner mode
- Boiler sequence can be reversed
- Hydraulic shut-off of the lag boiler with time delay
- Automatic or weather-compensated load limitation
- Control of heating circuit using CFB control unit or on-site control unit

Function description

The 3-way valve is actuated to control the return temperature. The return temperature sensor measures the boiler return temperature. If this falls below the set value, the flow rate to the return is constantly restricted by actuating the 3-way valve. If the return temperature rises above the set value, the 3-way valve is reopened and the flow rate to the heating circuit increases. Any boilers not in operation are hydraulically shut off.

Special design information

- Allow for a low loss header.
- The boiler circuit pump run-on time after burner shutdown should be five minutes for the lag boiler, and 30-60 minutes for the lead boiler.
- We recommend distributing the total rated output between the boilers so each has 50 % (maximum 60/ 40 %).
- This scheme can also be used if a third boiler is connected.

9.9 1-boiler system with UNIMAT UT-L boiler with flue gas heat exchanger: boiler circuit control unit

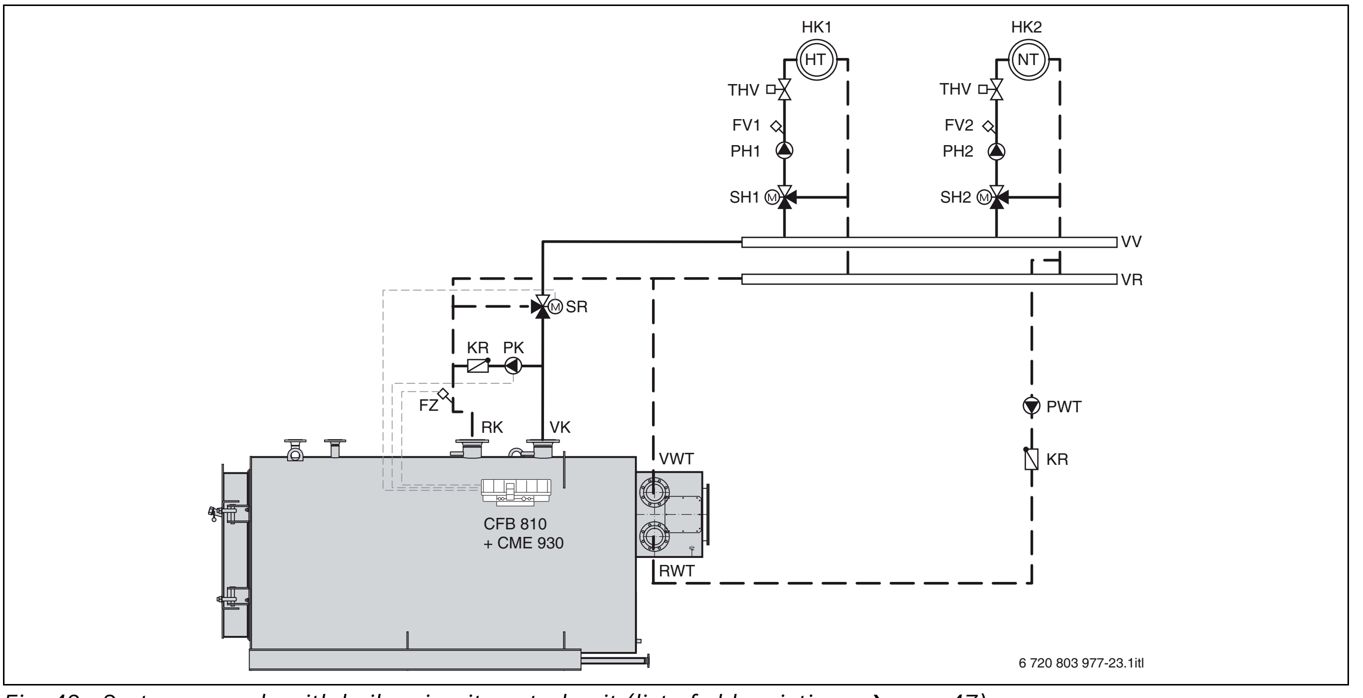

Fig. 43 System example with boiler circuit control unit (list of abbreviations → page 47)

[1)] Enabling (potential-free)
→ Burner stage I
→ Burner stage II or modulation

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler with flue gas heat exchanger or condensing heat exchanger
- CFB boiler circuit control unit
  - Maintaining the operating conditions
  - Enabling of burner stages
- Partial flow of the condensing heat exchanger (ECO 6)

Brief description of the system

- Minimum return temperature controlled via a separate actuator in the boiler circuit and a boiler circuit pump
- 2-stage or modulating burner mode
- Control of heating circuit using CFB control unit or on-site control unit

Function description

To control the return temperature, the 3-way valve is actuated, as is the boiler circuit pump which is installed in the bypass line to the boiler. If the return temperature at the return temperature sensor falls below the set value, the flow rate to the boiler return is constantly restricted and the bypass from the heating return to the heating flow is opened.

The heating circuit flow rate remains almost constant even during this operating phase. The boiler circuit pump safeguards the optimum flow rate in the boiler circuit. Targeted utilisation of the condensing effect is possible with the ECO 6 connected separately to the low temperature heating circuit.

Special design information

- If a check valve is installed, the boiler circuit pump run-on time should be five minutes. If no check valve is installed, set a run-on time of 60 minutes.
- The ECO 6 pump must be actuated in parallel to the burner. Match the head to the pressure loss of the ECO 6 and the connection pipework.
- If there are shut-off valves between the boiler and ECO 6, an additional safety valve and pressure gauge are required at the ECO 6.
- Protect the ECO 6 with an on-site safety temperature limiter or high limit safety cut-out.

9.10 1-boiler system with UNIMAT UT-L boiler with condensing heat exchanger: boiler circuit control unit with hydraulic separation

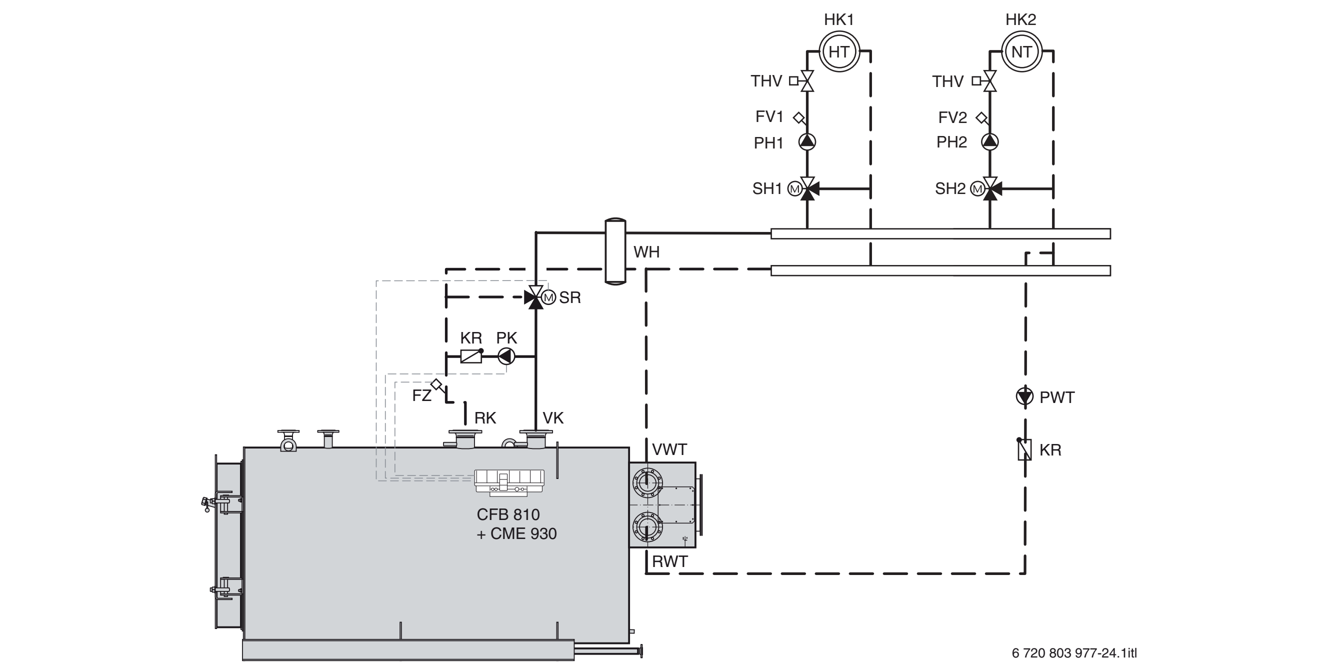

Fig. 44 System example with boiler circuit control unit and hydraulic separation (list of abbreviations → page 47)

[1)] Enabling (potential-free)
→ Burner stage I
→ Burner stage II or modulation

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i The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler with ECO 6 condensing heat exchanger
- CFB boiler circuit control unit
  - Maintaining the operating conditions
  - Enabling of burner stages
- System structure in this form if a feed pump is required, e.g. through sizing the heating circuit pumps, or if several distributor stations are required, or if the distributor stations are installed far apart

Brief description of the system

- Minimum return temperature controlled via a separate actuator in the boiler circuit and a boiler circuit pump as primary circuit pump
- 2-stage or modulating burner mode
- Control of heating circuit using CFB control unit or on-site control unit

Function description

The 3-way valve is actuated to control the return temperature. The return temperature sensor measures the boiler return temperature. If this falls below the set value, the flow rate to the heating return is constantly restricted by actuating the 3-way valve.
If the return temperature rises above the set value, the 3-way valve is reopened and the flow rate to the heating circuit increases. Targeted utilisation of the condensing effect is possible with the condensing heat exchanger (ECO 6) connected separately to the low temperature heating circuit.

Special design information

- If shut-off valves are installed between the boiler and ECO 6, an additional safety valve and pressure gauge are required at the ECO 6.
- Allow for a low loss header.
- Switch the boiler circuit pump to constant mode or set a run-on time of 60 minutes.
- The ECO 6 pump must be actuated in parallel to the burner. Match the head to the pressure loss of the ECO 6 and the connection pipework.
- Protect the ECO 6 with an on-site safety temperature limiter or high limit safety cut-out.

9.11 2-boiler system with UNIMAT UT-L boiler without flue gas heat exchanger and UT-L boiler with condensing heat exchanger: boiler circuit control unit with hydraulic separation

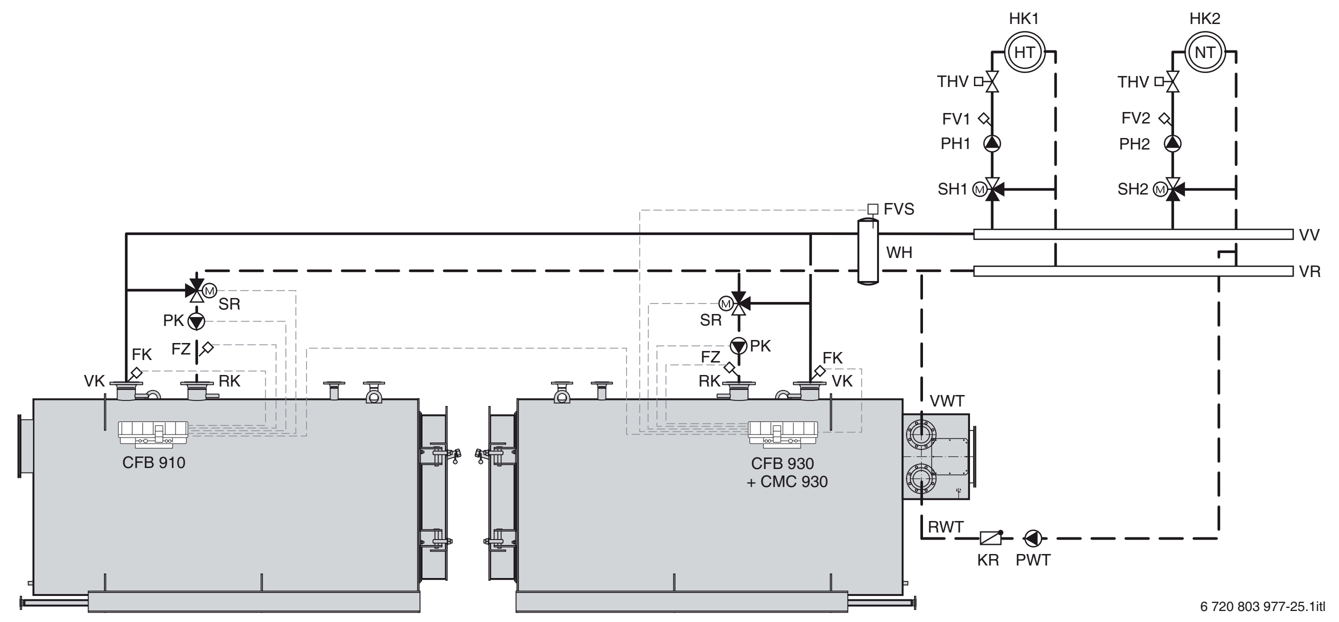

Fig. 45 System example of a 2-boiler system with UNIMAT UT-L boiler with and without condensing heat exchanger; boiler circuit control unit with hydraulic separation (list of abbreviations → page 47)

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler with condensing heat exchanger and UNIMAT UT-L boiler
- CFB boiler circuit control unit
  - Maintaining the operating conditions
  - Enabling of burner stages
- Hydraulic separation

Brief description of the system

- The UT-L with condensing heat exchanger is the lead boiler
- 2-stage or modulating burner mode
- Boiler sequence can be reversed, but is not recommended
- Hydraulic shut-off of the lag boiler with time delay
- Automatic or weather-compensated load limitation.

Function description

The 3-way valve is actuated to control the return temperature. The return temperature sensor measures the boiler return temperature. If this falls below the set value, the flow rate to the heating return is constantly restricted by actuating the 3-way valve. If the return temperature rises above the set value, the 3-way valve is reopened and the flow rate to the heating circuit increases.

Any boilers not in operation are hydraulically shut off. Targeted utilisation of the condensing effect is possible with the condensing heat exchanger (ECO 6) connected separately to the low temperature heating circuit.

Special design information

- The boiler circuit pump run-on times are set to 30-60 minutes for the lead boiler and five minutes for the lag boiler.
- We recommend distributing the total rated output between the boilers so each has 50 % (maximum 60/40 %).
- The ECO 6 pump should be actuated in parallel to the burner. Match the head to the pressure loss of the ECO 6 and the connection pipework.
- If there are shut-off valves between the boiler and ECO 6, an additional safety valve and pressure gauge are required at the ECO 6.
- Protect the ECO 6 with an on-site safety temperature limiter or high limit safety cut-out.
- This scheme can also be used if a third boiler is connected.

9.12 UNIMAT UT-L boiler with flue gas heat exchanger or condensing heat exchanger: return temperature raising

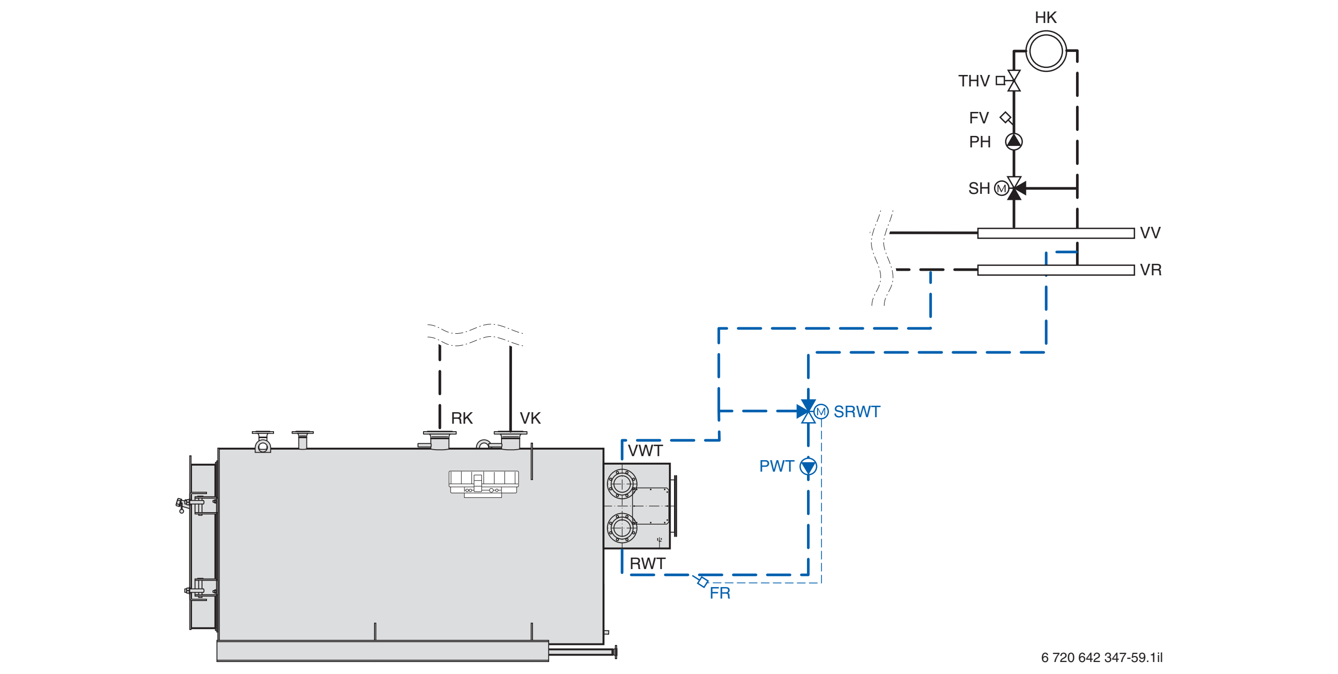

Fig. 46 Installation of the heat exchanger in the UNIMAT UT-L boiler (list of abbreviations → page 47)

The circuit diagram is only a schematic illustration! Information regarding all system examples → page 47 ff.

AREA OF APPLICATION

- UNIMAT UT-L boiler with flue gas heat exchanger or condensing heat exchanger
- Oil/gas combi burners

Brief description of the system

- The operating conditions of the flue gas heat exchanger are safeguarded with at low mains return temperatures by a separate actuator in conjunction with a return temperature control unit

Function description

In heating systems where the return temperature can be very low, the additional SRWT return actuator is required in the connection pipework of the ECO 7 heat exchanger or the ECO 6 condensing heat exchange on the water side. The return temperature control with 3-step signal output monitors the minimum return temperature, which depends on the type of flue gas heat exchanger or on the fireplace. If the temperature falls below the minimum return temperature of 60 °C, the mixer closes. The cold return water cannot enter the ECO 6 or ECO 7. If the temperature in this circuit rises above 60 °C, the mixer enables the system return.

Special design information

- If the SRWT actuator is installed between the boiler and flue gas heat exchanger, an additional safety valve and pressure gauge are required at the flue gas heat exchanger.
- Control of the actuator SRWT should be arranged on site or in conjunction with a control panel.
- Size the pump for the flue gas heat exchanger according to its pressure loss and the pressure loss in the circuit.
- Route away the condensate that occurs in the flue system separately and neutralise it (→ page 82 ff.).
- The flue gas heat exchanger pump is actuated in parallel to the burner.

10 Fitting

10.1 Transport and handling

10.1.1 Delivery method and transport options

The UNIMAT UT-L boiler and UNIMAT UT-L boiler with integrated heat exchanger are each delivered in a transport unit.

10.1.2 Handling dimensions

For handling the boiler, it is essential to size the entrance to the installation room slightly larger than the boiler dimensions. See tab. 29 for the minimum handling dimensions.

Transport

To transport the boiler block with a crane, only use the two lifting eyes. These are fitted at the top of the boiler pressure body, at the front and back.

The use of rollers underneath the base frame to transport the system at floor level is not permitted. There is a danger that the base frame will become warped.

UNIMAT UT-L boiler Boiler size		Entrance			
		UNIMAT UT-L boiler		UNIMAT UT-L boiler with flue gas heat exchanger	
		Minimum width [mm]	Minimum height [mm]	Minimum width [mm]	Minimum height [mm]
UT-L 1	–	1400	1850	1500	1865
UT-L 4	UT-L 2	1550	2000	1650	2015
UT-L 10	UT-L 6	1650	2100	1755	2115
UT-L 14	UT-L 8	1750	2200	1855	2215
UT-L 18	UT-L 12	1800	2250	1910	2265
UT-L 24	UT-L 16	1900	2350	1995	2365
UT-L 28	UT-L 20	1950	2400	2060	2415
UT-L 30	UT-L 22	2050	2500	2155	2515
UT-L 34	UT-L 26	2150	2600	2250	2615
UT-L 40	UT-L 32	2350	2800	2435	2800
UT-L 42	UT-L 36	2500	2950	2605	2950
UT-L 46	UT-L 38	2650	3100	2750	3100
UT-L 50	UT-L 44	2800	3300	2905	3250
UT-L 54	UT-L 48	2950	3400	3045	3400
UT-L 58	UT-L 52	3120	3650	3240	3600
UT-L 60	UT-L 56	3450	3950	3555	3900
UT-L 64	UT-L 62	3650	4150	3750	4100

Table 29 Minimum handling dimensions for UNIMAT UT-L boilers; the dimensions specified are recommended values and may vary from system to system.

10.2 Design of installation rooms and combustion air supply

10.2.1 Installation location

General information

The requirements of the installation room or building contain information for the installation of boilers and boiler house components for heating systems. They are to be used to assist engineers of installation rooms and buildings. All relevant national and local regulations and applicable standards must be observed.

Fundamental requirements

The following fundamental requirements of the installation room must be fulfilled:

- Only install the boiler system in a room that complies with relevant local regulations.
- Keep the installation room clean and free of dust and dripping water. The room temperature must be between 5 °C and 40 °C.
- The service intervals for the boiler system may be reduced if the air at the site contains salt (coastal areas).
- Entry to the boiler installation room must be forbidden to unauthorised personnel by noticeable, permanent signs.
- Depending on the boiler parameters (water capacity, pressure, output) and national regulations, less stringent installation or monitoring conditions may apply.
- Ensure sound insulation measures comply with local regulations.
- Install the control panels in such a way that no vibrations or shaking of the system components can be transmitted to the control panels. Install in areas where the control panels will be protected from impermissible heat radiation and ensure safe accessibility even in potentially dangerous circumstances.
- Free access to inspection apertures on boilers and system components must be ensured.

Requirements of the building

The following requirements of the building must be fulfilled:

- The installation location must be constructed in such a way that vibrations as a result of operation cannot cause any damage to buildings or adjacent systems.
- The static of the building structure must be taken into account for all fixings.
- Every boiler installation room must have a continuous or nearly continuous, free external wall or ceiling area of at least 1/10 the floor area (or as per local regulations), that will yield much more easily than the other surrounding walls if overpressure occurs in the boiler installation room.
- Design the entrance to the boiler installation room according to the dimensions of the individual components.
- Provide suitable lifting gear in the boiler installation room to move heavy equipment.
- The internal height and width of all walk-on surfaces must be sufficient. Access to the system must be ensured in line with local regulations. If the internal height of the installation room is lower than required for structural reasons, determine the minimum height together with the local responsible authorities.
- Suitable and designated escape routes must be available.
- The boiler installation room, especially around the valves and safety equipment, as well as the escape routes, must be illuminated.
- System components that are to be operated must be easily accessible and there must be enough space to open doors (including inspection apertures).

10.2.2 Combustion air supply

The design of installation rooms and the installation of boilers must comply with the relevant national regulations.

Fundamental requirements

- Combustion air apertures and lines must never be closed or covered unless there is special safety equipment that ensures the combustion equipment can only be operated if the flow cross-section is unobstructed.
- The required cross-section must not be restricted by a closure or grille.
- An adequate supply of combustion air must be verified.
- The ventilation air supply to the combustion equipment should come from the boiler installation room to compensate for outside temperature fluctuations. The maximum temperature fluctuation must not exceed 30 K.
- Combustion air temperature:
  - Minimum: + 5 °C
    or as specified by burner manufacturer
  - Maximum: + 40 °C
    or as specified by burner manufacturer

Arrangement of ventilation and extract air apertures

- Ideally, ventilation air apertures are arranged near the back of the boiler. If this is not possible for structural reasons, install air baffles or sheet metal channels inside the boiler installation room to deflect the inlet air.
- When designing the ventilation air apertures, the arrangement of frost-sensitive system components must also be taken into account (e.g. water treatment) if they cannot be installed in the direct path of the ventilation air.
- Furthermore, install the ventilation air apertures in the boiler installation room in such a way that the ventilation air does not flow over boiler doors or reversing chambers (to prevent condensation).
- Extract air apertures should also be provided.
- Ventilation air apertures should be fitted 500 mm above the boiler room floor; extract air apertures should be fitted at the highest point of the installation room.
  Ensure cross venting.

Sizing ventilation and extract air apertures

- Size ventilation and extract air apertures to obtain a pressure of ± 0 mbar in the boiler installation room.
- If the combustion air is routed via air inlet channels to the burner, ensure an optimised flow path and adequate sizing with regard to the pressure loss.
- The side ratio of the aperture must not be more than 1:2.
- Extract air cross-sections correspond to 60 % of the ventilation air cross-sections.

The calculation formulae below are a **non-binding recommendation.** It is essential that the system installer seeks the agreement of the responsible approval or building regulations body. Take into account additional consumers of ventilation air (e.g. compressors) when sizing.

For outputs ...	... the following calculation applies for the free ventilation air cross-section[1)]
≤ 2000 kW	A = 300 + [(Q – 50) × 2.5]
> 2000, ≤ 20000 kW	A = 5175 + [(Q – 2000) × 1.75]
> 20000 kW	A = 36675 + [(Q – 2000) × 0.88]

Table 30 Calculating free ventilation air cross-sections

1) A = free cross-section (net) in cm^2, Q = output in kW

10.3 Installation dimensions

10.3.1 Installation room dimensions for the UNIMAT UT-L boilers

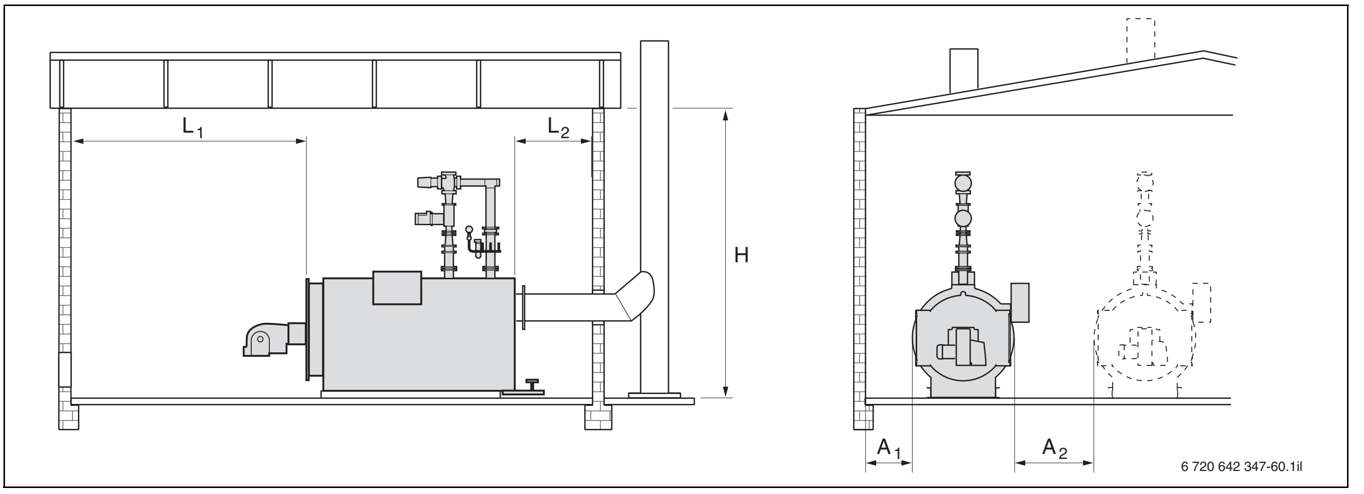

Fig. 47 UNIMAT UT-L boiler installation room dimensions

Allow extra space for sound insulation measures. Maintain the specified wall clearances to facilitate installation, service and maintenance work. Always observe the local regulations.

UNIMAT UT-L boiler		Installation room dimensions[1]				
Boiler size		Length		Height	Side clearance[2]	
		L_1 [mm]	L_2 [mm]	H [mm]	A_1 [mm]	A_2 [mm]
UT-L 1	–	2100	1000	3300	500	1200
UT-L 4	UT-L 2	2500	1000	3500	500	1300
UT-L 10	UT-L 6	2750	1000	3800	500	1300
UT-L 14	UT-L 8	3000	1000	4100	500	1300
UT-L 18	UT-L 12	3500	1000	4100	500	1300
UT-L 24	UT-L 16	3500	1000	4400	500	1500
UT-L 28	UT-L 20	3850	1000	4400	500	1500
UT-L 30	UT-L 22	4250	1000	4600	500	1550
UT-L 34	UT-L 26	4400	1000	5100	500	1650
UT-L 40	UT-L 32	4800	1000	5600	500	1800
UT-L 42	UT-L 36	5000	1000	On request	500	1800
UT-L 46	UT-L 38	5200	1000	On request	500	On request
UT-L 50	UT-L 44	5650	1000	On request	500	On request
UT-L 54	UT-L 48	5950	1000	On request	500	On request
UT-L 58	UT-L 52	6700	1000	On request	500	On request
UT-L 60	UT-L 56	7150	1000	On request	500	On request
UT-L 64	UT-L 62	7600	1000	On request	500	On request

Table 31 UNIMAT UT-L boiler installation room dimensions (dimensions of the boiler foundation → Tab. 39, page 78)

1) The values given are a guide. They may differ subject to the individual system.

2) Subject to the burner; the values given are a guide. The burner door can pivot either to the right or left.

10.3.2 Installation room dimensions for the UNIMAT UT-L boilers with flue gas heat exchanger

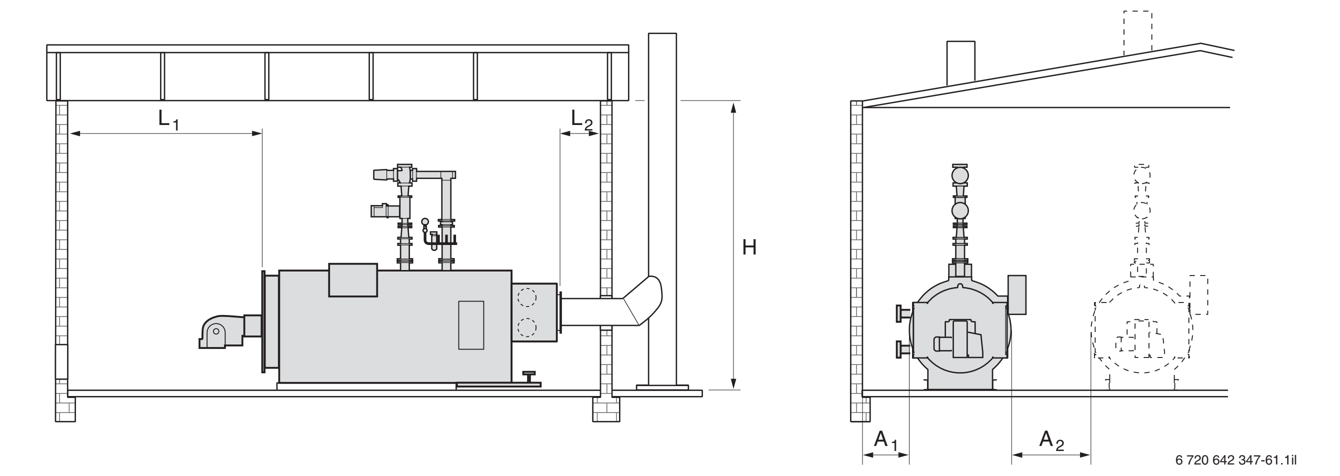

Fig. 48 UNIMAT UT-L boiler installation room dimensions

Allow extra space for sound insulation measures. Maintain the specified wall clearances to facilitate installation, service and maintenance work.

UNIMAT UT-L boiler Boiler size		Installation room dimensions[1)] Length[2)] L_1 [mm]	L_2 [mm]	Height H [mm]	Side clearance[3)] A_1 [mm]	A_2 [mm]
UT-L 4	UT-L 2	2700	500	3500	700	1300
UT-L 10	UT-L 6	2950	500	3800	700	1300
UT-L 14	UT-L 8	3200	500	4100	800	1300
UT-L 18	UT-L 12	3700	500	4100	900	1300
UT-L 24	UT-L 16	3700	500	4400	900	1500
UT-L 28	UT-L 20	4050	500	4400	950	1500
UT-L 30	UT-L 22	4450	500	4600	950	1550
UT-L 34	UT-L 26	4600	500	5100	950	1650
UT-L 40	UT-L 32	5000	500	5600	950	1800
UT-L 42	UT-L 36	5200	500	On request	1000	1800
UT-L 46	UT-L 38	5450	500	On request	1000	On request
UT-L 50	UT-L 44	5900	500	On request	1000	On request
UT-L 54	UT-L 48	6200	500	On request	1000	On request
UT-L 58	UT-L 52	6950	500	On request	1000	On request
UT-L 60	UT-L 56	7400	500	On request	1050	On request
UT-L 64	UT-L 62	7850	500	On request	1050	On request

Table 32 UNIMAT UT-L boiler installation room dimensions (dimensions of the boiler foundation → Tab. 39, page 78)

1) The values given are a guide. They may differ subject to the individual system.

2) Length L_1 relative to a flue gas heat exchanger with a tube bundle element; with a flue gas heat exchanger with two tube bundle elements, the length increases by 300 mm.

3) Subject to the burner; the values given are a guide. The burner door can pivot either to the right or left.

10.4 Additional safety equipment to DIN-EN 12828

10.4.1 Safety equipment

Safety equipment version	High limit safety cut-out (STB) with shutdown temperature ≤ 110 °C Heat source > 300 kW
Safety equipment assembly, standard equipment level	required
Set with STB and maximum pressure limiter	Required[1)]
Minimum pressure limiter	Alternative to low water indicator

Table 33 UNIMAT UT-L boiler safety equipment versions

1) As an alternative to a flash trap, the set with STB and maximum pressure limiter can be used

10.4.2 Boiler safety equipment assembly to DIN-EN 12828

An intermediate flow piece and boiler safety assembly are required to install the safety equipment.

Versions flange PN16 to DIN 2633:
- DN32/40/50/65/80/100/125/150/200/250/300/350

The safety equipment assembly for “standardised” boiler versions consists of:
- Intermediate flow piece
- Shut-off valve
- Boiler safety assembly
- Minimum pressure limiter
- PRESSURE GAUGE
- Pressure gauge shut-off valve with test connection

The safety equipment assembly in the standard equipment level consists of:
- Intermediate flow piece
- Shut-off valve
- Boiler safety assembly
- Minimum pressure limiter or low water indicator
- PRESSURE GAUGE
- Pressure gauge shut-off valve with test connection
- Maximum pressure limiter

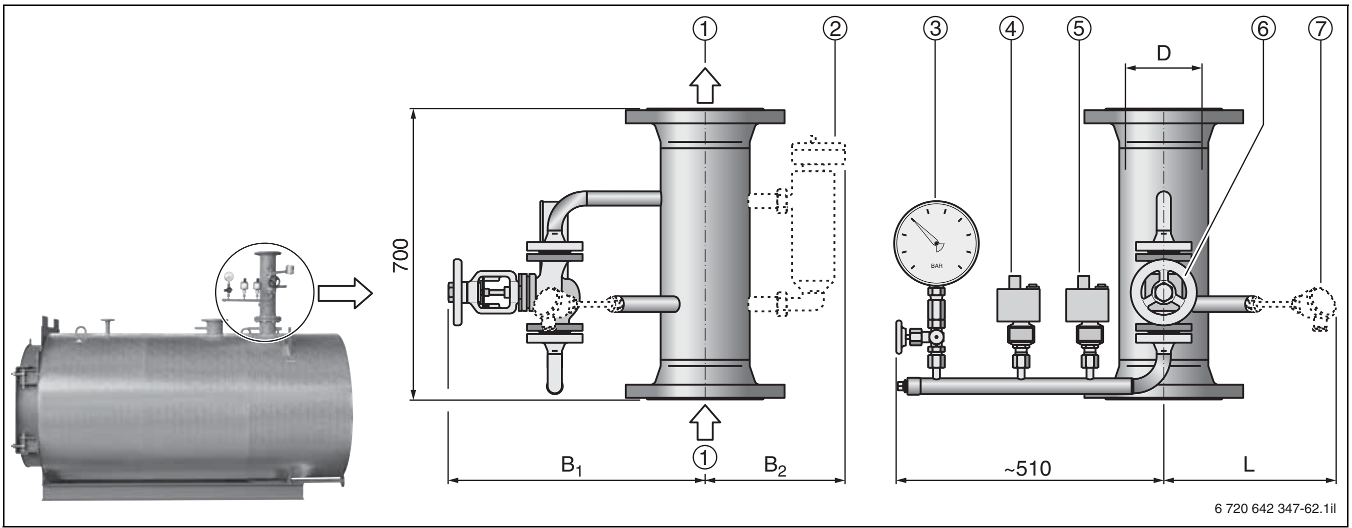

Fig. 49 Boiler safety equipment assembly for UNIMAT UT-L boilers (intermediate flow piece with boiler safety assembly and valves; dimensions in mm)

[1] Flow
[2] Level limiter (designed as low water indicator, optional)
[3] Pressure indicator (with test function)
[4] Maximum pressure limiter
[5] Level limiter (designed as minimum pressure switch)
[6] Shut-off valve DN20
[7] Temperature sensor (variable output control, optional)

Intermediate flow piece Type	Internal diameter[1)] D	Measurements Length L [mm]	Width B₁ [mm]	B₂ [mm]	Volume [l]	Shipping weight [kg]
SP 50	DN50	300	450	225	3.8	25
SP 65	DN65	300	450	225	3.3	24
SP 80	DN80	300	450	225	4.3	27
SP 100	DN100	310	460	240	6.3	33
SP 125	DN125	320	475	250	9.3	38
SP 150	DN150	330	490	265	13.8	44
SP 200	DN200	345	515	290	23.3	59
SP 250	DN250	365	540	320	38.0	77
SP 300	DN300	385	565	345	53.0	94
SP 350	DN350	395	580	360	62.0	130
SP 400	DN400	415	610	385	83.0	141

Table 34 Specification of the intermediate flow piece for UNIMAT UT-L boilers

1) Design of the flange connections: PN16 to DIN 2633 (≤ 16 bar, ≤ 120 °C)

10.4.3 Intermediate return piece

An intermediate return piece can be provided for installing the safety expansion line and for height compensation of the intermediate flow piece (→ Tab 34, page 72). A further temperature sensor can be connected to this. A fully functioning intermediate return piece is already integrated into the return temperature raising set (→ page 76).

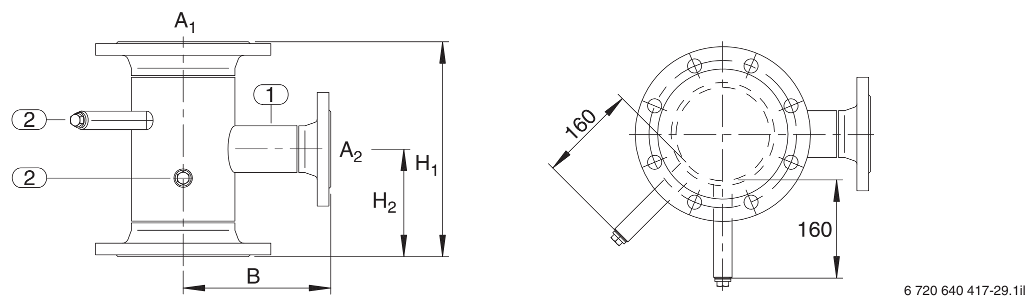

Fig. 50 Intermediate return piece for UNIMAT UT-L boilers (dimensions in mm)

[1] Flange connection for expansion line
[2] Thermometer or temperature sensor connection

Intermediate return piece Type	Nominal diameter A_1[1)]	A_2[2)]	Measurements Height H_1 [mm]	H_2 [mm]	Width B [mm]	Volume [l]	Shipping weight PN16 [kg]	PN25 [kg]	PN40 [kg]
RP 50	DN50	DN25	350	175	125	1	–	–	10
RP 65	DN65	DN32	350	175	135	2	12	–	13

Table 35 Specification of the intermediate return piece for UNIMAT UT-L boilers

Intermediate return piece Type	Nominal diameter		Measurements			Volume	Shipping weight		
			Height		Width		PN16	PN25	PN40
	A_1 1)	A_2 2)	H_1	H_2	B				
			[mm]	[mm]	[mm]	[l]	[kg]	[kg]	[kg]
RP 80	DN80	DN40	350	175	145	3	13	–	15
RP 100	DN100	DN50	350	175	160	4	18	–	21
RP 125	DN125	DN65	350	175	225	5	24	–	30
RP 150	DN150	DN65	350	175	240	7	32	–	40
RP 200	DN200	DN80	400	200	270	13	48	58	66
RP 250	DN250	DN100	450	225	305	23	67	83	101
RP 300	DN300	DN125	500	250	335	37	92	110	142
RP 350	DN350	DN150	550	275	405	50	125	156	192
RP 400	DN400	DN150	550	275	430	65	147	189	251
RP 500	DN500	DN200	650	325	500	123	228	278	331

Table 35 Specification of the intermediate return piece for UNIMAT UT-L boilers

1) Internal diameter for flanges to DIN 2633/2634/2635

2) Internal diameter for flanges to DIN 2633/2635

Dimensions given with ± 1 % tolerance; Transport weights given with ± 4 % tolerance

10.4.4 Safety valve

The safety valve from ARI, Figure 902, can be fitted directly to the boiler connector VSL (→ Fig. 13, page 23). The internal connector diameter of the boiler is matched to the required internal diameter of the safety valve during manufacture. For the outlet side of the safety valve, suitable mating flanges are available as accessories.

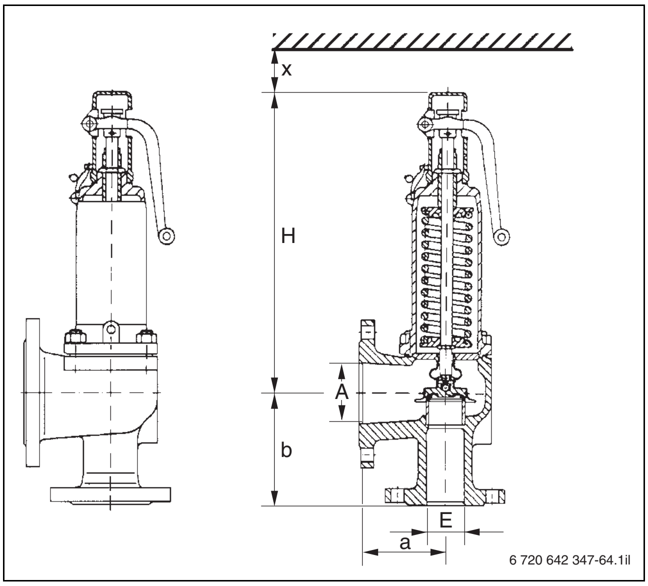

Fig. 51 Safety valve for heating systems with UNIMAT UT-L boiler

A Outlet
a Leg length
b Leg height
E Inlet
H Height
x Clearance above

ARI safety valve, Figure 902		Unit	Internal diameter, valve size 1)							
			DN32	DN40	DN50	DN65	DN80	DN100	DN125	DN150
Internal diameter outlet 1)	O	–	DN50	DN65	DN80	DN100	DN125	DN150	DN200	DN250
Leg length	A	mm	110	115	120	140	160	180	200	225
Leg height	b	mm	115	140	150	170	195	220	250	285
Height	H	mm	330	390	435	545	610	690	845	890
Clearance above	x	mm	200	250	300	350	400	500	500	500

Table 36 Specifications and dimensions of the safety valve for UNIMAT UT-L boilers

1) Version of the flange connections; PN16 to DIN 2633 or PN40 to DIN 2635.

ARI safety valve, Figure 902	Internal diameter, valve size[1]							
	DN32	DN40	DN50	DN65	DN80	DN100	DN125	DN150
Maximum response pressure	Applicable for a maximum boiler output of[2]							
[bar]	[kW]	[kW]	[kW]	[kW]	[kW]	[kW]	[kW]	[kW]
2.5	565	870	1360	2300	3480	5440	7120	9900
3.0	649	1000	1560	2640	4000	6250	8190	11400
4.0	810	1250	1950	3300	5000	7800	10200	14200
5.0	960	1480	2310	3900	5910	9240	12100	16900
6.0	1100	1700	2660	4500	6820	10600	14000	19400
8.0	1390	2140	3350	5660	8580	13400	17600	24500
10.0	1670	2570	4010	6790	10300	16000	21100	29300

Table 37 Output of the safety valve for UNIMAT UT-L boilers

1) Version of the flange connections; PN16 to DIN 2633 or PN40 to DIN 2635.

2) Non-binding specifications - subject to change.

10.4.5 Flash trap to DIN-EN 12828

In accordance with DIN-EN 12828, flash traps are to be provided for boilers with a rated output > 300 kW. It is not necessary to install a flash trap in heating systems. This applies as long as an additional high limit safety cut-out and an additional maximum pressure limiter are installed. Install flash traps in the discharge pipe from the safety valves. These separate the steam and the water phases. Install a water drain line at the lowest point of the flash trap. This enables escaping heating water to be routed away safely and visibly. Route the discharge pipe for steam to the outside at the highest point of the flash trap.

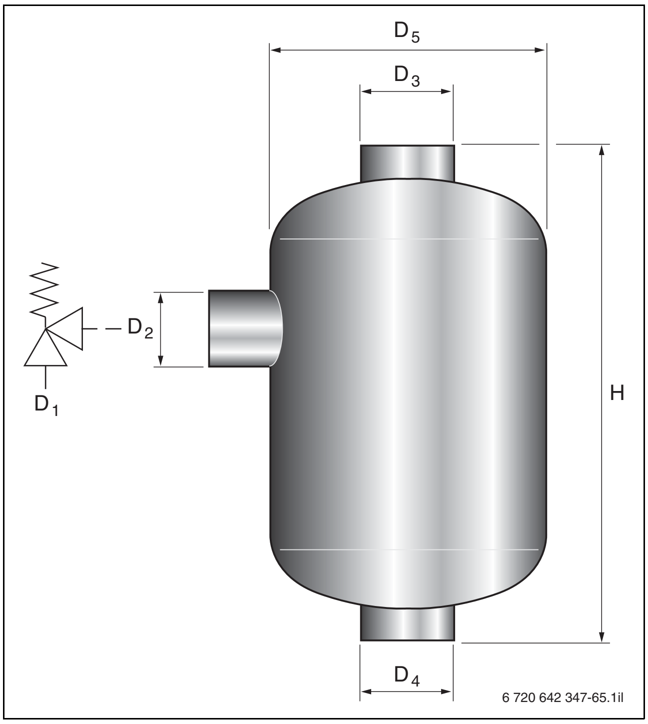

Fig. 52 Flash trap for UNIMAT UT-L boilers

D_{1-5} diameter
H Height

Safety valve	Flash trap	Measurements								Cable between safety valve and flash trap		Discharge pipe	
	Type	diameter					Height	Excess pressure	Weight	Length	Number of bends	Length	Number of bends
		D_1	D_2	D_3	D_4	D_5 [mm]	H [mm]	[bar]	[kg]	[m]		[m]	
DN25/40	ET 40	DN25	DN40	DN50	DN50	165	346	≤ 5	2.0	≤ 5	≤ 2	≤ 10	≤ 3
	ET 50	DN32	DN50	DN65	DN65	165	346	> 5 ≤ 10	2.2				
DN32/50	ET 50	DN32	DN50	DN65	DN65	165	346	≤ 5	2.2				
	ET 65	DN40	DN65	DN80	DN80	283	440	> 5 ≤ 10	6.8				
DN40/65	ET 65	DN40	DN65	DN80	DN80	283	440	≤ 5	6.8				
	ET 80	DN50	DN80	DN100	DN100	283	440	> 5 ≤ 10	7.2				
DN50/80	ET 80	DN50	DN80	DN100	DN100	283	440	≤ 5	7.2				
	ET 100	DN65	DN100	DN125	DN125	391	616	> 5 ≤ 10	14.2				
DN65/100	ET 100	DN65	DN100	DN125	DN125	391	616	≤ 5	14.2				
	ET 125	DN80	DN125	DN150	DN150	450	776	> 5 ≤ 10	19.5				
DN80/125	ET 125	DN80	DN125	DN150	DN150	450	776	≤ 5	19.5				
	ET 150	DN100	DN150	DN200	DN200	500	896	> 5 ≤ 10	28.0				
DN100/ 150	ET 150	DN100	DN150	DN200	DN200	500	896	≤ 5	28.0				

Table 38 Selection table for a flash trap for UNIMAT UT-L boilers for installation downstream of the safety valves with the identification letters D/G/H

10.4.6 Return flow temperature safeguard set (maintaining version)

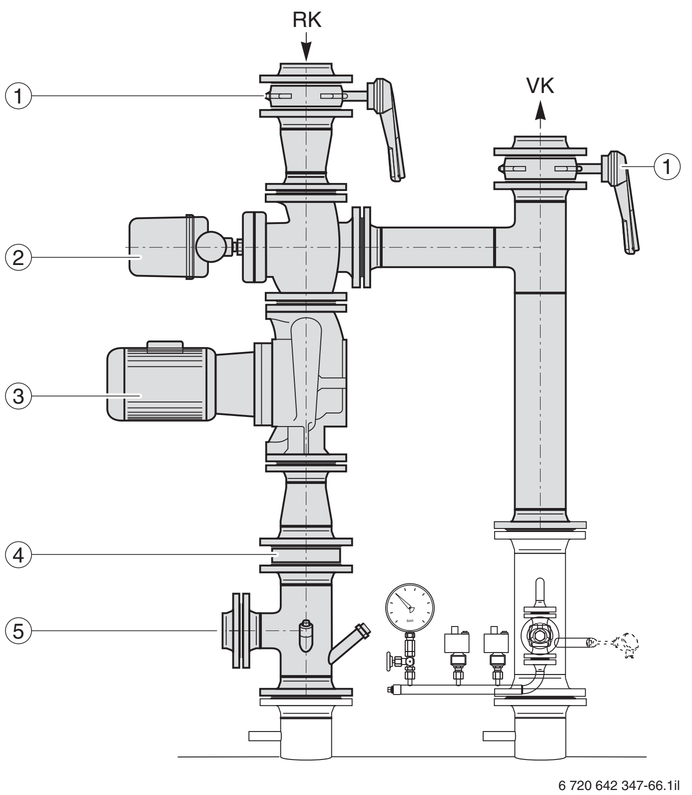

Fig. 53 Standard delivery of the return flow temperature safeguard set (coloured grey) for UNIMAT UT-L boilers

[RK] Return
[VK] Flow
[1] Shut-off damper with notched lever
[2] 3-way valve with actuator
[3] Pump
[4] Non-return valve or check valve
[5] Connection for pressure maintaining device

The return flow temperature safeguard set, available as an accessory, can be used to maintain a required minimum return temperature. It can be installed in heating systems that have either a low loss header or a low-pressure distributor (system examples → Fig. 41 to Fig. 44, page 60 ff.).

The set is delivered fully fitted which considerably reduces the time required to complete the boiler system. The boiler system can therefore be completed simply and easily with the set.

- The intermediate return piece (→ Fig. 50, page 72) is integrated ready for operation and can therefore not be used in addition.
- Other versions of the return flow temperature safeguard set (e.g. with bypass pump, horizontal connection layout, etc.) are available on request.
- When planning the system, ensure the set matches the system-specific conditions.
- Dimensions and specification of the return flow temperature safeguard set are available on request.

10.5 Additional devices for sound insulation

10.5.1 Requirements

The necessity and scope of measures for sound insulation are based on the sound pressure level and the noise disturbance this causes. Bosch offers three sound insulation devices that are specially matched to the UNIMAT UT-L boiler. They can be supplemented with additional on-site sound insulation measures.

On-site measures include providing sizing and installation information to attenuate structure-borne noise, compensators in the connection lines and flexible connections with the building. The devices for sound insulation require extra space, which should be factored in at the planning stage.

The use of sound insulation measures depends on the purpose of the building and the requirements made of adjacent rooms and the surrounding area.

10.5.2 Flue gas silencer

A large proportion of the noise caused by combustion can be transferred via the flue system to the building. Specially adapted flue gas silencers can significantly reduce the sound pressure level.

10.5.3 Burner silencer hoods

The airborne noise created by the burner during operation can be attenuated with a burner silencer hood.

When designing the installation room, allow extra space to remove the silencer hood.

Bosch offers burner silencer hoods matched to the relevant project. The space required, dimensions and attenuation values are available on request.

10.5.4 Boiler mounts to attenuate structure-borne noise

Boiler mounts to attenuate structure-borne noise can be used to prevent the transmission of structure-borne noise to the foundation and the building. To achieve the required attenuation, the boiler installation surface must be perfectly even (foundation dimensions → page 78).

When designing boiler mounts to attenuate structure-borne noise, bear in mind that the installation height of the boiler and therefore the position of the pipework connections can vary. To compensate for the spring deflection of the boiler mounts and to minimise sound transmission via the water connections, we also recommend installing pipe compensators in the heating water pipe.

The boiler mounts to attenuate structure-borne noise must be designed for the boiler in question.

The vibration dampers are no longer positioned right under the supports. Instead, the vibration dampers are positioned as strips, as they work best with a certain spring compression. Insulation strips are therefore supplied as required for the order.

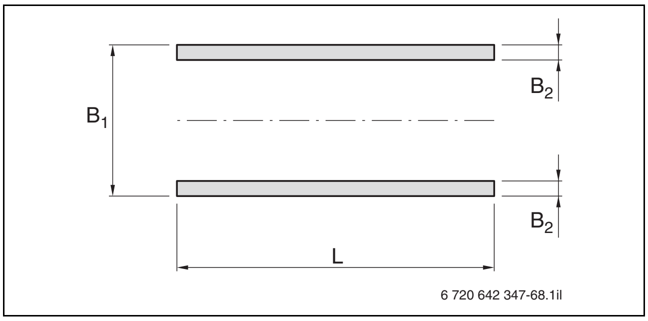

Fig. 54 Boiler mounts to attenuate structure-borne noise for UNIMAT UT-L boilers (example illustration)

10.5.5 Boiler foundation

The UNIMAT UT-L boiler is equipped with robust base supports consisting of channel sections for even load distribution. If a foundation is planned, it should not go as far as the side walls of the boiler room because of this sound insulation.

If suitable boiler mounts are planned for sound insulation (→ page 77), ensure the foundation is level to within ± 1 mm. This guarantees an even load on the boiler mounts.

The following requirements of the foundation must be met:

- Ensure that the floor of the installation area is perfectly even (tolerance with reference to DIN 18202) and has sufficient load-bearing capacity.
- Cover any floor channels and provide drainage facilities.
- When calculating the load-bearing capacity of the foundation, take account of the maximum operating weight of the components concerned. When determining the operating weight, take account of additional components (e.g. control panel, burner, silencer, flues, etc.) and include their weight. The operating weight is the weight of the components when filled.
- Measure the operating weight of the boiler at the front and back feet of the foundation. Please note that the back boiler foot (seen from the burner side) is designed as a fixed point on the longitudinal support. The front boiler foot is designed as a movable bearing, i.e. the boiler expands towards the front when heating up.
- Every component must be levelled.
- If separation is required between the installation space and the system for sound insulation, place sound insulating strips below before installing the system.
- If the boiler or system components are installed on a support base, use suitable spring systems as supports and to absorb operational vibrations.

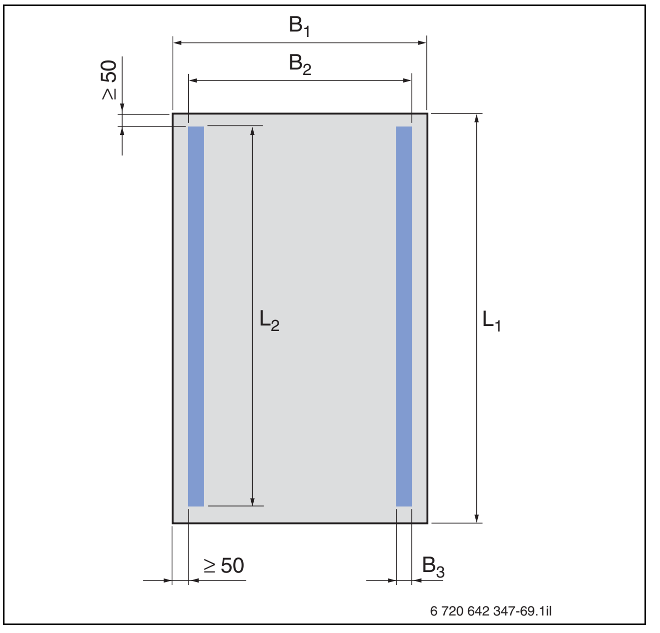

Fig. 55 Boiler foundation for UNIMAT UT-L boilers

UNIMAT UT-L boiler		Foundation		Base frame		Channel section	
Boiler size	Boiler size	Length L_1 [mm]	Width B_1 [mm]	Length L_2 [mm]	Width B_2 [mm]	Height H [mm]	Width B_3 [mm]
UT-L 1	–	1850	810	1750	710	120	55
UT-L 4	UT-L 2	2200	1010	2100	910	120	55
UT-L 10	UT-L 6	2450	1010	2350	910	120	55
UT-L 14	UT-L 8	2660	1030	2560	930	160	65
UT-L 18	UT-L 12	3130	1230	3030	1130	160	65
UT-L 24	UT-L 16	3160	1250	3060	1150	200	75
UT-L 28	UT-L 20	3510	1250	3410	1150	200	75
UT-L 30	UT-L 22	3920	1350	3820	1250	200	75
UT-L 34	UT-L 26	4020	1610	3920	1510	220	80
UT-L 40	UT-L 32	4380	1610	4280	1510	220	80
UT-L 42	UT-L 36	4580	1620	4480	1520	240	85
UT-L 46	UT-L 38	4750	1710	4650	1610	240	85
UT-L 50	UT-L 44	5150	1730	5050	1630	280	95
UT-L 54	UT-L 48	5420	1990	5320	1890	280	95
UT-L 58	UT-L 52	6100	1990	6000	1890	280	95
UT-L 60	UT-L 56	6490	2200	6390	2100	320	100
UT-L 64	UT-L 62	6890	2200	6790	2100	320	100

Table 39 Boiler foundation dimensions for UNIMAT UT-L boilers; the dimensions specified are recommended values and may vary from system to system.

10.6 Further accessories

10.6.1 Drain connection and blow-down valve assembly

To enable the boiler to be drained quickly and, if required, the boiler sludge to be removed, we recommend a drain connection as shown in Fig. 56.

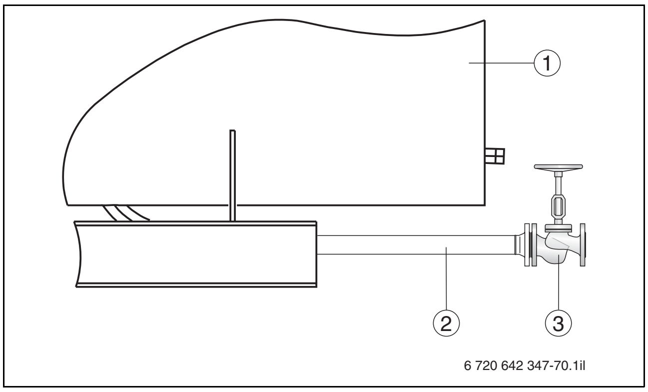

Fig. 56 Design of the drain connection for UNIMAT UT-L boilers

[1] UNIMAT UT-L boiler
[2] Boiler drain
[3] Drain valve

10.6.2 Walk-on boiler cover

As additional equipment, Bosch offers a walk-on boiler cover. Also available with this are a ladder and safety rail with toe board. The walk-on boiler cover is already fitted when the boiler is delivered. The safety rail and ladder are to be fitted on site. The ladder can be mounted on the left hand or right hand side of the boiler. Please specify which side when ordering the walk-on boiler cover. In the case of gas combustion, the ladder should be fitted opposite the gas train.

Fig. 57 Walk-on boiler cover

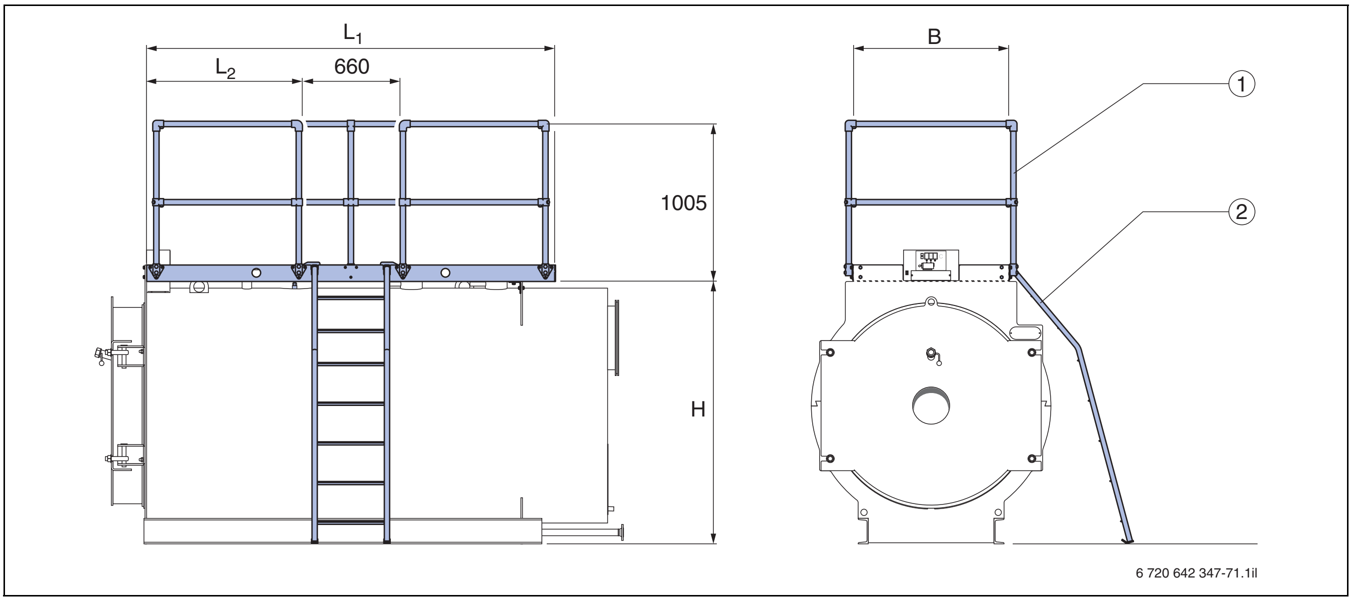

Fig. 58 Dimensions of the walk-on boiler cover for UNIMAT UT-L boilers; rail and ladder are optional (dimensions in mm)

[1] Rail (optional)
[2] Ladder on either the left hand or right hand side (optional)

UNIMAT UT-L boiler		Dimensions[1)]				Weight[2)]
		Length		Width	Height	
		L_1	L_2	B	H	
Boiler size		[mm]	[mm]	[mm]	[mm]	[kg]
UT-L 4	UT-L 2	2150	745	900	1505	155
UT-L 10	UT-L 6	2400	870	900	1605	165
UT-L 14	UT-L 8	2600	970	1000	1705	195
UT-L 18	UT-L 12	3100	1220	1100	1755	235
UT-L 24	UT-L 16	3100	1220	1100	1855	235
UT-L 28	UT-L 20	3450	1395	1100	1905	255
UT-L 30	UT-L 22	3800	1570	1200	2005	305
UT-L 34	UT-L 26	3950	1645	1200	2105	315
UT-L 40	UT-L 32	4300	1820	1400	2305	405
UT-L 42	UT-L 36	4500	1910	1400	2455	420
UT-L 46	UT-L 38	4800	2070	1600	2605	490
UT-L 50	UT-L 44	5100	2220	1800	2755	590
UT-L 54	UT-L 48	5400	2370	1800	2905	610
UT-L 58	UT-L 52	6100	2720	1800	3105	680
UT-L 60	UT-L 56	6600	2970	2000	3405	900
UT-L 64	UT-L 62	7000	3170	2000	3605	980

Table 40 Specification of the walk-on boiler cover for UNIMAT UT-L boilers

1) The dimensions specified are recommended values and may vary from system to system.

2) Including rail and ladder

11 Flue system

11.1 Requirements

11.1.1 General notes

As a basis for calculation and for sizing the flue system, please refer to EN 13384. The following formulae can be used to calculate the flue gas mass flow rates.

With oil combustion (CO_2 content 13,5 %):

$$m_{Abg,\,Ös} = Q_F \times \frac{4{,}104\ \text{kg}}{10000\ \text{kWs}}$$

F. 9 Calculation of the flue gas mass flow rate with oil combustion

$\dot{m}_{Abg,\,Öl}$ Flue gas mass flow rate with oil combustion in kg/s
$\dot{Q}_F$ Rated heat input in kW

With gas combustion (CO_2 content 10,5 %):

$$m_{Abg,\,Gas} = Q_F \times \frac{4{,}082\ \text{kg}}{10000\ \text{kWs}}$$

F. 10 Calculation of the flue gas mass flow rate with gas combustion

$\dot{m}_{Abg,\,Gas}$ Flue gas mass flow rate with gas combustion in kg/s
$\dot{Q}_F$ Rated heat input in kW

The rated heat output is the result of the selected rated output and the associated efficiency (→ page 28).

$$Q_F = \frac{Q_N}{\eta_K} \times 100\ \%$$

F. 11 Calculating the rated heat input

η_K Boiler efficiency in %
$\dot{Q}_F$ Rated heat input in kW
$\dot{Q}_N$ Rated output in kW

The requirements of the flue system and flue gas routing can be derived from the results of the calculations.

11.1.2 Special information for flue systems of boilers with condensing flue gas heat exchangers

A correctly sized flue system is essential for the function and operation of the boiler with condensing heat exchanger. Only flue pipes approved according to Building Regulations are permissible. When selecting the flue system, also consider the requirements in the approval document.

If positive pressure is to be expected within the flue system and if the flue system is routed through frequently used rooms, the entire flue must be installed in a duct with secondary ventilation. Observe country-specific requirements.

11.1.3 Material requirements for flue systems of boilers with condensing heat exchangers

The material of the flue must be heat-resistant with regard to the flue temperature that will occur, moisture-resistant and resistant to acidic condensate. Among other materials, stainless steel flues or other moisture-resistant chimneys are suitable.

Flues are categorised into groups depending on their maximum flue gas temperature (80 °C, 120 °C, 160 °C and 200 °C). With gas condensing boilers, the flue gas temperature can be below 40 °C, independent of the maximum flue gas temperature. Moisture-resistant chimneys must therefore also be suitable for temperatures below 40 °C. A suitable flue must be approved by the "Deutsches Institut für Bautechnik" in Berlin.

With moisture-resistant chimneys, the draught must not be more than 0 Pa at the chimney inlet.

12 Condensate drain

12.1 Condensate

12.1.1 Creation

When fuels containing hydrogen are burned, water vapour condenses in the condensing heat exchanger and flue system. The volume of condensate created per kilowatt hour is determined by the ratio of carbon to hydrogen in the fuel. The condensate volume depends on the return temperature, the amount of excess air during combustion and the loading of the heat source.

12.1.2 Condensate disposal

Route condensate from boilers, especially boilers with condensing heat exchangers, into the public sewage system in accordance with local regulations. As the rated output levels of the boilers and boilers with condensing heat exchangers are above 200 kW, check whether the condensate needs neutralising before disposal. With dual fuel combustion, ensure the neutralising system is suitable for oil combustion.

To calculate the precise condensate volume created per year, use the following formula:

$$V_K = Q_F \times m_K \times b_{VH}$$

F. 12 Calculation of the annual condensate volume

b_{VH} Hours of full utilisation (to VDI 2067) in h/a
m_K Specific condensate volume in kg/kWh (assumed density ρ = 1 kg/l)
$\dot{Q}_F$ Rated heat input of the heat source in kW
$\dot{V}_K$ Condensate volume in l/a

> **i** It is advisable to find out about local regulations regarding condensate disposal prior to installation.

12.2 Neutralising system NE 2.0

12.2.1 Installation

In the case of gas combustion, the neutralising system NE 2.0 can be used. It should be installed between the condensate outlet from the gas condensing boiler and the connection to the public sewage system. Site the neutralising system behind or adjacent to the boiler with condensing heat exchanger. To enable the condensate to drain freely, install the neutralising system at the same height as the boiler. As an alternative, it can also be installed at a lower height.

> **i** Design the condensate hose in accordance with country-specific requirements using suitable materials, e.g. PP plastic.

Dimensions and connections	Unit	Neutralising system NE 2.0 1)
Width	mm	545
Depth	mm	840
Height	mm	275
Inlet	–	DN40/DN20 2)
Sequence	–	DN20
Drain	–	DN20

Table 41 Dimensions and connections of the neutralising system NE 2.0

1) Weight in operation approx. 60 kg

2) Option for hose connection

12.2.2 Equipment level

The neutralising system NE 2.0 consists of a rectangular plastic casing with separate chambers for the neutralising agent and the neutralised condensate, a level-controlled condensate pump and an integral electronic control unit.

The level-controlled condensate pump has a head of approx. 2 m. If required, the head can be increased to approx. 4.5 m with a pressure raising module.

The integral electronic control unit has functions for monitoring and service:

- Burner safety shutdown in conjunction with CFB control units from Bosch
- Overflow protection
- Display for changing the neutralising granulate
- Display of the operating status
- Forwarding fault signals

12.2.3 Neutralising agent

Fill the neutralising system NE 2.0 with 17.5 kg of neutralising agent. Through contact between the condensate and the neutralising agent, the condensate pH value will be raised to between 6.5 and 10. At this pH value, the neutralised condensate can be introduced into the domestic sewage system. The condensate volume affects how long the granulate filling will last. Replace the spent neutralising agent when the pH value of the neutralised condensate falls below 6.5. Refill with granulate when the signal lamp illuminates.

12.2.4 Pump output graph

The graph in Fig. 59 shows the head of the neutralising system NE 2.0 subject to the pump rate. If the pressure raising module is used for the neutralising system NE 2.0, the heads are added together, as two pumps with the same characteristics are connected downstream of one another. When calculating the actual pump head, take the pipework pressure loss on the pressure side into consideration.

The limited start duration of the condensate pump means the neutralising system NE 2.0 can be used for maximum condensate volumes of approx. 200 litres per hour.

For larger condensate volumes, two neutralising systems NE 2.0 can be connected in parallel. BFor systems with a higher output and therefore larger condensate volumes, or for systems with dual fuel combustion, Bosch offers a further range of neutralising systems.

Example

For a boiler with condensing heat exchanger, boiler size UT-L 24 (DHW inlet temperature into the condensing heat exchanger 30 °C), approx. 200 litres of condensate are created per hour of heating operation. A neutralising system NE 2.0 is sufficient for this.

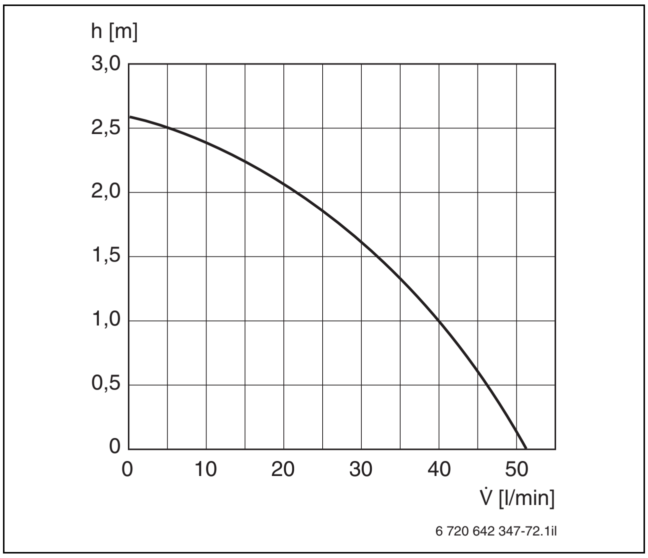

Fig. 59 Pump output graph for the neutralising system NE 2.0

h Residual head
V̇ Flow rate

Keyword index

Notes

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