Planner Guide

High-output calorifier Modul-plus

Hoval

Favourite choice for refined domestic hot water convenience

planning

planning

planning

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1 Outstanding application for a Hoval Modul-plus system

The Hoval Modul-plus system is an ideal solution for all applications where a big demand of fresh domestic hot water is needed in a short time.
Ideal fields of application would be for example:

- Hospitals
- Hotels
- Sport centers
- Restaurants
- Universities
- Factories
- etc.

1.1. Benefits of a Hoval Modul-plus system

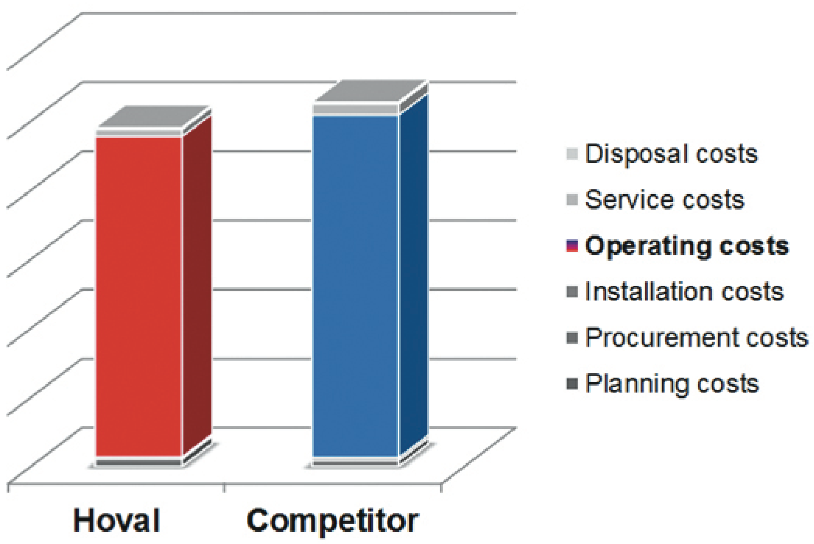
Our best cost of ownership philosophy is part of the Hoval Modul-plus system which means: Related over the product lifetime, the best price performance ratio for our end-users.

This takes in consideration following aspects:

Planning costs	1. Planning
Procurement costs	2. Purchase 3. Product 4. Administration
Installation costs	5. Installation 6. System integration 7. Commissioning
Operating costs	8 .Operating 9. Environmental 10. Maintenance
Service costs	11. Service
Disposal costs	12. Disposal

Hoval is worldwide known as technological leading supplier of innovative easy- systems for heat and ventilation technology with a high measurably economical and ecological added value for the customer.

Innovative easy-systems with measurable added value



1. Planner: Easy to plan (providing fast information in the required quality and quantity)
2. Installer: Easy to purchase (one order, one supplier)
3. Owner: Product costs are not necessarily to be low (high quality material and manufacturing, high efficiency, Swiss engineered products)
4. Installer: Administration cost (responsible one stop shop)
5. Installer: Installation cost (principle P&I including all information and supply of components for a perfect functional system)
6. Installer: System integration (Hoval System technology and controls matches all building requirements, eg. BMS, lead lag, etc.)
7. Installer: Commissioning costs (since all components match from the beginning,checked by Hoval engineers and Hoval on site engineers fast commissioning is possible)
8. Owner: Running cost (high efficiency, engineered products with focus to conservation of energy and environment lead to low running cost. Cheap products are not always cheap in the long run time.)
9. Owner: Environmental costs (all our products comply with the latest regulations and they are even better)
10. Owner: Maintenance costs (engineered products with focus to easy maintenance lead to lower costs)
11. Owner: Service cost's (engineered quality products usually need less Service in life)
12. Owner: Disposal cost's (Construction in combination with the selected materials allow a cost effective disposal)

Last but not least, a Hoval Modul-plus system provides you further advantages, such as:

- Thanks to the internal construction, long life time calcium carbonate or difficult / bad water qualities will not reduce the long life time of Modul-plus
- Less fuel consumption since our hot water systems operate on highest efficiency
- More safety by using two boilers with smaller capacity instead of one large boiler
- Less pipe work & fittings
- Less space required in comparison to storage tanks, therefore more usable space for other applications
- Less weight in comparison to storage tanks leads to less static in the building construction
- More than 35 years experience with semi-instantaneous heaters

and finally, behind all you will find the Hoval family; friendly, professional, solution oriented, enthusiastic and responsible for energy and environment.

1.2. Product overview

The following Hoval Modul-plus types are available:
F21, F31, F41, F51 and F32, F42, F52

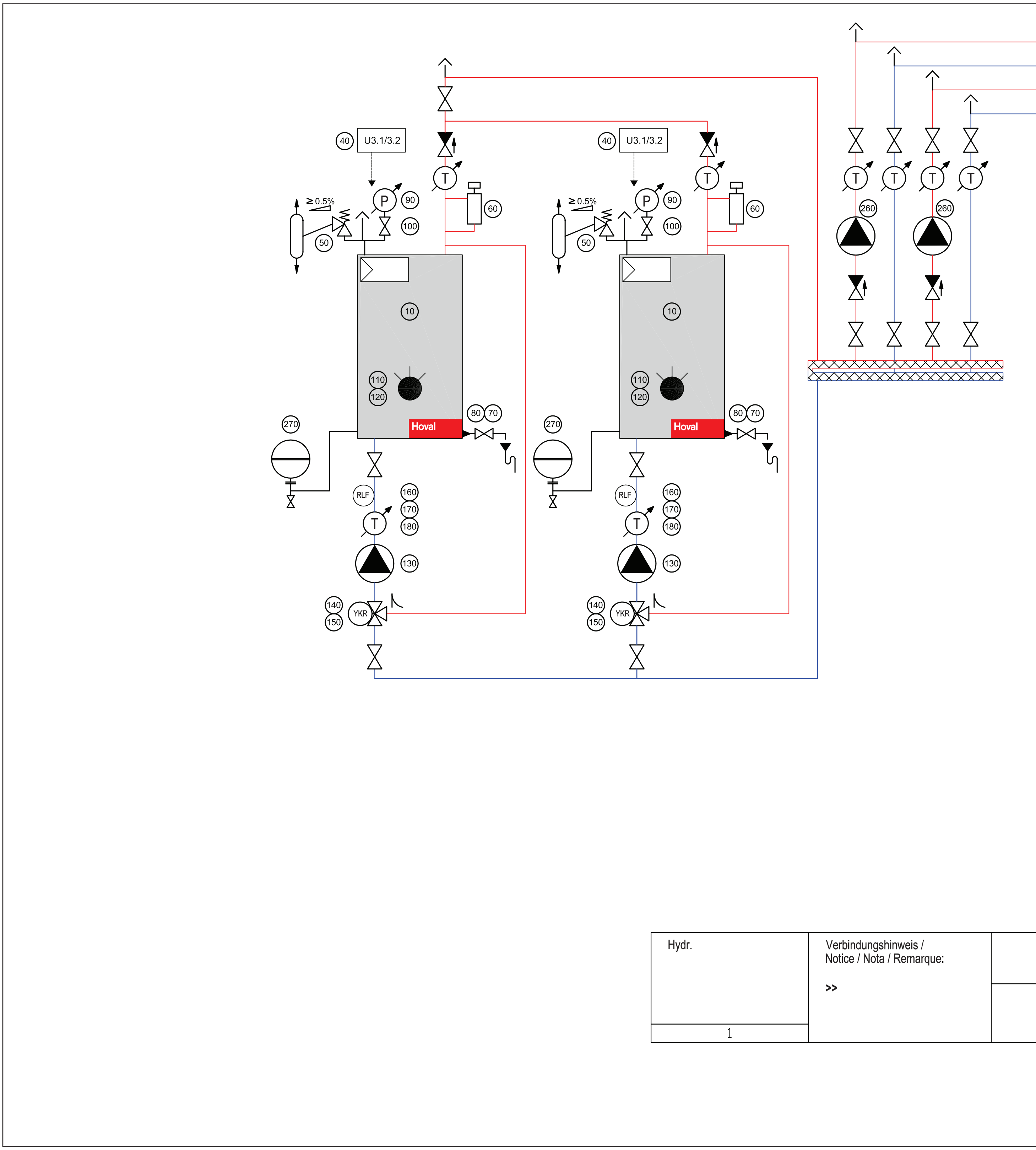
You can combine all Hoval Modul-plus types with:

- Hoval Uno-3 (low temperature hot water boiler with possibility of low NOx firing)
- Hoval Max-3 (traditional 3-pass hot water boiler with possibility of low NOx firing)
- Hoval CompactGas (new developed high efficiency near condensing high temperature boiler with the possibility on low NOx firing)
- Hoval UltraGas (fully condensing high efficiency, high tech and easy boiler)
- Hoval Biral pumps
- Hoval Control panel
- Hoval selected and matched control valves, safety valves, pressure gauges, etc.

All types of the Modul-plus can be used for different domestic hot water qualities.

Modul-plus type	Maximum chloride content of drinking water [mg/liter]	Working pressure [bar] Drinking water	Working pressure [bar] Heating
F21, F31, F41, F51, F32, F42, F 52	30	6	5
	100	6	5
	100	10	8
	200	6	5
	200	10	8
	300	10	8

2 System P&I Diagram (Cascade with digital control panel)



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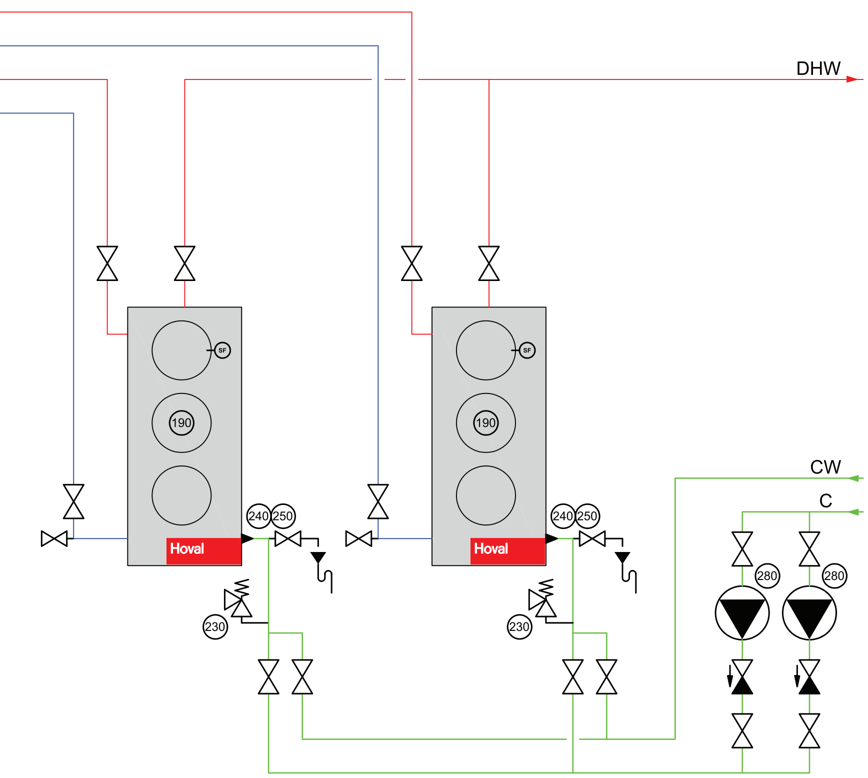

Position	Description	Legend
10	Hoval Boiler	DHW : domestic hot water
40	Boiler control panel	CW : Cold water
50	Safety valve	C : Circulation
60	Low water protection	
70	Drain valve	
80	Reduction sleeve	
90	Pressure gauge	
100	Pushbutton valve	
110	Intermediate flange drilled	
120	Burner	
130	Boiler loading pump	
140	3-way valve	
150	Actuator	
160	Fixed value controller	
170	Immersion sleeve	
180	Immersion sensor	
190	Hoval calorifier Modul-plus	
220	Calorifier Modul-plus control panel	
230	Safety valve	
240	Reduction sleeve	
250	Drain valve	
260	Calorifier Modul-plus loading pump	
270	Expansion tanks	
280	DHW circulation pump	

System P & I diagram Modul Plus

Hoval

Achtung! Für die Installation muss das anlagenbezogene Schema verwendet werden!
Attention! This is just a schematic. For installation please use the detail-plan!
Attenzione! Per la messa in opera, utilizzare le schema dettagliato!
Attention! Pour la réalisation pratique de l'installation, il faut utiliser le schéma détaillé!

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3 Domestic hot water demand and selection of Modul-plus

Four steps to design the main components of the Modul-plus hydraulic.

To be able to calculate the size of the Modul-plus and boiler capacity, it is necessary to know the peak demand rate and the average demand rate. If no demand values are given, the values below can be used for further calculation. The load factors given in the end columns indicate the typical distribution of the demands. It is highly recommended that these values are accepted by the design agency. One should always ask for details of hot water peak requirement!

3.1. Step 1: Calculation of the maximum demand rate at 60°C

Installation litres per hour at 60° C	Private Hand Basin	Public Hand Basin	Shower*)	Bath	Slop Sink	Bar Sink	Kitchen Sink	Pantry Sink	Laboratory Sink	Average Load Factor	10 min Peak Load Factor
Hospital	10	15	70	60	50		80			**0.80**	**0.30**
Hotel (> 100 rooms) and residential hall	5	15	50	50	50	100	80			**0.75**	**0.25**
Day school	5	20	180		40		80			**0.80**	**0.40**
Sport centre	5	15	220		40	100	80			**1.00**	**0.50**
Restaurant	5	25			100	100	140	120		**1.00**	**0.50**
University	5	20	220		40		80		40	**0.80**	**0.40**
Offices	5	10			40		40		40	**1.00**	**0.50**
Factory	5	20	120		50		80		40	**1.00**	**0.75**
Apartments (>30 units)	5		50	100			45			**0.50**	**0.20**

*) Where shower and bath are combined in one single cubicle it is only necessary to use one demand rate and the total number of cubicles.

Example: Hotel with 200 rooms & restaurant

Installation - Hotel	Quanities	Consumption each item according table page 8		Total
Hotel, Combined baths/showers*)	200 pcs.	50 l/h	=	10'000 l/h
Hotel, Private hand basins*)	200 pcs.	5 l/h	=	1'000 l/h
Hotel, Pubilc hand basins*)	10 pcs.	15 l/h	=	150 l/h
Hotel, slop sinks*)	10 pcs.	50 l/h	=	500 l/h
Hotel, Kitchen sinks*)	10 pcs.	80 l/h	=	800 l/h
Restaurant, Kitchen Sinks*)	4 pcs.	140 l/h	=	560 l/h
		Maximum Demand Rate		**13'010 l/h**

Hotel, Average Load Factor	0.75
Hotel, 10 Minutes Peak Load Factor	0.25

*) estimated number of consumption fittings (to be checked locally)

3.2. Step 2: Calculation of the average demand rate at 60°C

You need this average demand on page 12 for the required boiler output.

Average Demand Rate =
Maximum Demand Rate x Average Load Factor

Average Demand Rate =

$$13'010 \left[\frac{\text{liters}}{\text{hour}} \right] \times 0.75 = 9'757.5 \left[\frac{\text{liters}}{\text{hour}} \right]$$

3.3. Step 3: Calculation of the 10 minutes peak demand rate at 60°C

Peak Demand Rate $_{(10\ \text{min},\ 60°\text{C})}$ =
Maximum Demand Rate x Peak Load Factor $_{(10\ \text{min})}$

Peak Demand Rate $_{(10\ \text{min},\ 60°\text{C})}$ =

$$13'010 \times \left[\frac{\text{liters}}{\text{h}} \right] \times 0.25 = 3'252.5 \left[\frac{\text{liters}}{\text{10 min}} \right]$$

3.4. Step 4: Selection of Modul-plus calorifier

In the end, you have to decide which flow temperature for your plant you want.

There are three tables:

Table 1, see page 10:
Hot water output at a flow temperature of 90°C
Table 2, see page 11:
Hot water output at a flow temperature of 80°C
Table 3, see page 11:
Hot water output at a flow temperature of 70°C

The formula of how many Modul-plus calorifier are needed is the following:

Number of Modul plus calorifier =

$$\frac{\text{Calculated Peak Demand Rate}_{(10\ \text{min},\ 60°\text{C})}}{\text{litres /10 min}_{(60°\text{C, according table})}}$$

Remark: The result must always be rounded up to a whole number.

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In our example we have chosen a flow temperature of 90°C.
According to the table “Hot water output at a flow temperature of 90°C” you can calculate the number of Modul-plus calorifiers as follows:

Modul-plus F32

Number of Modul-plus calorifier F32 =

3'252.5 /1250 = 2.6 (rounded up) = 3

Modul-plus F42

Number of Modul-plus calorifier F42 =

3'252.5 /1790 = 1.81 (rounded up) = 2

Modul-plus F52

Number of Modul-plus calorifier F52 =

3'252.5 /2315 = 1.4 (rounded up) = 2

What we have chosen for our example is 2 times Modul-plus F42 with Biral pump L804.
The calorifier Modul-plus F42 fits a little bit better in comparison to F52.

Hot water outputs at a flow temperature of 90°C

Only to be used if high outputs are demanded constantlys (e.g. Hotels, Industriy and Trade).
Primary flow connection on the top of the Calorifier (counter flow).

Calorifier Modul-plus								Hot Water Output				
Type	Number	Volume	Heating	Loading Pump Biral Redline				*Liter/10 min.		*Liter/h		
	of Bottles	Liter	Surface m²	Type	m3/h	mWS	*mbar	60°C	45°C	60°C	45°C	*kW
F21	2	230	2.84	L323	3.5	1.7	25	385	550	1360	2250	91.5
				L402	8	2.0	120	455	650	1960	3480	141.80
F31	3	345	4.26	L323	4	1.5	40	499	713	1850	3450	140.4
				L402	7	2.2	120	555	793	2550	4300	175.0
				L654	12	5.5	450	625	893	3300	5800	236.0
F41	4	460	5.68	L323	4	1.5	55	685	978	2250	4100	166.8
				L503	8	3.4	240	810	1157	3500	6400	260.4
				L654	10.5	5.7	440	875	1250	4150	7500	305.2
F51	5	575	7.10	L323	4	1.5	75	930	1329	3050	5650	229.9
				L504	8	4.3	300	1080	1543	4350	7800	317.4
				L804	12	8.1	720	1185	1692	5250	9100	370.3
F32	6	690	8.52	L401	8	1.5	45	998	1426	3700	6900	280.8
				L653	14	3.5	165	1110	1585	5100	8600	350.0
				L654	18	4.8	300	1170	1671	5800	9800	398.8
				L804	24	7.0	530	1250	1785	6600	11600	472.0
F42	8	920	11.36	L401	8	1.5	62	1370	1956	4500	8200	333.7
				L653	12	3.7	150	1500	2142	5800	10400	423.2
				L654	16	5.1	260	1620	2314	7000	12800	520.9
				L804	21	7.3	440	1790	2544	7990	14000	569.7
F52	10	1150	14.20	L402	8	2.0	82	1860	2658	6100	11300	459.8
				L654	16	4.8	340	2160	3085	8700	15600	634.8
				L804	21	7.3	610	2315	3316	10000	17500	712.2

*mbar = Flow resistance in the calorifier
*Liter/10 min. = Calorifier heated up to 60°C
*Liter/h = Continuous output per hour (cold water inlet temperature 10°C)
*kW = Input required at 45°C/10°C

Hot water outputs at a flow temperature of 80°

Primary flow connection on the top of the Calorifier (counter flow).

Calorifier Modul-plus Type	Number of Bottles	Volume Liter	Heating Surface m²	Loading Pump Biral Redline Type	m3/h	mWS	*mbar	Hot Water Output *Liter/10 min. 60°C	45°C	*Liter/h 60°C	45°C	*kW
F21	2	230	2.84	L323	3.5	1.7	25	335	478	900	1880	76.5
				L402	8	2.0	120	380	542	1300	2840	115.5
F31	3	345	4.26	L323	4	1.5	40	457	652	1350	2800	113.9
				L402	7	2.2	120	495	706	1800	3650	148.5
				L654	12	5.5	450	545	778	2400	4600	187.2
F41	4	460	5.68	L323	4	1.5	55	635	907	1750	3350	136.3
				L503	8	3.4	240	730	1042	2700	5250	213.6
				L654	10.5	5.7	440	780	1113	3200	6150	250.2
F51	5	575	7.10	L323	4	1.5	75	831	1187	2200	4900	199.4
				L504	8	4.3	300	950	1356	3200	6600	268.6
				L804	12	8.1	720	1035	1477	3950	7900	321.5
F32	6	690	8.52	L401	8	1.5	45	914	1305	2700	5600	227.9
				L653	14	3.5	165	990	1413	3600	7300	297.0
				L654	18	4.8	300	1040	1485	4200	8100	329.6
				L804	24	7.0	530	1090	1556	4800	9200	374.4
F42	8	920	11.36	L401	8	1.5	62	1270	1814	3500	6700	272.6
				L653	12	3.7	150	1380	1970	4600	8700	354.0
				L654	16	5.1	260	1480	2113	5400	10500	427.3
				L804	21	7.3	440	1620	2290	5920	12480	507.9
F52	10	1150	14.20	L402	8	2.0	82	1662	2374	4400	9800	398.8
				L654	16	4.8	340	1900	2713	6400	13200	537.2
				L804	21	7.3	610	2015	2877	7400	15600	634.8

Hot water outputs at a flow temperature of 70°C

Primary flow connection on the top of the Calorifier (counter flow).

Calorifier Modul-plus Type	Number of Bottles	Volume Liter	Heating Surface m²	Loading Pump Biral Redline Type	m3/h	mWS	*mbar	Hot Water Output *Liter / 10 min. 60°C	45°C	*Liter / h 60°C	45°C	*kW
F21	2	230	2.84	L323	3.5	1.7	25	304	434	640	1520	61.8
				L402	8	2.0	120	342	488	960	2120	86.2
F31	3	345	4.26	L323	4	1.5	40	403	575	700	2100	85.4
				L402	7	2.2	120	420	600	900	2800	113.9
				L654	12	5.5	450	445	635	1200	3600	146.5
F41	4	460	5.68	L323	4	1.5	55	570	814	1100	2700	109.8
				L503	8	3.4	240	630	900	1700	4100	166.8
				L654	10.5	5.7	440	660	942	2000	4850	197.3
F51	5	575	7.10	L323	4	1.5	75	720	1028	1250	3750	152.6
				L504	8	4.3	300	796	1137	1900	5200	211.6
				L804	12	8.1	720	855	1221	2400	6300	256.3
F32	6	690	8.52	L401	8	1.5	45	806	1151	1400	4200	170.9
				L653	14	3.5	165	840	1200	1800	5600	227.9
				L654	18	4.8	300	864	1234	2100	6200	252.3
				L804	24	7.0	530	890	1271	2400	7200	293.0
F42	8	920	11.36	L401	8	1.5	62	1140	1628	2200	5400	219.7
				L653	12	3.7	150	1200	1714	2800	6700	272.6
				L654	16	5.1	260	1260	1800	3400	8200	333.7
				L804	21	7.3	440	1340	1940	3600	9490	384.1
F52	10	1150	14.20	L402	8	2.0	82	1440	2057	2500	7500	305.2
				L654	16	4.8	340	1592	2274	3800	10400	423.3
				L804	21	7.3	610	1674	2391	4500	11800	480.2

*mbar = Flow resistance in the calorifier
*Liter/10 min. = Calorifier heated up to 60°C
*Liter/h = Continuous output per hour (cold water inlet temperature 10°C)
*kW = Input required at 45°C/10°C

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4 Required boiler output

For applications such as first-class hotels, hospitals etc. where hot water is of great importance, we recommend for safety and redundancy reasons, to choose two boilers working as a cascade. Each of them being able to cover 2/3 of the total average hot water demand. This is for safety reasons important if one boiler failed.

Required boiler output [kW] =

$$\left[\frac{2}{3}\right] \text{ x Average Demand Rate x c x } \Delta t$$

Average Demand Rate:
9757.5 [l/h], (1 liter of water = 1 kg)

c: Specific thermal capacity of water

$$\left[\ 0.00116 \frac{\text{kWh}}{\text{kg x k}}\right]$$

t1: DHW target temperature [60°C]
t2: Cold water temperature [10°C]
Δt: t1 - t2 Kelvin, [K]

Required boiler output [kW] =

$$\left[\frac{2}{3}\right] \text{ x } 9'757.5 \left[\frac{\text{kg}}{\text{h}}\right]$$

$$\text{x } 0.00116 \left[\frac{\text{kWh}}{\text{kg x K}}\right] \text{ x (60 - 10) K = 377 kW}$$

We choose two heating boilers of the type **Hoval Max-3 (420**), with a capacity range of - in depending of the used burner - 320 up to 500 kW.

Determination of the heating power
If a heating circuit is required by the building, the engineer (planner) must define the required capacity [kW].

5 General - Calculation of pressure losses

The total pressure losses are determined by adding the individual pressure losses.

These are:

- Pressure losses in the piping, comprising:
  Pressure losses in straight piping
  Pressure losses at the individual points of resistance (fittings, heat exchanger, elbow bends, etc.)

Calculation of total pressure losses

P: Total pressure loss
Δp: Pressure loss due to friction in straight piping
Z: Pressure loss at the individual points of resistance (fittings, heat exchanger, elbow bends, etc.)

R: Pressure gradients $\left[\frac{\text{mbar}}{\text{m}} \right]$

L: Piping length [m]

$$P = \Delta p + Z \text{ [mbar]}$$

$$\Delta p = R \times L$$

ξ values for calculating the pressure loss at the individual points of resistance

The zeta values of the fittings are dependent on their type and size. The manufacturer must provide these zeta values!

The values in the table are based on comparative values which were determined in experiments. They can be used as a rough guide.

Individual point of resistance	ξ value
Straight-way cock	0.2
Right angle stopcock	2
Elbow bend 90°	0.5
Tiered elbow bend	0.5
Y-piece	1.5
Straight-way T-piece	0.5
T-piece branch	1

Nominal width DN	10 15	20 25	32 40	50 >50
Straight-seated valve	10	7	5	4
Angled-seated valve	3.5	3	2.5	2
Non-return valve	5	4	4	3.5
Check valve	2	1.5	1.2	1

Fittings

Straight-way stopcock

Elbow bend 90°

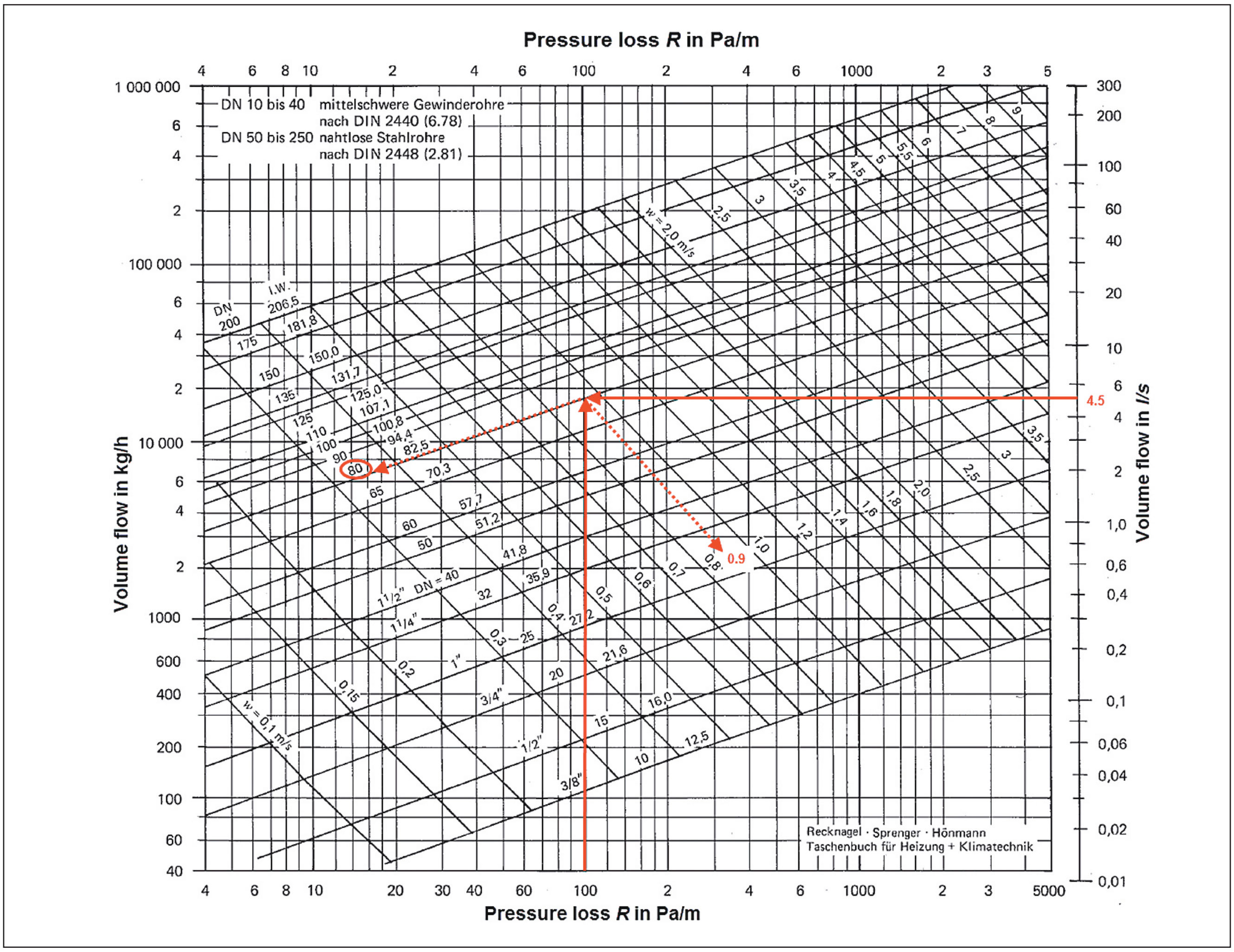
T-piece straight stopcock

Angle-seated valves

Straight-seated valve

Non-return valve

6 Pressure loss calculation (Heating distributor to Modul-plus)



According to the pipe friction chart for steel pipes, a pipe diameter of DN 80 needs to be chosen for the piping between heating distributor to Hoval Calorifier Modul-plus.

Maximum volume flow of the Biral pump L804 is 21 m³/h (see page 10)

In our example we have:

$$m = \frac{Q}{c \times \Delta T} =$$

$$= \frac{377\ \text{kW}}{(0.00116\ \text{kWh / kg x K}) \times 20\ \text{K}} = 16.2\ \text{m}^3/\text{h}$$

Assumption:
Maximum temperature rise, ΔT 20K

Volume flow m =

$$16'200 \left[\frac{\text{l}}{\text{h}}\right] = \frac{16'200}{3'600} \left[\frac{\text{L}}{\text{s}}\right] = 4.5 \left[\frac{\text{l}}{\text{s}}\right]$$

The pressure loss R in our case is:

$$100 \left[\frac{\text{Pa}}{\text{m}}\right] = \frac{1\ \text{mbar}}{\text{m}}$$

At the end we get the result of a pipe diameter of **DN 80** and a flow speed of **0.9 m/s.**

6.1. Pressure losses in straight piping (Heating distributor to Modul-plus)

The resistance of the piping is normally calculated by using a design program.
This procedure is indispensable for large systems with complex hydraulics.

$$\Delta p = R \times L$$

Δp: Pressure loss due to friction in straight piping sections [mbar]

R: Pressure loss (see diagram, page 14)

$$100 \left[\frac{Pa}{m} \right] = \frac{1.0 \text{ mbar}}{m}$$

L: Piping length 21 m (flow and return pipes)

$$\Delta p = 1.0 \left[\frac{mbar}{m} \right] \times 21 \text{ [m]} = 21 \text{ [mbar]}$$

6.2. Pressure loss at individual points of resistance (Heating distributor to Modul-plus)

$$Z = \sum\xi \times \left[\frac{\vartheta \times v^2}{200} \right] \text{ [mbar]}$$

Z: Pressure losses caused by individual points of resistance [mbar]

ϑ: Density of medium in $\left[\frac{kg}{m^3} \right]$

v: Flow speed $\left[\frac{m}{s} \right]$

The following individual points of resistance are used as examples for calculation:

	Number	ξ value	∑ξ
Elbow bend 90°	8	0.5	4.0
Straight-way cock	4	0.2	0.8
Non-return valve	1	4.0	4.0
		∑ξ total	8.8

ϑ: $1000 \left[\frac{kg}{m^3} \right]$ (water)

v: $0.9 \left[\frac{m}{s} \right]$ (from pressure loss diagram, page 14

$$Z = 8.8 \times \left[\frac{1000 \text{ (kg/m}^3) \times 0.9 \text{ (m/s)}^2}{200} \right]$$

$$= 35.64 \approx 36 \text{ [mbar]}$$

6.3. Total pressure loss P (Heating distributor to Modul-plus)

$$P = \Delta p + Z$$

$$P = 21 \text{ mbar} + 36 \text{ mbar} = 57 \text{ mbar} \approx 0.6 \text{ MWC}$$

(MWC = meter water column)

6.4. Pressure loss diagram Biral L804

The Modul-plus F42 data sheet also indicates the required pump. In our case it is the Biral pump L804.

With our given volume flow of 16.2 m³/h, the maximum pump pressure is 7.5 MWC (see pump diagram below).

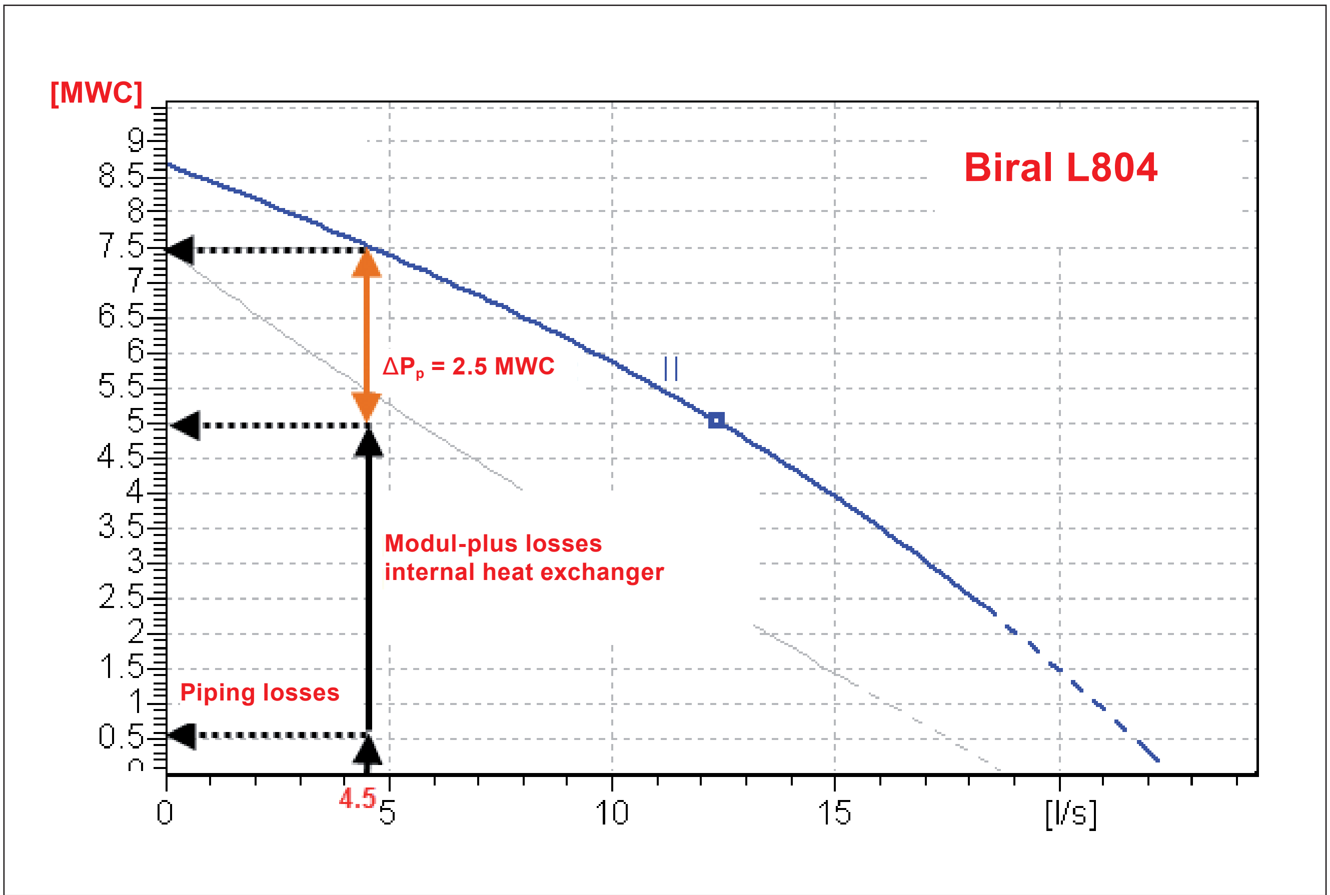
The Modul-plus F42 internal pressure loss of the heat exchanger is 440 mbar ≈ 4.4 MWC (see table page 10).

The remaining pumping head ΔPp is:

ΔP_p = Maximum pump pressure — Pressure loss piping — pressure loss internal heat exchanger

ΔP_p = 7.5 - 0.6 - 4.4 = 2.5 MWC = 250 mbar

To make the pump exactly working at 7.5 [MWC] and 4.5 [l/s], that means on the operating point of the Biral L804 a pressure loss of 250 mbar is missing. This pressure loss can be realized by a flow control valve, with the result that the pump has to work stronger to hold the flow at 4.5 [l/s].



7 Determination of the boiler volume flow

Each Hoval calorifier Modul-plus needs according table page 10 a Biral pump L804 with a volume flow of 16.2 m^3 per hour. In total the whole system needs 32.4 m^3 per hour.

We would like to have a balanced system with two boilers installed, the volume flow of each boiler has to be 16.2 m^3 per hour.

7.1. Determination of the boiler pump

The boiler volume flow is identical to the Modul-plus volume flow. Therefore we choose once more a Biral L804 as boiler pump.

7.2. Pressure loss calculation (Boiler to Heating distributor)

The calculation of the pipe pressure losses is identical to the calculation we did on page 14 (Pressure loss calculation, Heating distributor to Modul-plus).

8 Selection of the correct control panel

Top Tronic®T - Digital control panel

The two boilers of our hydraulic are working as a cascade system. Therefore you have to choose as control panel a Hoval TropTronic®T. With the choice of the cascade and the TTT you will have an optimal efficiency of the system (Hydraulic, see page 6).

	Digital control panel	
How high is your operating temperature?	90°C	105°C
Your safety temperature for boiler control is	110°C	120°C
Your Hoval control panel is	**Control panel with TopTronic® T/U 3.1**	**Control panel with TopTronic® T/U 3.2**
If you have a building control system, you have to choose	Mod Bus or GLT modul	

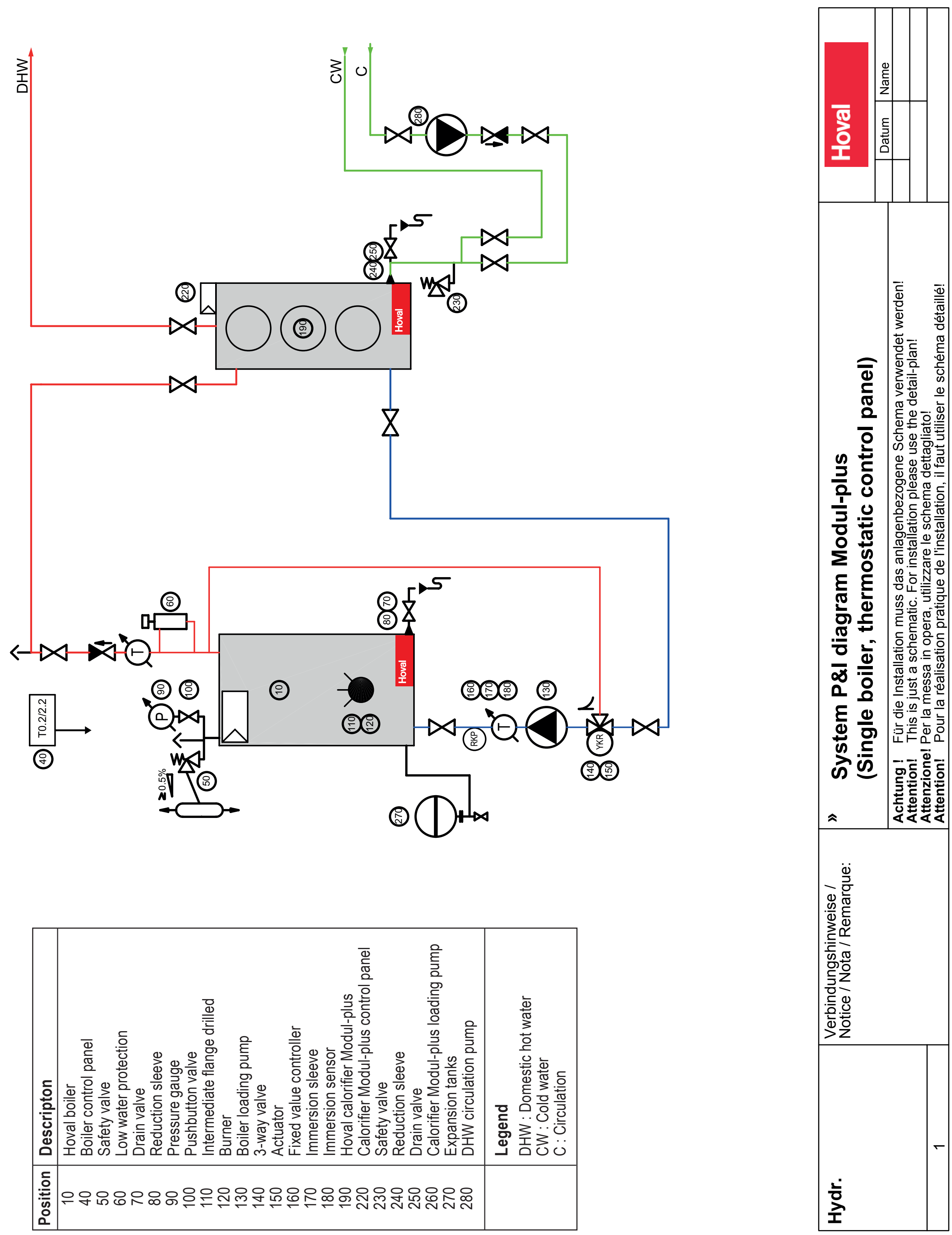
Thermostatic control panel

If you have a single boiler in combination with one Modul-plus then it is also possible to design the hydraulic with thermostatic control panels (Hydraulic, see page 18).

	Thermostatic control panel	
How high is your operating temperature?	90°C	105°C
Your safety temperature for boiler control is	110°C	120°C
Your Hoval control panel is	**Control panel with thermostat T 2.2**	**Control panel with thermostat T 0.2**
If you have a building control system, you have to choose	BMS Box	

1 2 3 4 5 6 7 8 9 10 11 12 13

9 System P&I Diagram (Single Boiler with thermostatic control panel)



Position	Descripton
10	Hoval boiler
40	Boiler control panel
50	Safety valve
60	Low water protection
70	Drain valve
80	Reduction sleeve
90	Pressure gauge
100	Pushbutton valve
110	Intermediate flange drilled
120	Burner
130	Boiler loading pump
140	3-way valve
150	Actuator
160	Fixed value controller
170	Immersion sleeve
180	Immersion sensor
190	Hoval calorifier Modul-plus
220	Calorifier Modul-plus control panel
230	Safety valve
240	Reduction sleeve
250	Drain valve
260	Calorifier Modul-plus loading pump
270	Expansion tanks
280	DHW circulation pump

Legend
DHW : Domestic hot water
CW : Cold water
C : Circulation

Hydr.

Verbindungshinweise / Notice / Nota / Remarque:

» **System P&I diagram Modul-plus (Single boiler, thermostatic control panel)**

Achtung ! Für die Installation muss das anlagenbezogene Schema verwendet werden!
Attention! This is just a schematic. For installation please use the detail-plan!
Attenzione! Per la messa in opera, utilizzare le schema dettagliato!
Attention! Pour la réalisation pratique de l'installation, il faut utiliser le schéma détaillé!

Hoval

Datum | Name

1

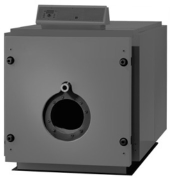
10 Hoval burner matching list

10.1 Hoval boiler types

Uno-3

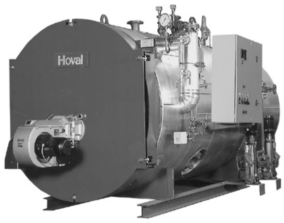
CompactGas

THD-U



Max-3

THW-I NT E



THSD-I E

10.2 Oil burner

The details in the tables are recommendations. Other combinations are possible.

	Uno-3 (Model-No.)	Max-3 (Model-No.)	THW-I NT E (Model-No.)	THW-I HT E (Model-No.)	THD-U (Model-No.)	THSD-I../..E (Model-No.)
Oil burner SPARK 35 DSG; 2-stage	280					
Oil burner BTL 14 P; 2-stage	110 125					
Oil burner BTL 20 P; 2-stage	160-220					
Oil burner BTL 26 P; 2-stage	250					
Oil burner BL 45 P DACA; 2-stage	320 360				500	
Oil burner TBL 60 P DACA; 2-stage		420			650 800	
Oil burner TBL 85 P DACA; 2-stage		530 620			1000	
Oil burner TBL 105 P DACA; 2-stage		750			1200	
Oil burner TBL 130 P DACA; 2-stage				10/05	1500	
Oil burner TBL 160 P DACA; 2-stage		1000			2000	
Oil burner TBL 210 P; 2-stage		1250		13/08	2500	
Oil burner BT 250 DSG 4T; 2-stage				17/10 22/15	3000 3500	25/20 30/25
Oil burner BT 300 DSG 4T; 2-stage				27/20	4000	35/30
Oil burner BT 250 DSPG; 2-stage progress			23/15			
Oil burner BT 300 DSPG; 2-stage progress			28/20			
Oil burn°er GI 350 DSPG; 2-stage progress			35/25	34/25		45/40 55/50
Oil burner GI 420 DSPG; 2-stage progress			40/30	39/30 43/35		
Oil burner GI 510 DSPG; 2-stage progress			45/35 50/40	54/45 59/50 68/60 78/70		70/60
Oil burner GI 1000 DSPG; 2-stage progress			55/45 60/50 70/60 80/70	54 / 45 59 / 50 68 / 60 78 / 70		90/80 110/100

10.3 Gas burner

	Uno-3 (Model-No.)	Max-3 (Model-No.)	THW-I NT E (Model-No.)	THW-I HT E (Model-No.)	THD-U (Model-No.)	THSD-I../..E (Model-No.)	THSD-I../..E (Model-No.)
Gas burner two-stage & Low NOx; BTG 15P	110 125						
Gas burner two-stage & Low NOx;BTG 20 P	160						
Gas burner two-stage; BTG 28 P	190 220						
Gas burner two-stage & Low NOx;TBG 35 P	250-320						
Gas burner two-stage & Low NOx;TBG 45 P	360					500	
Gas burner two-stage & Low Nox;TBG 60 P		420				650 800	
Gas burner two-stage; TBG 85 P		530 620				1000	
Gas burner two-stage; TBG 85 PN pneu m		530 620					
Gas burner two-stage; TBG 120 P		750				1200 1500	
Gas burner two-stage; TBG 120 PN pneu m		750	1000				
Gas burner two-stage; TBG 120 P			1000				
Gas burner two-stage; TBG 150 P		1000	1400		10/05	2000	
Gas burner two-stage; TBG 150 PN pneu m		1000	1400				
Gas burner two-stage; TBG 210 P		1250	1800		13/08	2500	
Gas burner two-stage; TBG 210 PN pneu m		1250					
Gas burner two-stage; TBG 210 PN pneu m			1800				
Gas burner two-stage; BGN 250 P			2200		17/10	3000	
Gas burner two-stage; BGN 300 P					22/15	3500 4000	25/20 30/25
Gas burner two-stage; BGN 300 P			2800	23/15 28/20			

10.4 Low NOx burner

Gas burner pneu m & Low Nox, GI 1000 LX				80/70 90/80	78/70 89/80		110/100 130/120
Gas burner pneu. modul. GI 500 DSPGN ME				35/25 40/30 45/35	34/25 39/30		45/40 55/50
Gas burner pneu. modul. GI 500 DSPGN ME					43/35		
Gas burner pneu. modul. GI 700 DSPGN ME				50/40 55/45	48/40 54/45		70/60
Gas burner pneu m & Low Nox, TBG 800 ME				70/60	68/60		90/80
Gas burner two-stage; BGN 350 P					27/20		35/30

10.5 Dual burner

Dual burner two-stage; TBML 160PN					10/05	1200 1500	
Dual burner two-stage; COMIST 180					13/08	2000	
Dual burner two-stage; COMIST 250				23/15	17/10 22/15	2500 3000 3500	25/20 30/25 35/30
Dual burner two-stage; COMIST 300				28/20	27/20	4000	
Dual burner two-stage; GI MIST 350 DSPGM				35/25	34/25		45/40 55/50
Dual burner two-stage; GI MIST 420 DSPGM				40/30	39/30		
Dual burner two-stage; GI MIST 510 DSPGM				45/35 50/40	43/35 48/40		70/60
Dual burner two-stage;GI MIST 1000 DSPGM				55/45 60/50 70/60 80/70	54/45 59/50 68/60 78/70		90/80 110/100
Dual burner two-stage; TBML 80PN						650 800 1000	

11 Expansion vessel

11.1 Individual plant protection

If flow and return pipes of total pipeline system can be interrupted by components (valves etc), each part of the separately locked plant must be equipped with a single expansion vessel !

11.2 Total plant protection

Only one expansion vessel for the whole plant. You have to be be sure that flow and return cannot be locked.

11.3 Determination of the expansion vessel

For reasons of simplification we decided to make a total plant protection with one expansion vessel for the whole plant.

11.4 Determination of thermal expansion coefficient (f)

$$T = \frac{(Tv + Tr)}{2} \left[°C\right]$$

T Average temperature [°C]
Tv 90°C - Flow temperature
Tr 70°C - Return temperature
f Thermal expansion coefficient

$$T = \frac{(90 + 70)°C}{2} = 80°C \implies f = 0.029$$

T [°C]	30	40	60	**80**	100
f	0.004	0.008	0.017	**0.029**	0.043

Determination of allowance factor (X)

Boiler capacity	<= 30 kW	30 kW - 150 kW	> 150 kW
Allowance factor	3	2	**1.5**

The calculated boiler capacity is 377 kW.
Therefore the allowance factor has to be 1.5.

11.5 Expansion volume (VN)

VN = 1.1 x Va x f x X [liters]

VN: Expansion volume
Va: Water volume of the plant: 2 x boiler, piping (estimated)
= 2 x 552 + 420 = 1524 liters
f: Thermal expansion coefficient
X: Allowance factor

VN [Liter]=1.1*1524*0.029*1.5=72.93 ≈73.0 [Liter]

11.6 Selction of expansion vessel

Assumption: Plant height: 12 m = 1.2 bar

Minimum pre – pressure [bar] = plant height [bar] + 0.3[bar]

Minimum pre-pressure [bar]=1.2 [bar]+ 0.3[bar]=1.5 bar

Selection table for Reflex NG/ N

with safety valve 3 bar
capacity V_N of the empty container in litres
at a pre-pressure of

Type		0.5 bar	0.8 bar	1.0 bar	1.2 bar	1.5 bar	1.8 bar	2,1 bar
18/6	L	10	9	7	6	4	2	1,5
25/6	L	14	12	10	8	6	3	2
35/6	L	20	17	14	12	8	5	2,5
50/6	L	25	22	18	15	11	7	3
80/6	L	42	36	30	26	18	11	4
100/6	L	61	54	44	37	27	17	4,5
140/6	L	79	70	57	48	35	22	5
200/6	L	119	106	86	73	53	33	6
250/6	L	142	126	103	87	63	39	7,5
300/6	L	165	146	119	101	73 (VN)	45	9
400/6	L	210	187	151	128	93	58	11
500/6	L	269	239	194	164	119	74	14
600/6	L	324	288	234	198	144	90	18
800/6	L	420	373	302	257	186	116	22
1000/6	L	525	467	380	321	233	145	28
max, possible plant height *		2 m	5 m	7 m	9 m	12 m	15 m	18 m

* Plant height = centre of expansion chamber to topmost point of the heating system / solar plant

Selection: Expansion chamber, type Reflex N 300/6

12 Water quality – Desalination

To decide whether the plant filling water has to be desalinated or not we need to know the following data:

- Heating power
- Water volume of the plant
- Total hardness of filling water
- Conductance of filling water

With this data and maximum three further steps, we are able to qualify if the plant has to be desalinated or not.

In our example:

Heating power:	377 kW (lowest bolier capacity)	
Water volume of the plant:		1524 liters
Filling water:	Total hardness:	11 d°H
	Conductance:	520 µS/cm

(You get the filling water information from the water supply).

Remark: If you have multiple boilers with different capacities installed, it is necessary to always operate with the boiler of the lowest capacity.

12.1 Desalination Table

Maximum filling quantity according to VDI 2035

	Degrees of water hardness					
f°H	< 1,0	< 5,0	< 10	< 15	< 20	< 25
d°H	< 0,56	< 2,8	< 5,6	< 8,4	< 11,2	< 14
e°H	< 0,71	< 3,6	< 7,1	< 10,7	< 14,2	< 17,8
Conductance (µS/cm)	< 20	> 100	> 200	> 300	> 400	> 500
Boiler Capacity						
50 to 200 kW	No desalination necessary			<= 20 l/kW		
200 to 600 kW		<= 50 l/kW				
over 600 kW			Desalination or water analysis			

<= 20 l/kW	Check if you have more than 20 liters per kW heating water, if yes desalination is necessary
<= 50 l/kW	Check if you have more than 50 liters per kW heating water, if yes desalination is necessary

f°H French degrees of water hardness
d°H German degrees of water hardness
e°H English degrees of water hardness

12.2. Step 1 – Conductance of filling water

We need to check the conductance of the filling water.
In our example we have a value of 520 µS/cm.

We have to search the intersection inside the installed boiler capacity. In our case the boiler with the lowest capacity has 377 kW which refers to line “200 to 600 kW”.
The intersection gives us the result “Desalination or water analysis.

Now we have the choice to make a desalination - without checking the water quality - or to check if the desalination is definitely a must.

Maximum filling quantity according to VDI 2035

	Degrees of water hardness					
f°H	< 1,0	< 5,0	< 10	< 15	< 20	< 25
d°H	< 0,56	< 2,8	< 5,6	< 8,4	< 11,2	< 14
e°H	< 0,71	< 3,6	< 7,1	< 10,7	< 14,2	< 17,8
Conductance (µS/cm)	< 20	> 100	> 200	> 300	> 400	> 500
Boiler Capacity						
50 to 200 kW	No desalination necessary			<= 20 l/kW		
200 to 600 kW		<= 50 l/kW				
over 600 kW			Desalination or water analysis			

<= 20 l/kW	Check if you have more than 20 liters per kW heating water, if yes desalination is necessary
<= 50 l/kW	Check if you have more than 50 liters per kW heating water, if yes desalination is necessary

f°H French degrees of water hardness
d°H German degrees of water hardness
e°H English degrees of water hardness

In our example we would like to check if desalination is definitely a must. This can be checked with the value “Degrees of water hardness”. This value is a result of the now necessary water analysis. We will do this in step 2.

12.3 Step 2 – Hardness of filling water

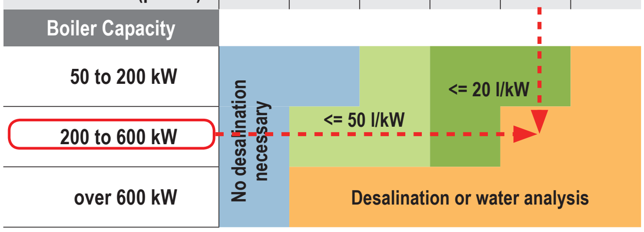
Now we need to check the hardness of the filling water. In our example we have an amount of 11 d°H (German degrees of water hardness) of the filling water.

First search the line in the table where d°H is written. Then find the appropriate cell in this row to which the specified water hardness of 11°dH fits. In our case it is < 11.2 d°H

Now we have to search the intersection inside the installed boiler capacity. In our case the boiler with the lowest capacity has 377 kW which refers to line “200 to 600 kW”. After the water analysis the intersection gives us the result “Desalination”. You have to desalinate the water!

Maximum filling quantity according to VDI 2035

	Degrees of water hardness					
f°H	< 1,0	< 5,0	< 10	< 15	< 20	< 25
d°H	< 0,56	< 2,8	< 5,6	< 8,	< 11,2	< 14
e°H	< 0,71	< 3,6	< 7,1	< 10,7	< 14,2	< 17,8
Conductance (µS/cm)	< 20	> 100	> 200	> 300	> 400	> 500



<= 20 l/kW	Check if you have more than 20 liters per kW heating water, if yes desalination is necessary
<= 50 l/kW	Check if you have more than 50 liters per kW heating water, if yes desalination is necessary

f°H French degrees of water hardness
d°H German degrees of water hardness
e°H English degrees of water hardness

13 Corrosion protection

A professional installation and commissioning as well as compliance with the required operating parameters are as a corrosion protection measure, mandatory.

As a rule, no additional corrosion protection measures such as the addition of corrosion inhibitors are required.

The treatment of water with chemicals should only be used if all other measures have been exhausted

Notes:

Notes:

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Notes:

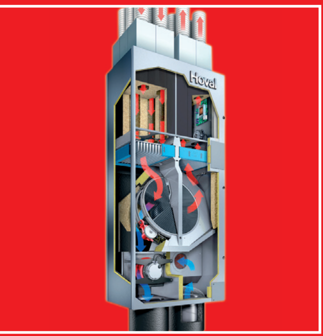
Notes:

Disclaimer
Although Hoval does everything possible to ensure the accuracy of all data within this document, we cannot be held responsible for the contained information.

Hoval

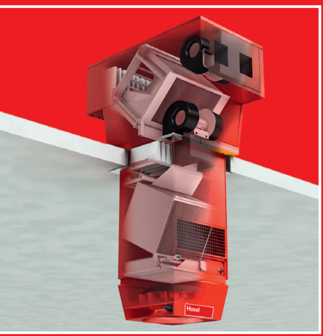
Hoval heating technology

As an energy neutral supplier with a full range of products, Hoval helps its customers to select innovative system solutions for a wide range of energy sources, such as heat pumps, biomass, solar energy, gas, oil and district heating. Services range from private residential units to large-scale industrial projects.



Hoval residential ventilation

Increased comfort and more efficient use of energy from private housing to industrial halls: our controlled residential ventilation products provide fresh, clean air for living and working space. Our innovative system for a healthy room climate uses heat and moisture recovery, while at the same time protecting energy resources and providing a healthier environment.



Hoval indoor climate systems

Supplying fresh air, removing extract air, heating, cooling, filtering and distributing air, utilising heat gains or recovering cold energy – no matter what the task, Hoval indoor climate systems provide tailor-made solutions with low planning and installation costs.

Responsibility for energy and environment.

The Hoval brand is internationally known as one of the leading suppliers of indoor climate control solutions. More than 66 years of experience have given us the necessary capabilities and motivation to continuously develop exceptional solutions and technically superior equipment. Maximising energy efficiency and thus protecting the environment are both our commitment and our incentive. Hoval has established itself as an expert provider of intelligent heating and ventilation systems that are exported to over 50 countries worldwide.

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