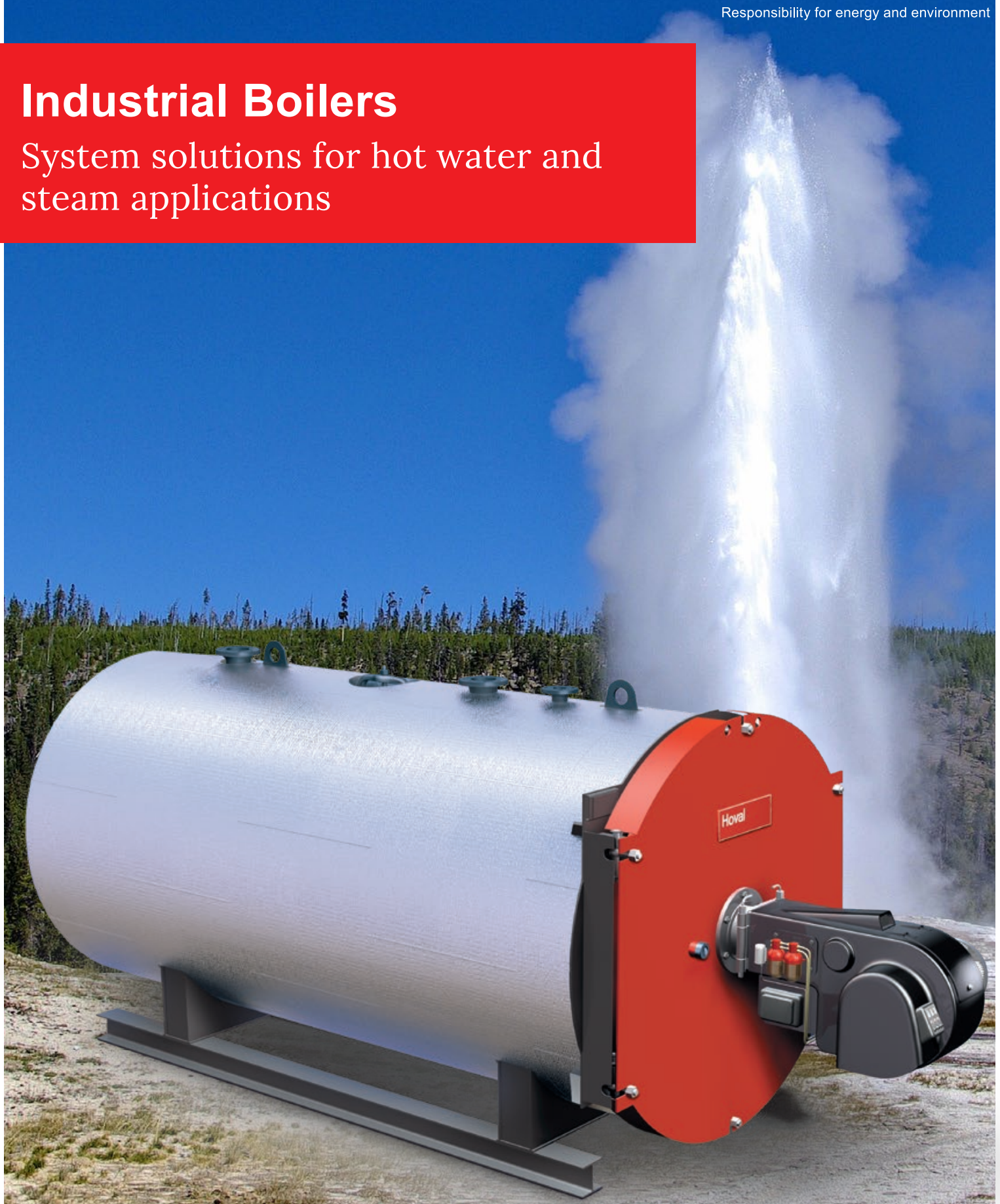






Hoval




Responsibility for energy and environment

Industrial Boilers

System solutions for hot water and steam applications



		Page
Hot water boilers		THW-I NTE ■ Description 3 Sectional view 4 ■ Technical data 5 Flue gas diagram 11 Flue gas temperature and boiler efficiency 12 ■ Dimensions 13 Space requirements 14 ■ Engineering 15 Boiler water specifications 16
		aqua3 E ■ Description 17 Sectional view 18 ■ Technical data 19 Flue gas diagram 25 Flue gas temperature and boiler efficiency 26 ■ Dimensions 27 Space requirements 28 ■ Engineering 29 Boiler water specifications 30
Steam boilers		THD-U ■ Description 33 ■ Technical data 34 ■ Dimensions 38 ■ Engineering 40 Boiler and feed water specifications for steam boiler plants 41
		THSD-I E ■ Description 45 ■ Technical data 46 ■ Dimensions 50 Space requirements 52 ■ Engineering 53 Boiler and feed water specifications for steam boiler plants 54

		Page
Accessories		Feed water tank - pressureless SPW-D
	■ Description	57
	■ Technical data	58
	■ Dimensions	60
		Feed water tank - pressurised with deaerator - SPW-E
	■ Description	63
	■ Technical data	64
	■ Dimensions	70
		Condensate station KDS
	■ Description	71
	■ Technical data	72
	■ Dimensions	75
	Standard terms and conditions of delivery	77

THW-I NTE

Hoval hot water boiler

The Hoval high output hot water boilers are made of quality steel and are distinguished by their solid, robust and elastic construction. They particularly convince by their easy way of operation, their easy maintenance and optimal efficiency. The client receives an economical, environment friendly compact unit, ready for installation. The boilers are constructed for oil or gas firing.

Boiler type THW-I NTE

The type THW-I NTE classical 3 pass flame tube wet back boiler with an inner fully water cooled flue gas turning chamber guarantees high efficiency. The boiler consists of a cylindric shell, the two head plates, the centric flame tube including the back flue gas turning chamber with water cooled finned tube wall and the two flue gas passes. The boiler door is thermally insulated and flue gas proof for burner mounting. The boiler is completely electrically welded and provided with all required inspection openings.

The spacious designed flame tube with low thermal charges results in an excellent combustion and reduces emissions. The large water content secures an even boiler running time and thus reduces the number of boiler starts.

Admissible max. safety valve pressure/temperature

Standard pressures: 6 and 10 bar.

Higher pressure on request.

Max. operating temperature: 110/120 °C (depending on local regulations).

Thermal insulation

The boiler is fully insulated including flue gas collector with rock wool insulation. The casing is made of structured aluminium plate. Sockets and cuttings are nicely framed.

Connection fittings and sockets

The connection fittings and sockets on the boiler and on the fitting pipe are meant for the attachment of:

flow intermediate piece, thermometer for return, return shut-off, safety valve, drain, vent.

Large equipment

2 boiler supports

1 flue gas collector with integrated flue gas exit backward.

1 back cleaning cover with bleeder valves

1 boiler door for burner mounting, thermally insulated and designed flue gas proof, placed on left and right swivelable hinges for the flue gas sided cleaning of boiler

1 boiler plate

High efficiency

Due to the above technical facts an efficiency of up to 95 % (standard efficiency 75/ 60 °C flow/ return) can be achieved. Thus continuous working costs are kept low. The sources of energy are used more efficiently and Hoval spares the environment.



Construction guiding, quality approval

The boiler is designed with all necessary inspection doors.

The construction and manufacturing of the boilers is done according to the European Pressure Equipment Directive (PED) 2014/68/EU, with CE-Certification; boilers up to 10 MW and 10 bar according to EN 14394. The ISO 9001:2000 certification and the quality approval at our factory with our Hoval quality performance department guarantees the highest product quality. For installation and operation of the boiler the local laws and norms are to be respected.

Control panel

The control panel for the Hoval boiler can be equipped with the required control units and indicators for control and supervision of boiler and burner. The operation and alarm reports may be shown as fault indication. The control panel will be made upon customer requirements and depending on the burner to be used.

Boiler water quality

For operation the Hoval and the country specific boiler water regulations have to be respected and local waste water regulations have to be paid attention to. Detailed information for the boiler water quality can be found in the appendix.

Delivery

The pressure body is provided with a primer. Due to transport reasons the insulation can be fixed at the factory. Burner armatures and control panel are either pre-mounted (as far as transport technically possible) or packed loosely in a separate box. The mounting and wiring can be done at the factory or at site. Connection openings are covered.

On request

Volt-free contacts for BMS connection (Building Management System)

Sectional view



Return injection: The return water from the heating system is led into the warm area of the boiler. Because of the special return injection the entering water into the boiler will be turned by 90° and accelerated by a baffle plate. By injector effect hot water will be sucked in and will be mixed intensively with the cold water. Thereby the temperature of the return water increases.

Boiler door: Large boiler door provides easy access for cleaning of the combustion chamber to the second and third pass. The boiler door can be easily opened by the special hinge construction to the left or right. The boiler door with an optimised thermal insulation helps to reduce the calorific losses of the boiler to a minimum.

Heating surface: The smooth flue gas flame tube without any turbulators reduces the exhaust gas losses and makes an easy and fast cleaning possible for an economical operation.

Burner: The boiler can be optimally fitted with LowNOx burners due to combustion chamber geometry and the low combustion chamber load.

Finned tube wall (reverse chamber): Due to the finned tube wall a completely water cooled turning chamber of the first to the second pass secure a maximum utilisation of the heat.

Insulation: A highly effective thermal insulation with aluminium boarding reduces the standby losses to a minimum and contributes to highest economy.



THW-I NTE (23/15 - 50/40)

Technical data

Type		(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• Nominal output (oil and gas)	kW	2300/1500	2800/2000	3300/2500	4000/3000	4500/3500	5000/4000
• Operating temperature max. (SBT) ¹⁾	°C	120	120	120	120	120	120
• Temperature level flow/return	°C	80/60	80/60	80/60	80/60	80/60	80/60
• Safety valve pressure	bar	6	6	6	6	6	6
	bar	10	10	10	10	10	10
• Boiler efficiency at 80/60 °C (natural gas)	%	90.1/92.2	90.4/92.1	90.7/92.3	90.9/92.3	91.1/92.3	91.7/92.7
• Flue gas resistance	mbar	9.0/6.0	9.0/6.0	10.0/7.0	11.0/7.5	11.0/8.0	11.0/8.0
• Water content	l	2800	3500	4500	5000	5500	6500
• Water flow resistance *	mbar	150	200	150	200	250	150
	z-value **	0.0145	0.01305	0.00626	0.00639	0.00631	0.00307
• Flue gas temperature after boiler (natural gas)	°C	226/180	222/184	217/180	213/182	209/182	197/174
• Flue gas temperature after boiler (diesel oil)	°C	216/172	213/177	208/173	204/174	200/175	189/167

¹⁾ Country and equipment specific

* for boiler max. load and $\Delta T = 20 \text{ K}$

** for other flow rates use "z-value" for water side pressure loss calculation: $\Delta p \text{ (mbar)} = \text{asked flow rate (m}^3/\text{h)}^2 \cdot z$

Dimensions and weights

Type			(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• Flame tube diameter	6 bar	mm	750	800	850	900	950	1000
	10 bar	mm	750	800	850	900	950	1000
• Flame tube length without turning chamber		mm	2420	2920	3270	3570	3720	4120
• Boiler length								
• with insulation, without burner		mm	3430	3930	4280	4580	4730	5330
• Boiler width		mm	1770	1870	1970	2020	2070	2170
• with insulation, without armatures								
• Boiler height		mm	2600	2800	2900	2950	3000	3250
• with insulation, with armatures								
• Diameter flue gas outlet		mm	450	500	500	550	600	600
• Transport weight without burner incl. equipment	6 bar	kg	4000	5300	6000	6600	7300	8400
	10 bar	kg	4500	6000	6900	7600	8200	10000

Fitting pipe

Type	(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• 1 fitting pipe without insulation (flow intermediate piece) (dimension for $\Delta T = 20\text{ K}$)	DN 150	DN 150	DN 150	DN 200	DN 200	DN 200

Boiler basic equipment

Type		(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• 1 drain ball valve	[DN]	40	40	40	40	40	40
• 1 ventilation valve (fitting pipe)	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 thermometer flow	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 thermometer return flow	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 safety thermostat	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 cleaning set		Brush with rod					

Boiler ancillary equipment

Type		(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• 1 safety valve 6 bar		DN 50/80	DN 65/100	DN 65/100	DN 65/100	DN 65/100	DN 80/125
• 1 safety valve 10 bar		DN 40/65	DN 50/80	DN 50/80	DN 50/80	DN 65/100	DN 65/100
• 1 temperature switch		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 temperature limiter STB		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 pressure gauge		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 pressure limiter SDB		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 low water level indicator (Syr)		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"

Boiler return flow heat up

Type		(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• 1 pump 120 °C	[m³/h]	35	40	45	60	65	75
• 1 thermostat	[DN]	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 non return valve	[DN]	65	80	80	80	80	100
• 2 non return flaps	[DN]	65	80	80	80	80	100

1 connection pipe

Type		(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)
• 1 connection pipe	[DN]	65	80	80	80	80	100

Subject to project-related alterations

THW-I NTE (55/45-100/90)

Technical data

Type		(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• Nominal output (oil and gas)	kW	5500/4500	6000/5000	7000/6000	8000/7000	9000/8000	10000/9000
• Operating temperature max. (SBT) ¹⁾	°C	120	120	120	120	120	120
• Temperature level flow/return	°C	80/60	80/60	80/60	80/60	80/60	80/60
• Safety valve pressure	bar	6	6	6	6	6	6
	bar	10	10	10	10	10	10
• Boiler efficiency at 80/60 °C (natural gas)	%	91.4/92.4	91.4/92.3	91.5/92.3	91.5/92.1	91.5/92.1	91.6/92.1
• Flue gas resistance	mbar	12.0/9.0	13.0/9.5	13.0/10.0	14.0/10.5	14.0/11.0	15.0/12.0
• Water content	l	7000	8000	9000	10000	11500	13000
• Water flow resistance *	mbar	150	150	200	150	200	200
	z-value **	0.00254	0.00213	0.00209	0.00120	0.00126	0.00102
• Flue gas temperature after boiler (natural gas)	°C	202/181	203/184	201/184	202/188	201/188	200/189
• Flue gas temperature after boiler (diesel oil)	°C	194/174	195/177	193/177	195/181	193/181	193/182

¹⁾ Country and equipment specific* for boiler max. load and $\Delta T = 20\text{ K}$ ** for other flow rates use "z-value" for water side pressure loss calculation: $\Delta p\text{ (mbar)} = \text{asked flow rate (m}^3/\text{h)}^2 \cdot z$

Dimensions and weights

Type		(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• Flame tube diameter	6 bar mm	1025	1050	1100	1150	1200	1250
	10 bar mm	1025	1050	1100	1150	1200	1250
• Flame tube length without turning chamber	mm	4370	4420	4620	4820	5120	5420
• Boiler length with insulation, without burner	mm	5380	5430	5630	5830	6230	6530
• Boiler width with insulation, without armatures	mm	2220	2270	2370	2470	2570	2670
• Boiler height with insulation, with armatures	mm	3300	3400	3600	3700	3800	3900
• Diameter flue gas outlet	mm	650	650	700	750	750	800
• Transport weight without burner incl. equipment	6 bar kg	9200	10000	11200	12500	14000	16000
	10 bar kg	10800	12200	13500	15000	17000	18500

Fitting pipe

Type	(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• 1 fitting pipe without insulation (flow intermediate piece) (dimension for $\Delta T = 20\text{ K}$)	DN 200	DN 250	DN 250	DN 250	DN 250	DN 300

Boiler basic equipment

Type	(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• 1 drain ball valve [DN]	40	40	40	40	40	40
• 1 ventilation valve (fitting pipe) [DN]	½"	½"	½"	½"	½"	½"
• 1 thermometer flow [DN]	½"	½"	½"	½"	½"	½"
• 1 thermometer return flow [DN]	½"	½"	½"	½"	½"	½"
• 1 safety thermostat [DN]	½"	½"	½"	½"	½"	½"
• 1 cleaning set	Brush with rod					

Boiler basic equipment

Type	(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• 1 safety valve 6 bar	DN 80/125	DN 80/125	DN 100/150	DN 100/150	DN 100/150	DN 100/150
• 1 safety valve 10 bar	DN 65/100	DN 65/100	DN 80/125	DN 80/125	DN 80/125	DN 80/125
• 1 temperature switch	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 temperature limiter STB	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 pressure gauge	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 pressure limiter SDB	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 low water level indicator (Syr)	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"

Boiler return flow heat up

Type	(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• 1 pump 120 °C [m³/h]	80	85	100	115	130	145
• 1 thermostat [DN]	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 non return valve [DN]	100	100	125	125	125	125
• 2 non return flaps [DN]	100	100	125	125	125	125

1 connection pipe

Type	(55/45)	(60/50)	(70/60)	(80/70)	(90/80)	(100/90)
• 1 connection pipe [DN]	100	100	125	125	125	125

Subject to project-related alterations

THW-I NTE (120/100)

Technical data

Type	(120/100) ²⁾	
• Nominal output (oil and gas)	kW	12000/10000
• Operating temperature max. (SBT) ¹⁾	°C	120
• Temperature level flow/ return	°C	80/60
• Safety valve pressure	bar	6
	bar	10
• Boiler efficiency at 80/60 °C (natural gas)	%	91.6/92.24
• Flue gas resistance	mbar	15/12
• Water content	l	14000
• Water flow resistance *	mbar	250
	z-value **	0.00089
• Flue gas temperature after boiler (natural gas)	°C	200/187
• Flue gas temperature after boiler (diesel oil)	°C	193/180

¹⁾ Country and equipment specific

²⁾ According to EN 14394 max. allowed load = 10 MW

* for boiler max. load and $\Delta T = 20 \text{ K}$

** for other flow rates use "z-value" for water side pressure loss calculation: $\Delta p \text{ (mbar)} = \text{asked flow rate (m}^3/\text{h)}^2 * z$

Dimensions and weights

Type	(120/100)		
• Flame tube diameter	6 bar	mm	1300
	10 bar	mm	1300
• Flame tube length without turning chamber	mm		5520
• Boiler length	mm		6630
with insulation, without burner			
• Boiler width	mm		2770
with insulation, without armatures			
• Boiler height	mm		4200
with insulation, with armatures			
• Diameter flue gas outlet	mm		850
• Transport weight without burner incl. equipment			
	6 bar	kg	18000
	10 bar	kg	21000

Fitting pipe

Type	(120/100)
<ul style="list-style-type: none"> 1 fitting pipe without insulation (flow intermediate piece) dimension for $\Delta T = 20\text{ K}$, * dimension for $\Delta T = 30\text{ K}$ 	DN 300

Boiler basic equipment

Type	(120/100)
<ul style="list-style-type: none"> 1 drain ball valve 	[DN] 40
<ul style="list-style-type: none"> 1 ventilation valve (fitting pipe) 	[DN] ½"
<ul style="list-style-type: none"> 1 thermometer flow 	[DN] ½"
<ul style="list-style-type: none"> 1 thermometer return flow 	[DN] ½"
<ul style="list-style-type: none"> 1 safety thermostat 	[DN] ½"
<ul style="list-style-type: none"> 1 cleaning set 	Brush with rod

Boiler ancillary equipment

Type	(120/100)
<ul style="list-style-type: none"> 1 safety valve 6 bar 	DN 125/200
<ul style="list-style-type: none"> 1 safety valve 10 bar 	DN 100/150
<ul style="list-style-type: none"> 1 temperature switch 	R ½"
<ul style="list-style-type: none"> 1 temperature limiter STB 	R ½"
<ul style="list-style-type: none"> 1 pressure gauge 	R ½"
<ul style="list-style-type: none"> 1 pressure limiter SDB 	R ½"
<ul style="list-style-type: none"> 1 low water level indicator (Syr) 	R ½"

Boiler return flow heat up

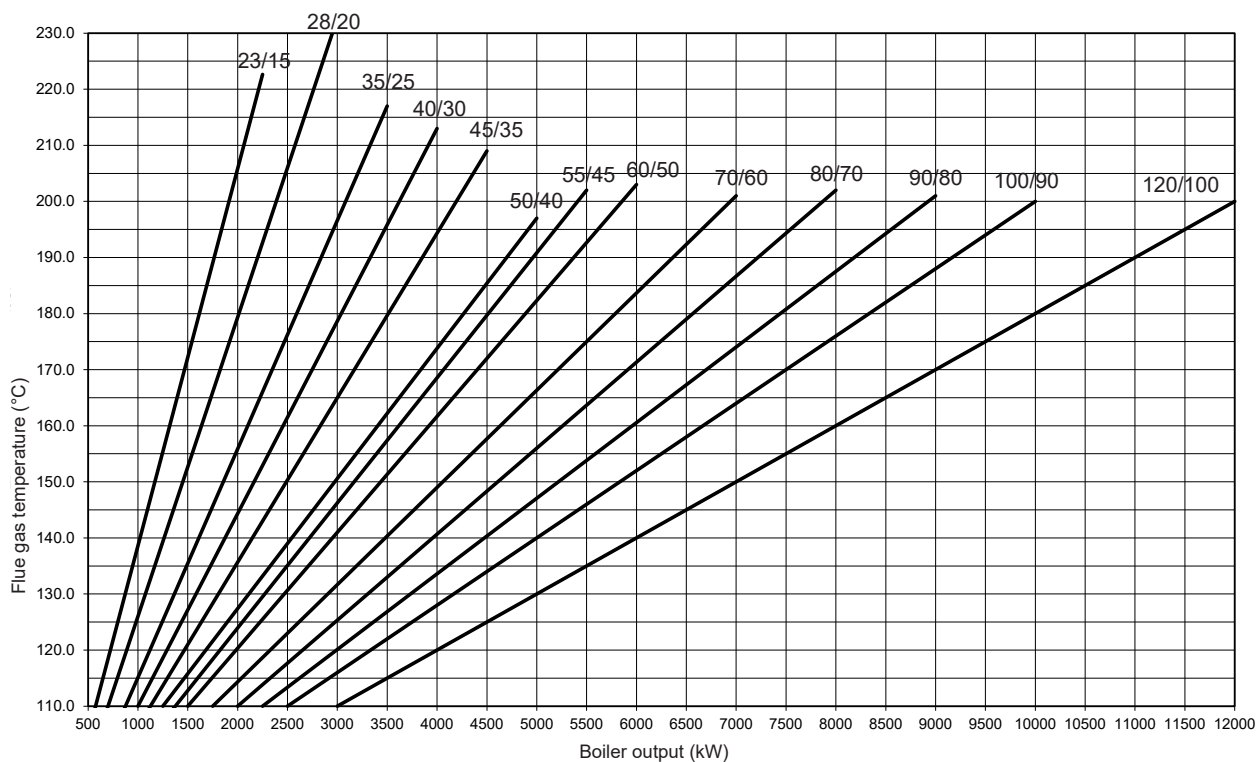
Type	(120/100)
<ul style="list-style-type: none"> 1 pump 120 °C 	[m³/h] 175
<ul style="list-style-type: none"> 1 thermostat 	[DN] R ½"
<ul style="list-style-type: none"> 1 non return valve 	[DN] 150
<ul style="list-style-type: none"> 2 non return flaps 	[DN] 150

1 connection pipe

Type	(120/100)
<ul style="list-style-type: none"> 1 connection pipe 	[DN] 150

Subject to project-related alterations

Flue gas diagram



These data represent an average value from measurements with different burner manufacturers.

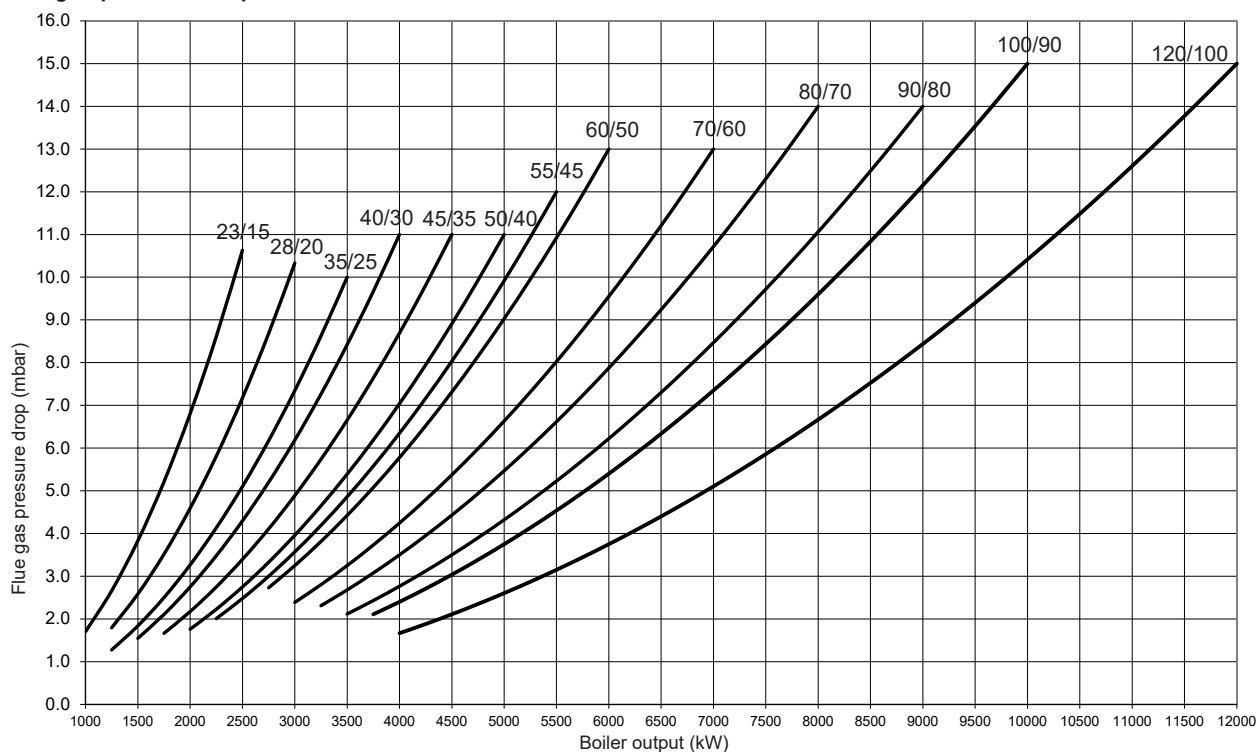
kW = Boiler output

°C = Flue gas temperature with cleaned heating surface, boiler flow temperature 80 °C, boiler return flow temperature 60 °C

- Operated with natural gas,
λ = 1.15 with max. burner output

- A reduction of the boiler water temperature of 10 K causes a reduction of the flue gas temperature by approx. 6-8 K.

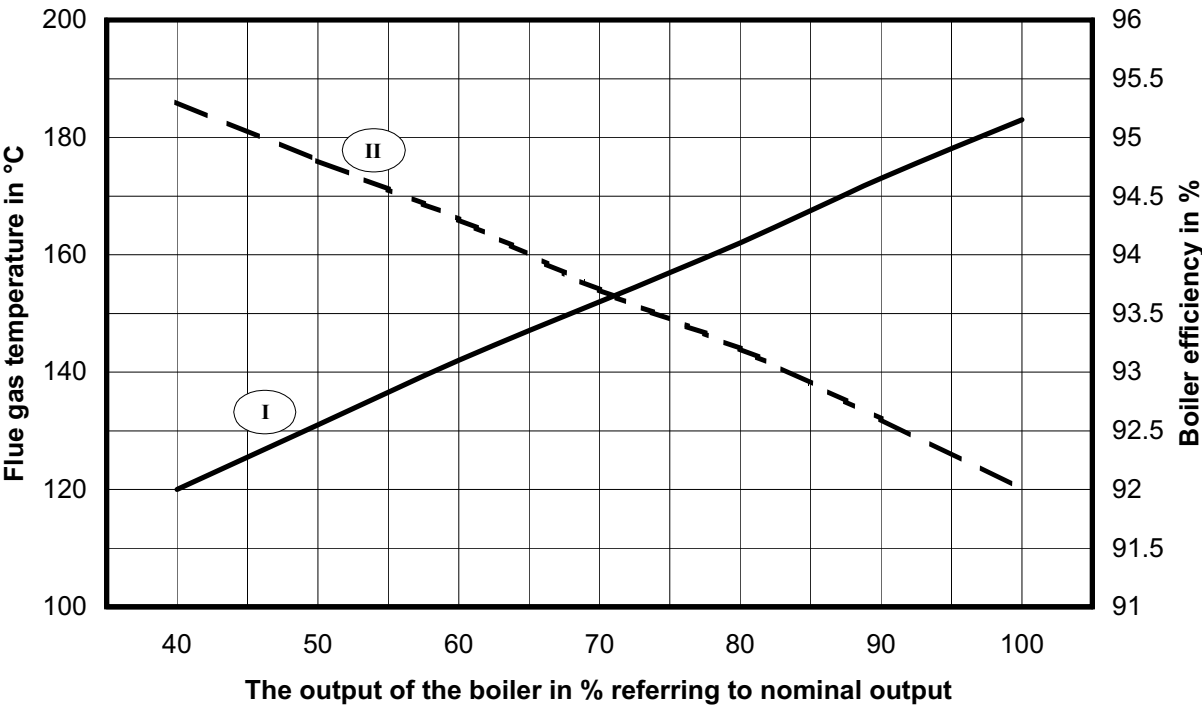
Flue gas pressure drop



Flue gas temperature and boiler efficiency

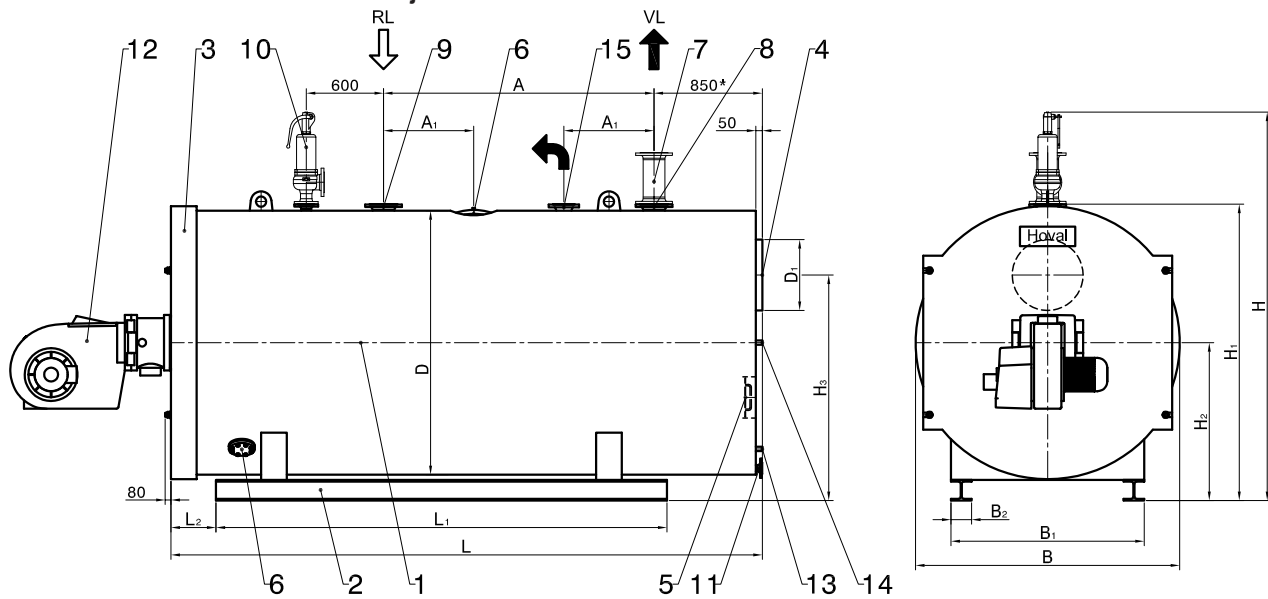
Flue gas temperature and boiler efficiency

In dependence on the boiler efficiency with a boiler water temperature of 80/60 °C.



- I Flue gas temperature in °C
- II Boiler efficiency in %

THW-I NTE without economiser - subject to construction-caused alterations



- 1 Boiler (with flue gas collector)
- 2 Boiler base
(to THW-I NTE (45/35) with U-girder,
from THW-I NTE (50/40) with I-girder)
- 3 Hinged door, incl. reversal chamber
2nd/3rd smoke gas pass

- 4 Flue gas outlet with 1 x 1/2" fitting
- 5 Explosion flap and cleaning opening
- 6 Inspection opening
- 7 Fitting pipe PN 16
- 8 Boiler outlet nozzle

- 9 Return flow nozzle
- 10 Safety valve nozzle PN 16
- 11 Drain nozzle DN 40/PN 16
- 12 Burner
- 13 Condensate drain nozzle 1"
- 14 Flame peephole
- 15 Admixing nozzle (BS)

Pressure stage 6 or 10 bar (overpressure).
 Dimensions for boiler design pressure 10 bar
 Safety valve dimensions for boiler design pressure 6 bar
 For transport lugs 100 mm to H₁, are to add.

* from boiler size 90/80
 upward = 950 mm
 Further pressure stages on request!
 Dimensions incl. 100 mm insulation.

Boiler type	Main dimensions					Boiler foundation					Transport dim		OL/IL nozzle			Flue gas con.		SV	BS
	B Width	L Length	H	H ₁	H ₂	D	L ₁	L ₂	B ₁	B ₂	B _{min}	H _{min} ⁴⁾	A	A ₁	DN ^{1),3)}	H ₃	D ₁	DN ¹⁾	DN ¹⁾
(23/15)	1770	3430	2600	1960	1000	1700	2650	230	1250	60	2000	2160	1600	600	150	1400	450	50	65
(28/20)	1870	3930	2800	2060	1050	1800	3000	230	1350	60	2100	2260	1800	600	150	1500	500	65	80
(35/25)	1970	4280	2900	2160	1100	1900	3500	230	1400	60	2200	2360	2100	700	150	1550	500	65	80
(40/30)	2020	4580	2950	2210	1125	1950	3500	230	1450	60	2250	2410	2100	700	200	1600	550	65	80
(45/35)	2070	4730	3000	2260	1150	2000	3500	230	1500	60	2300	2460	2100	700	200	1650	600	65	80
(50/40)	2170	5330	3250	2410	1250	2100	4000	350	1550	160	2400	2610	2500	800	200	1750	600	80	100
(55/45)	2220	5380	3300	2460	1325	2150	4000	350	1600	160	2450	2660	2500	800	200	1800	650	80	100
(60/50)	2270	5430	3400	2560	1350	2200	4500	350	1650	160	2500	2760	2500	800	250	1850	650	80	100
(70/60)	2370	5630	3600	2660	1400	2300	4500	350	1700	160	2600	2860	2500	800	250	1900	700	100	125
(80/70)	2470	5930	3700	2760	1450	2400	5000	350	1800	160	2700	2960	3000	900	250	2050	750	100	125
(90/80)	2570	6230	3800	2860	1500	2500	5000	350	1850	160	2800	3060	3000	900	250	2100	750	100	150
(100/90)	2670	6530	3900	2960	1550	2600	5500	350	1950	160	2900	3160	3000	900	300	2200	800	100	150
(120/100)	2770	6630	4200	3060	1600	2700	5500	350	2000	160	3000	3260	3000	900	300	2300	850	125	150

¹⁾ DN/...PN 16

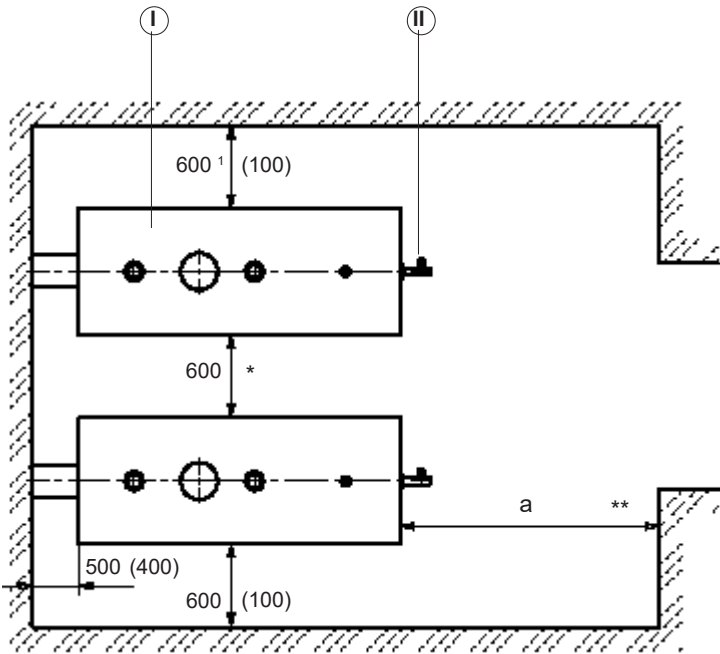
³⁾ Diameter for standard $\Delta T = 20$ K (from THW-I 140/120 NTE upwards $\Delta T = 30$ K), other dimensions on request

⁴⁾ without fitting pipe

Space requirements

Installation

(Dimensions in mm)



- I

Boiler
- II

Burner
- * Consider control panel
- ** Flame tube length (cleaning)
- ¹ 600-900, depending on local standards

To facilitate installation and maintenance the given measures should be kept; in case of limited space the minimal spaces (measures in brackets) are sufficient.

Positioning

- No air pollution through halogenated hydrocarbon (contained e.g. in sprays, paints, solvents and cleaners)

- No large amounts of dust

- No high atmospheric humidity

- Frost-resistant and well ventilated
- Otherwise errors and damages to the installation may occur.
- The boiler may only be installed in rooms where air pollution through halogenated hydrocarbon can occur if sufficient measures are taken ensuring the supply of unpolluted combustion air.

Type	(23/15)	(28/20)	(35/25)	(40/30)	(45/35)	(50/40)	(55/45)	(60/50)
THW-I NTE a (mm)	2900	3400	3750	4050	4200	4600	4850	4900

Type	(70/60)	(80/70)	(90/80)	(100/90)	(120/100)
THW-I NTE a (mm)	5100	5300	5600	5900	6100

Rules and regulations

The following rules and regulations have to be respected:

- Hoval technical information and installation guide.
- hydraulic and control technical regulations, to guarantee the min. admissible boiler temperature and the conditions for a safe operation according to national regulations.
- fire protection regulations
- national regulations concerning permission, installation and operation of boiler appliances. Boiler appliances have to be installed according to national laws and regulations and accessories requirements.
- Besides the national and local regulations the project specific circumstances of the boiler supplier have to be considered for every application.

Water treatment/water quality

- The quality of the boiler water has to be guaranteed according to Hoval technical information and national regulations.
- Hoval boilers must only be operated with treated water. For the treatment of water apply for the values to be kept refer to the Hoval guide lines.
- Requested water quality: see supplement.
- Do not use chemical additives such as anti-freeze, inhibitors, etc. without written confirmation from Hoval.
- Old and new installations must be well flushed before filling.
- The water quality should be monitored and recorded.

Planning, operation and maintenance

- National and local rules and regulations have to be considered for the fuel supply.
- Safety and exhaust valve connections must be able to discharge the system pressure without any risk.
- Filters and strainers have to be cleaned periodically, especially if installed in front of control devices.
- The components containing heat and the pipes are to be insulated in order to reduce radiation losses.

Combustion air

- The supply of combustion air must be guaranteed for a safe and economic operation. There must be no possibility to close the air supply opening.
- Aeration and ventilation of the boiler house has to be secured.
- In the installation room no negative pressure larger than 3 N/m^2 is allowed. To adhere to this demand, plan a cross free section for the air supply opening of at least 200 cm^2 , resp. 2 cm^2 per kW output. The aspect ratio for rectangular openings should not be more than $1.5 : 1$. If the opening is trellised an adequate surcharge is needed. National laws have to be respected.
- Boilers are not to be installed in rooms where halogen compounds occur which can enter the combustion air. (e.g. laundries, drying, etc.).

Noise level reduction

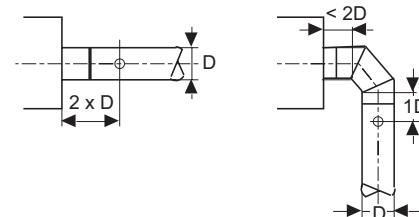
The following measures for noise level reduction are possible:

- Solid construction of heating room walls, ceiling and floor, installation of silencer in fresh air supply, noise insulation for support and bracket of pipes.
- Installation of sound attenuation cowl for burner.
- A substantial part of the sound caused in the combustion chamber and in the top heating surfaces is radiated from the flu gas system as sound transmitted by air. In addition to this, resonance features, depending on chimney dimensioning and inlet, may occur which are triggered by the oscillation of the combustion noises (snooping). These sounds can be reduced by burner-lateral measures, e.g. changes of flame geometry, atomisation characteristics or fuel throughput.
- Flue gas sound absorbers cause a substantial sound level reduction as well. These sound absorbers should usually be tuned at low frequencies of 60 - 250 Hz. Flue gas sound absorbers function according to the principle of sound absorption. The kinetic energy of the exhaust gases is consumed by friction requiring an increase in chimney draft in the flue gas system. This has to be considered for burner dimensioning. The connection piece from the boiler to the flue gas sound absorber has to be gas-tight because the draft- and pressure-zero point is behind the flue gas sound absorber.
- The necessary space requirement of approx. 2 m for the later installation of a flue gas sound absorber should already be included when planning.

Chimney/flue gas system

Flue gas line

- The flue gas connection pipe between the boiler and the vertical part of the flue gas line should be routed into the vertical part with a $30\text{--}45^\circ$ incline.
- Thermal insulation is required with a length of more than 1 m
- The insertion of the connection tube into the chimney must be carried out in such a way that no condensate can flow into the boiler
- A closable flue gas test port with a circular internal diameter of between 10-21 mm must be installed in the connection tube. The port must protrude beyond the thermal insulation



Flue gas system

- The flue gas system must be humidity-insensitive and acid-proof and admitted for flue gas temperatures up to $>200^\circ \text{C}$.
- For existing flue gas systems the restoration must be carried out according to the instructions of the chimney constructor.
- Calculation of the chimney section based on EN 13384 and EN 1443.
- Planning a bypass air flap as a chimney limitation is recommended.

Start-up condensate from the boiler

- When commissioning a cold boiler, condensate always occurs within the boiler. This collects in the lower area of the boiler (flue gas collector) and is then evaporated through the boiler's continued heating up.
- The boiler should therefore – due also to this reason – only be started up without “network acceptance”, so that the condensation temperature threshold (approx. 55°C) is exceeded as quickly as possible
- If necessary, the condensate which occurs can be drained via the flue gas collector's cleaning fitting (remove cap on the drain connection before starting the burner, connect ball valve and temperature-resistant drain hose).

Remarks

- When draining the condensate, it must be ensured that no uncontrolled escape of flue gas occurs in the installation room (do not keep the ball valve open “constantly”, but only drain off the condensate “intermittently”).
- The locally valid waste water regulations must be observed when disposing of the condensate!

- As soon as the boiler has reached its minimum temperature and this can be kept stable via the return boost, the burner should be shut off briefly and the closure cap mounted on the cleaning drain connection again.
- The drain connection on the boiler's flue gas collector is not intended for the permanent connection of a drainage line – frequent condensation in the area of the boiler is impermissible!

Boiler water specifications

Guiding lines for boiler water and system water specifications for pump circulation boilers (large water room boiler)

Operating pressure	bar	$> 0.5 \leq 25$
General requirements	colourless, clear, free from suspended matter and foam	
pH value at 25 °C		9.0-11.5
Sum of earth alkalies (Ca + Mg) ¹⁾	mmol/l	< 0.02
	°dH	< 0.112
Conductivity at 25 °C ⁴⁾	µS/cm	< 1500
Acid capacity KS 8.2 ²⁾ (p-value)	mmol/l	1-5
Silicic acid (SiO ₂)	mg/l	< 100
Phosphate (P ₂ O ₄) ³⁾	mg/l	10-30
Sodium sulphite (Na ₂ SO ₃) ³⁾	mg/l	5-10
Iron (Fe)	mg/l	< 0.2
Copper (Cu)	mg/l	< 0.1
Oil/fat	mg/l	< 1.0
Oxygen (O ₂)	mg/l	< 0.02

¹⁾ Noted in the past as °dH, changing factor: 1 mmol/l = 5.6 °dH (German hardness)

²⁾ Noted in the past as p-value, changing factor: KS 8.2 = 1 according p-value = 1

³⁾ Measuring only necessary if dosing chemicals are used which contains these values.

⁴⁾ For level electrodes minimum conductivity $> 5 \mu\text{S/cm}$

It is not necessary to make continuous control of following parameters: silicic acid (SiO₂)

Important notice:

Hoval recommends that a water treatment specialist is employed to carry out routine monitoring of the supply water in order to ensure it remains within specification.

aqua3 E

Hoval hot water boiler

The Hoval high output hot water boilers are made of quality steel and are distinguished by their solid, robust and elastic construction. They particularly convince by their easy way of operation, their easy maintenance and optimal efficiency. The client receives an economical, environment friendly compact unit, ready for installation. The boilers are constructed for oil or gas firing.

Boiler type aqua3 E

The type aqua3 E as classical 3 pass flame tube wet back boiler with an inner fully water cooled flue gas turning chamber guarantees high efficiency. The boiler consists of a cylindric shell, the two head plates, the centric flame tube including the back flue gas turning chamber with water cooled finned tube wall and the two flue gas passes. The boiler door is thermally insulated and flue gas proof for burner mounting. The boiler is completely electrically welded and provided with all required inspection openings.

The spacious designed flame tube with low thermal charges results in an excellent combustion and reduces emissions. The large water content secures an even boiler running time and thus reduces the number of boiler starts.

Admissible max. safety valve pressure/temperature

Standard pressures: 10, 13 and 16 bar.

Higher pressure on request.

Max. temperature up to 210 °C.

Thermal insulation

The boiler is fully insulated including flue gas collector with rock wool insulation. The casing is made of structured aluminium plate. Sockets and cuttings are nicely framed.

Connection fittings and sockets

The connection fittings and sockets on the boiler and on the fitting pipe are meant for the attachment of:

Flow intermediate piece, Thermometer for return, return shut-off, safety valve, drain.

Large equipment

2 boiler supports

1 flue gas collector with integrated flue gas exit backward

1 back cleaning cover with bleeder valves

1 boiler door for burner mounting, thermally insulated and designed flue gas proof, placed on left and right swivelable hinges for the flue gas sided cleaning of boiler

1 boiler plate

High efficiency

Due to the above technical facts an efficiency of up to > 91 % (120 °C middle temperature, flow/return) can be achieved. Thus continuous working costs are kept low. The sources of energy are used more efficiently and Hoval protects the environment.



Construction guiding, quality approval

The boiler is designed with all necessary inspection doors.

The construction and manufacturing of the boilers is done according to the European Pressure Equipment Directive (PED) 2014/68/EU - EN 12953 with CE-certificate. The ISO 9001:2000 certification and the quality approval at our factory with our Hoval quality performance department guarantees the highest product quality. For installation and operation of the boiler the local laws and norms are to be respected.

Control panel

The control panel for the Hoval boiler can be equipped with the required control units and indicators for control and supervision of boiler and burner. The operation and alarm reports may be shown as fault indication. The control panel will be made upon customer requirements and depending on the burner to be used.

Boiler water quality

For operation the Hoval and the country specific boiler water regulations have to be respected and local waste water regulations have to be paid attention to. Detailed information for the boiler water quality can be found in the appendix.

Delivery

The pressure body is provided with a primer. Due to transport reasons the insulation can be fixed at the factory. Burner armatures and control panel are either pre-mounted (as far as transport technically possible) or packed loosely in a separate box. The mounting and wiring can be done at the factory or at site. Connection openings are covered.

On request

Volt-free contacts for BMS connection (Building Management System).

Sectional view



Return injection: The return water from the heating system is led into the warm area of the boiler. Because of the special return injection the entering water into the boiler will be turned by 90° and accelerated by a baffle plate. By injector effect hot water will be sucked in and will be mixed intensively with the cold water. Thereby the temperature of the return water increases.

Boiler door: Large boiler door provides easy access for cleaning of the combustion chamber to the second and third pass. The boiler door can be easily opened by the special hinge construction to the left or right. The boiler door with an optimised thermal insulation helps to reduce the calorific losses of the boiler to a minimum.

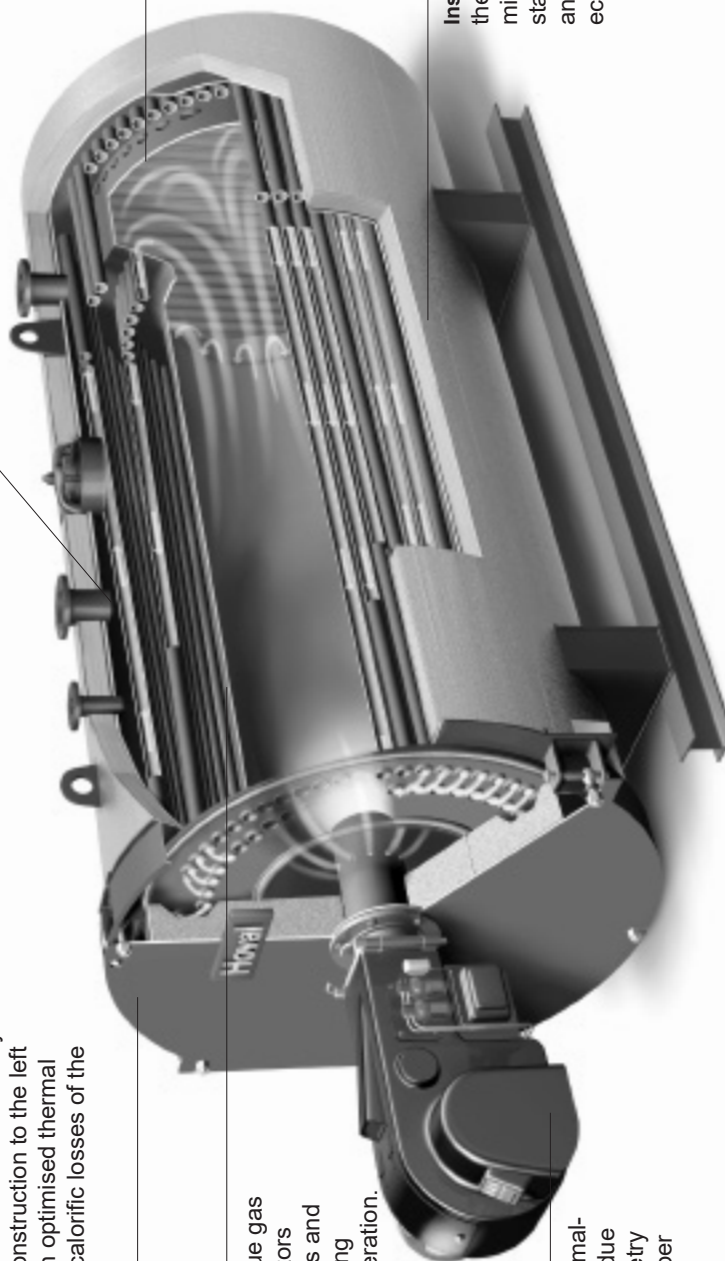
Heating surface: The smooth flue gas flame tube without any turbulators reduces the exhaust gas losses and makes an easy and fast cleaning possible for an economical operation.

Burner: The boiler can be optimally fitted with LowNOx burners due to combustion chamber geometry and the low combustion chamber load.

Finned tube wall (reverse chamber)

Due to the finned tube wall a completely water cooled turning chamber of the first to the second pass secure a maximum utilisation of the heat.

Insulation: A highly effective thermal insulation with aluminium boarding reduces the standby losses to a minimum and contributes to highest economy.



aqua3 E (1000-6000)

Technical data

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• Nominal output (oil firing)	kW	1000	2000	3000	4000	5000	6000
• Nominal output (gas firing)	kW	1000	2000	3000	4000	5000	6000
• Operating temperature max. (SBT) ¹⁾		depending on net pressure					
• Temperature level flow/return		depending on net pressure					
• Safety valve pressure	bar	10	10	10	10	10	10
	bar	13	13	13	13	13	13
	bar	16	16	16	16	16	16
• Boiler efficiency at 120 °C (natural gas) *	%	89.2	89.6	89.7	89.6	89.4	89.5
• Boiler efficiency at 120 °C (diesel oil) *	%	89.9	90.3	90.3	90.2	90.1	90.2
• Flue gas resistance	mbar	8.0	9.0	10.0	11.0	11.0	11.0
at max. boiler load of	kW	1000	2000	3000	4000	5000	6000
• Water content	l	2150	4000	5810	6890	8310	10020
• Water flow resistance **	mbar	95	65	72	52	80	110
	z-value ***	0.05264	0.00901	0.00406	0.00181	0.00178	0.00170
• Flue gas temperature after boiler (natural gas)	°C	246	240	241	244	248	247
• Flue gas temperature after boiler (diesel oil)	°C	235	230	231	234	238	237

¹⁾ Country and equipment specific

* efficiency for boiler middle temperature

** for boiler max. load and $\Delta T = 20 \text{ K}$

*** for other flow rates use "z-value" for water side pressure loss calculation: $\Delta p \text{ (mbar)} = \text{asked flow rate (m}^3/\text{h)}^2 \cdot z$

Dimensions and weights

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• Flame tube diameter	10 bar mm	600	740	860	920	980	1050
	13 bar mm	600	740	860	920	980	1050
	16 bar mm	600	740	860	920	980/1080	1050/1200
• Flame tube length without turning chamber	mm	1764	2606	3206	3610	4056	4306
• Boiler length							
with insulation, without burner	mm	2830	3680	4280	4680	5130	5480
• Boiler width							
with insulation, without armatures	mm	1660	1910	2110	2210	2310	2460
• Boiler height							
with insulation, without assembly tube	mm	1800	2050	2250	2450	2550	2700
• Diameter flue gas outlet	mm	300	450	500	600	650	750
• Transport weight without burner incl. equipment							
	10 bar kg	3500	5000	7500	9200	11100	13300
	13 bar kg	3800	5500	8300	10000	11400	14300
	16 bar kg	4100	6000	8800	10800	12500	15200

Assembly tube

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• 1 assembly tube without insulation (flow intermediate piece) (dimensions for $\Delta T = 20 \text{ K}$)	[DN]	80	125	150	200	200	200

Boiler basic equipment

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• 1 drain ball valve	[DN]	40	40	40	40	40	40
• 1 ventilation valve (assembly tube)	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 thermometer flow	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 thermometer return flow	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 safety thermostat	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 cleaning set		Brush with rod					

Boiler basic equipment

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• 1 safety valve 10 bar		25/40	40/65	50/80	50/80	65/100	65/100
• 1 safety valve 13 bar		25/40	32/50	40/65	50/80	65/100	65/100
• 1 safety valve 16 bar		25/40	32/50	40/65	50/80	50/80	65/100

Flow/return flow shut off armature

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• Shut-off flap		80	125	150	200	200	200

Boiler equipment according to TRD 604 - EN 12953-6

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• 2 safety temperature controls		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 return flow temperature control		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 pressure gauge		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 2 safety pressure controls		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 pressure min. control		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 water level limiter		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 min. flow control switch		DN 50	DN 50	DN 50	DN 50	DN 50	DN 50

Boiler return flow heat up

Type		(1000)	(2000)	(3000)	(4000)	(5000)	(6000)
• 1 pump 140 °C	[m³/h]	14	35	50	65	80	90
• 1 thermostat	[DN]	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 non return valve	[DN]	40	80	80	80	80	100
• 2 shut-off flaps	[DN]	40	80	80	80	80	100
• 1 pump 180 °C	[m³/h]	14	35	50	65	80	90
• 1 thermostat	[DN]	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 non return valve	[DN]	65	80	80	80	80	100
• 2 shut-off flaps	[DN]	65	80	80	80	80	100

Subject to project-related alterations

aqua3 E (8000-16500)

Technical data

Type		(8000)	10000)	(12000)	(15000)	(16500)
• Nominal output (oil firing)	kW	7930	9400	12000	12730	12810
• Nominal output (gas firing)	kW	8000	10000	12000	15000	16380
• Operating temperature max. (SBT) ¹⁾		depending on net pressure				
• Temperature level flow/return		depending on net pressure				
• Safety valve pressure	bar	10	10	10	10	10
	bar	13	13	13	13	13
	bar	16	16	16	16	16
• Boiler efficiency at 120 °C (natural gas) *	%	89.4	89.5	89.1	89.6	89.9
• Boiler efficiency at 120 °C (diesel oil) *	%	90.1	90.4	89.8	90.8	91.4
• Flue gas resistance	mbar	12.0	11.0	14.0	15.0	14.0
at max. boiler load of	kW	8000	10000	12000	15000	16380
• Water content	l	12970	15870	20780	26920	32350
• Water flow resistance **	mbar	80	120	85	135	120
	z-value ***	0.00070	0.00067	0.00033	0.00033	0.00022
• Flue gas temperature after boiler (natural gas)	°C	250	249	259	248	240
• Flue gas temperature after boiler (diesel oil)	°C	240	234	248	223	210

¹⁾ Country and equipment specific

* efficiency for boiler middle temperature

** at boiler max. load and $\Delta T = 20 \text{ K}$

***for other flow rates use "z-value" for water side pressure loss calculation: $\Delta p \text{ (mbar)} = \text{asked flow rate (m}^3/\text{h)}^2 \cdot z$

Dimensions and weights

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• Flame tube diameter	10 bar mm	1170	1280	1400/1550	1550/1700	1620/1770
	13 bar mm	1170/1320	1280/1430	1400/1550	1550/1700	1620/1770
	16 bar mm	1170/1320	1280/1430	1400/1550	1550/1700	1620/1770
• Flame tube length without turning chamber	mm	4680	5130	5830	6130	6430
• Boiler length						
with insulation, without burner	mm	5830	6330	7030	7365	7665
• Boiler width						
with insulation, without armatures	mm	2660	2860	3060	3360	3560
• Boiler height						
with insulation, without assembly tube	mm	2900	3150	3350	3650	3900
• Diameter flue gas outlet	mm	850	950	1050	1150	1200
• Transport weight without burner incl. equipment						
	10 bar kg	17800	20500	23000	26500	31000
	13 bar kg	19000	22000	24500	28000	33000
	16 bar kg	20500	23500	26700	32000	35000

Assembly tube

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• 1 assembly tube without insulation (flow intermediate piece) (dimensions for $\Delta T = 20 \text{ K}$)	[DN]	250	250	300	300	350

Boiler basic equipment

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• 1 drain ball valve	[DN]	40	40	40	40	40
• 1 ventilation valve (assembly tube)	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 thermometer flow	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 thermometer return flow	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 safety thermostat	[DN]	1/2"	1/2"	1/2"	1/2"	1/2"
• 1 cleaning set		Brush with rod				

Safety valve

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• 1 safety valve 10 bar		80/125	80/125	100/150	100/150	125/200
• 1 safety valve 13 bar		65/100	80/125	80/125	100/150	100/150
• 1 safety valve 16 bar		65/100	65/100	80/125	80/125	100/150

Flow/return flow shut-off armature

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• Shut-off flap		250	250	300	300	350

Boiler equipment according to TRD 604 - EN 12953-6

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• 2 safety temperature controls STB		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 return flow temperature control		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 pressure gauge		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 2 safety pressure controls		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 pressure min. control		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 water level limiter		R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 min. flow control switch		DN 50	DN 50	DN 50	DN 50	DN 50

Boiler return flow heat up

Type		(8000)	(10000)	(12000)	(15000)	(16500)
• 1 pump 140 °C	[m³/h]	120	150	175	230	260
• 1 thermostat	[DN]	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 non return valve	[DN]	125	150	150	200	200
• 2 shut-off flaps	[DN]	125	150	150	200	200
• 1 pump 180 °C	[m³/h]	120	150	175	230	260
• 1 thermostat	[DN]	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 non return valve	[DN]	125	150	150	200	200
• 2 shut-off flaps	[DN]	125	150	150	200	200

Subject to project-related alterations

aqua3 E (18000-20000)

Technical data

Type		(18000)	(20000)
• Nominal output (oil firing)	kW	17980	19580
• Nominal output (gas firing)	kW	18000	20000
• Operating temperature max. (SBT) ¹⁾		depending on net pressure	
• Temperature level flow/return		depending on net pressure	
• Safety valve pressure	bar	10	10
	bar	13	13
	bar	16	16
• Boiler efficiency at 120 °C (natural gas) *	%	90.2	90.9
• Boiler efficiency at 120 °C (diesel oil) *	%	91.0	91.5
• Flue gas resistance	mbar	15.0	15.0
at max. boiler load of	kW	18000	19580
• Water content	l	35140	38250
• Water flow resistance **	mbar	80	100
	z-value ***	0.00014	0.00014
• Flue gas temperature after boiler (natural gas)	°C	235	220
• Flue gas temperature after boiler (diesel oil)	°C	226	211

¹⁾ Country and equipment specific

* efficiency for boiler middle temperature

** at boiler max. load and $\Delta T = 20 \text{ K}$

*** for other flow rates use "z-value" for water side pressure loss calculation: $\Delta p \text{ (mbar)}$
 $= \text{asked flow rate (m}^3/\text{h)}^2 \cdot z$

Dimensions and weights

Type			(18000)	(20000)
• Flame tube diameter	10 bar	mm	1700/1850	1770/1920
	13 bar	mm	1700/1850	1770/1920
	16 bar	mm	1700/1850	1770/1920
• Flame tube length without turning chamber		mm	6680	7080
• Boiler length				
with insulation, without burner		mm	7915	8315
• Boiler width				
with insulation, without armatures		mm	3660	3760
• Boiler height				
with insulation, without assembly tube		mm	4050	4200
• Diameter flue gas outlet		mm	1250	1300
• Transport weight without burner incl. equipment				
	10 bar	kg	35000	40000
	13 bar	kg	38500	43000
	16 bar	kg	42000	46000

Assembly tube

Type		(18000)	(20000)
• 1 assembly tube without insulation (flow intermediate piece) (dimensions for $\Delta T = 20\text{ K}$)	[DN]	400	400

Boiler basic equipment

Type		(18000)	(20000)
• 1 drain ball valve	[DN]	40	40
• 1 ventilation valve (assembly tube)	[DN]	1/2"	1/2"
• 1 thermometer flow	[DN]	1/2"	1/2"
• 1 thermometer return	[DN]	1/2"	1/2"
• 1 safety thermostat	[DN]	1/2"	1/2"
• 1 cleaning set		Brush with rod	

Safety valve

Type		(18000)	(20000)
• 1 safety valve 10 bar		125/200	125/200
• 1 safety valve 13 bar		100/150	125/200
• 1 safety valve 16 bar		100/150	100/150

Flow/return flow shut-off armature

Type		(18000)	(20000)
• Shut-off flap		400	400

Boiler equipment according to TRD 604 - EN 12953-6

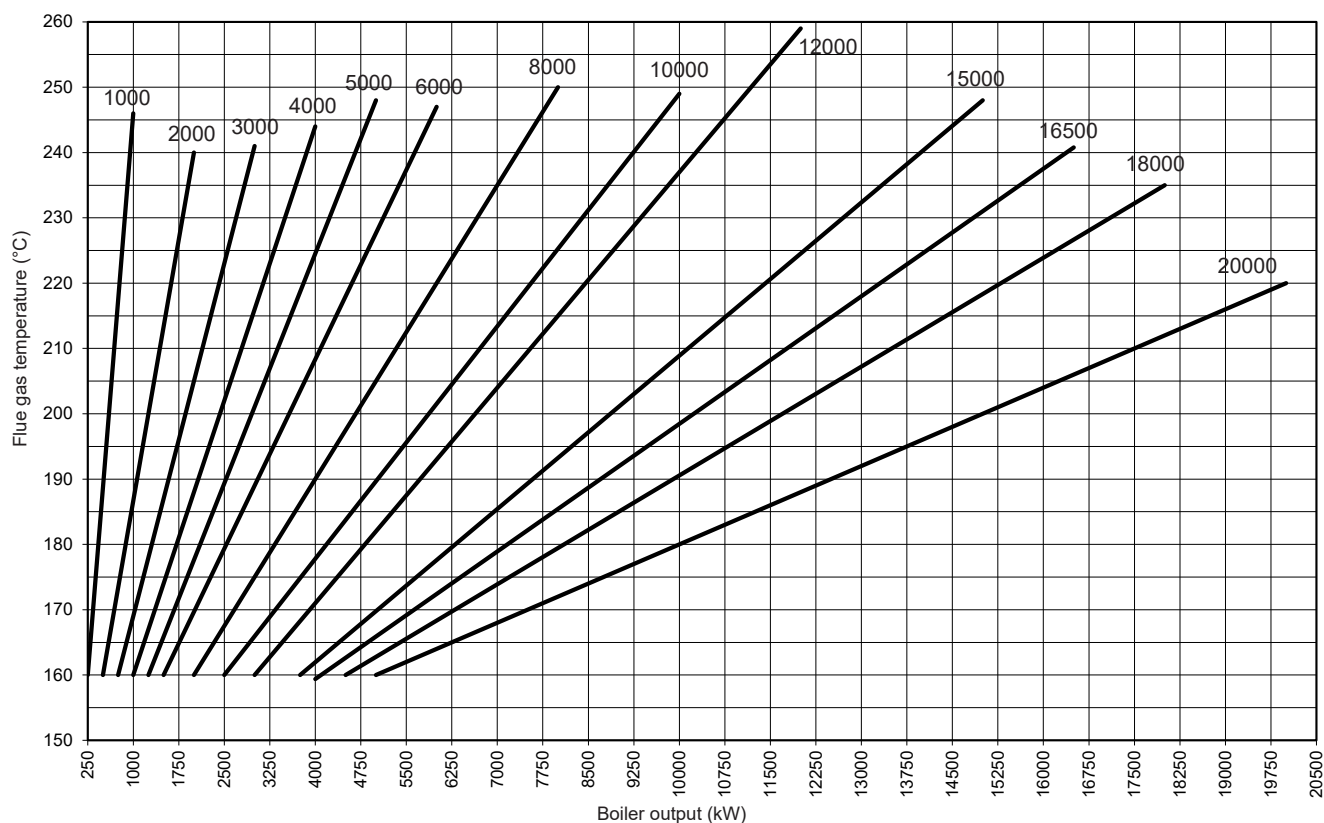
Type		(18000)	(20000)
• 2 safety temperature controls		R 1/2"	R 1/2"
• 1 return flow temperature control		R 1/2"	R 1/2"
• 1 pressure gauge		R 1/2"	R 1/2"
• 2 safety pressure controls		R 1/2"	R 1/2"
• 1 pressure min. control		R 1/2"	R 1/2"
• 1 water level limiter		R 1/2"	R 1/2"
• 1 min. flow control switch		DN 50	DN 50

Boiler return flow heat up

Type		(18000)	(20000)
• 1 pump 140 °C	[m³/h]	290	320
• 1 thermostat	[DN]	R 1/2"	R 1/2"
• 1 non return valve	[DN]	200	200
• 2 shut-off flaps	[DN]	200	200
• 1 pump 180 °C	[m³/h]	290	320
• 1 thermostat	[DN]	R 1/2"	R 1/2"
• 1 non return valve	[DN]	200	200
• 2 shut-off flaps	[DN]	200	200

Subject to project-related alterations

Flue gas diagram



These data represent an average value from measurements with different burner manufacturers.

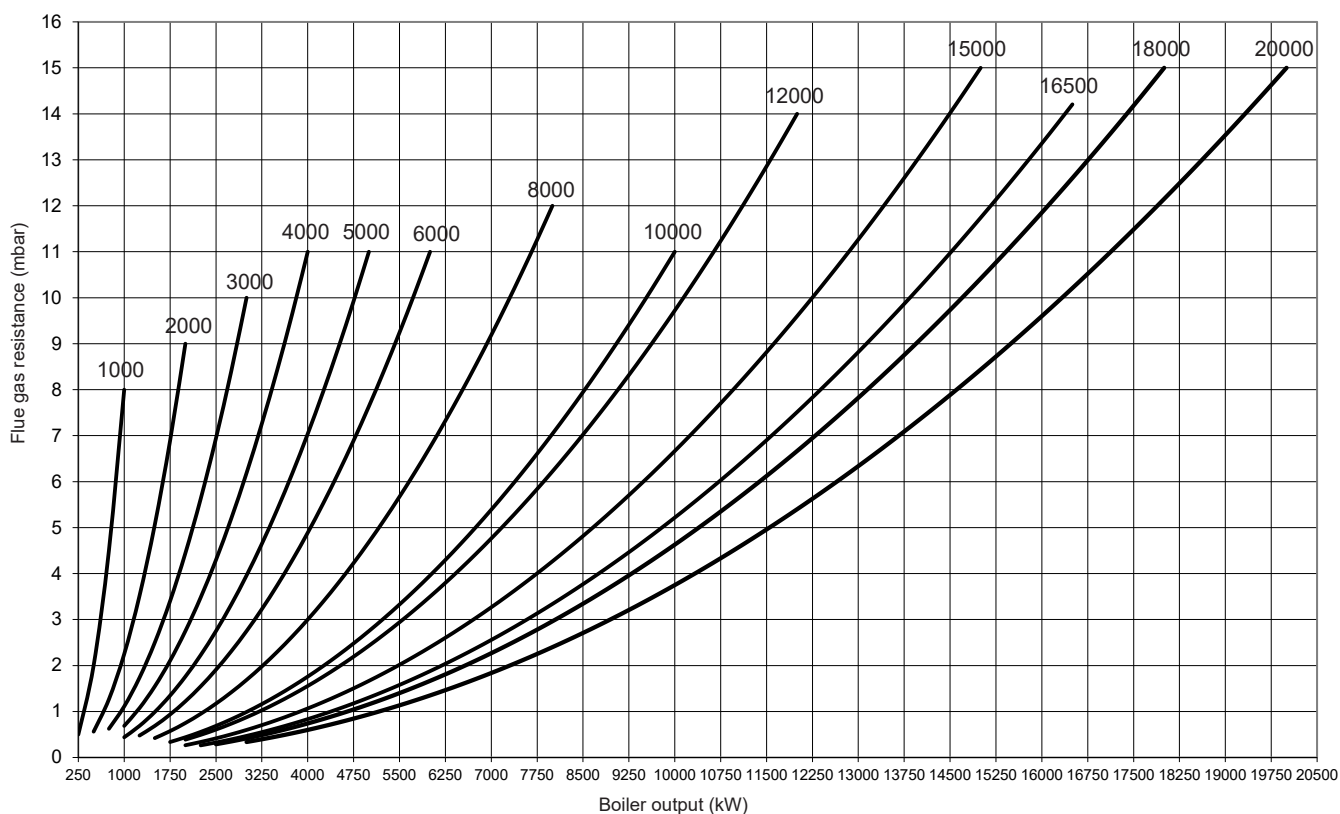
kW = Boiler output

°C = Flue gas temperature with cleaned heating surface, boiler middle temperature 120 °C

- Operating with natural gas,
 $\lambda = 1.15$ with max. burner output

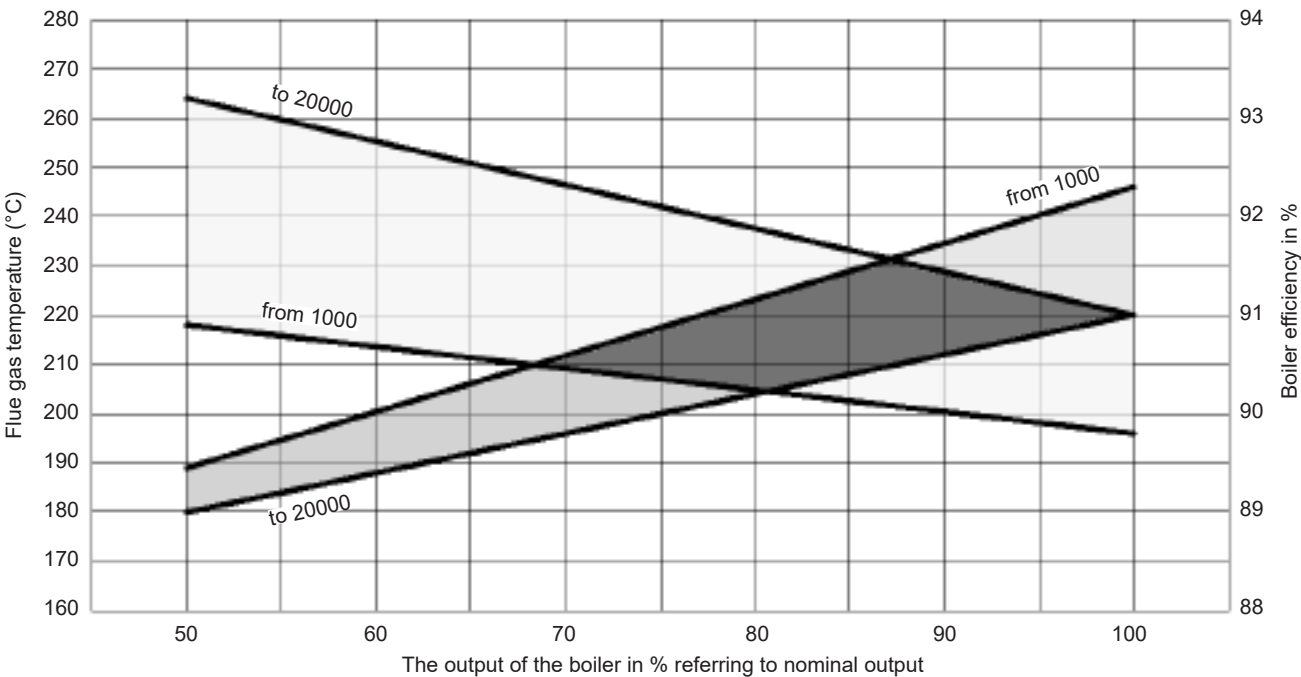
- A reduction of the boiler water temperature of 10 K causes a reduction of the flue gas temperature by approx. 6-8 K.

Flue gas resistance

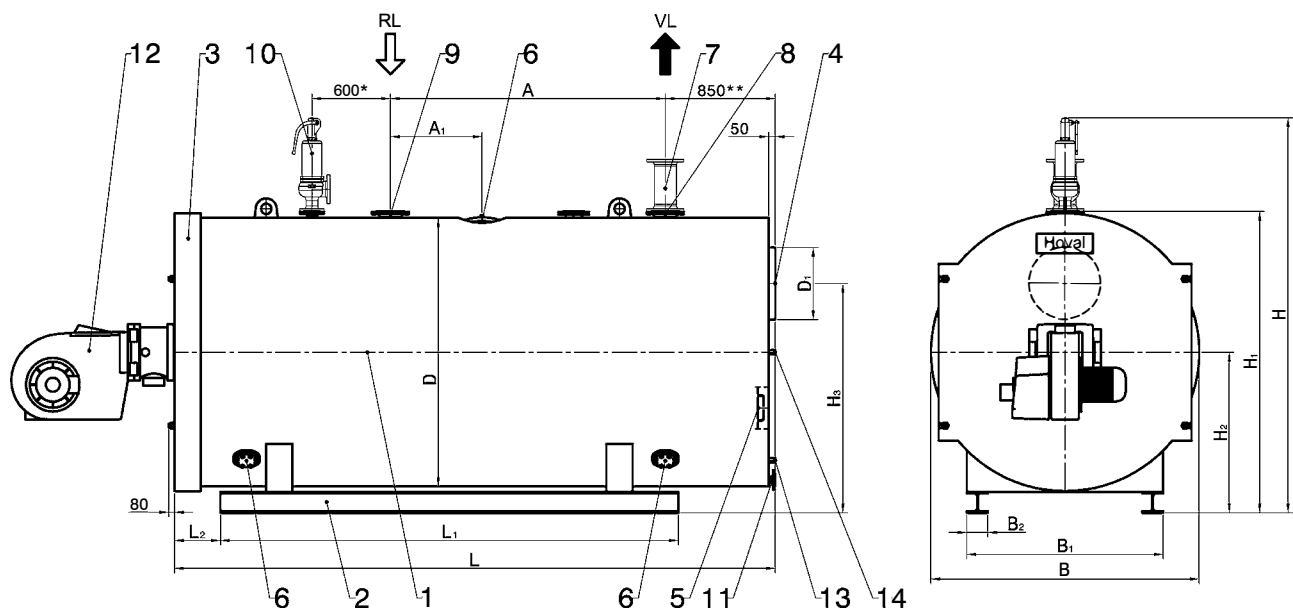


Flue gas temperature and boiler efficiency

In dependence on the boiler efficiency with a middle boiler water temperature of 120 °C.



aqua3 E (1000-20000)



- 1 Boiler (with flue gas collector)
- 2 Boiler base
(up to type 3000 with U-girder, from
type 4000 with I-girder)
- 3 Hinged door, incl. reversal chamber
2nd/3rd smoke gas pass
- 4 Flue gas outlet with 1 x 1/2" pipe fitting
- 5 Explosion flap and cleaning opening
- 6 Inspection opening
- 7 Boiler outlet armature tube PN 16/PN 25
- 8 Boiler flow nozzle (BF)
- 9 Return flow nozzle

- 10 Safety valve nozzle (SV)
- 11 Purge/drain valve DN 40/PN 40
- 12 Burner
- 13 Condensate drain nozzle R1"
- 14 Flame peephole

* type 1000 = 400, type 2000 = 500,
type 16500 - 20000 = 700 mm
** From type 6000 upwards = 950 mm

Design pressure 10, 13 and 16 bar (gauge).
Dimensions for boiler design pressure 10 bar
Safety valve dimensions for boiler design pressure 10 bar
Notice: Add 100 mm to H₁ for crane hooks.

Other pressure levels on request!
Dimensions incl. 100 mm insulation

Boiler type	Main dimensions					Boiler foundation					Transport dim.		F/R nozzle			Flue gas con.		SV
	B	L	H	H ₁	H ₂	D	L ₁	L ₂	B ₁	B ₂	B _{min}	H ₄ ⁴ _{min}	A	A ₁	DN ^{1,3}	H ₃	D ₁	DN ¹
(1000)	1660	2830	2185	1800	950	1600	2000	0	1150	60	1760	2285	800	300	80	1300	300	25
(2000)	1910	3680	2580	2050	1075	1850	2850	0	1375	60	2010	2680	1500	500	125	1500	450	40
(3000)	2110	4280	2835	2250	1175	2050	3450	0	1550	60	2210	2935	2000	700	150	1700	500	50
(4000)	2210	4680	3035	2450	1325	2150	3700	150	1600	160	2310	3135	2400	800	200	1800	600	50
(5000)	2310	5130	3265	2550	1375	2250	4150	150	1700	160	2410	3365	2850	950	200	1900	650	65
(6000)	2460	5480	3415	2700	1450	2400	4400	150	1800	160	2560	3515	3100	1000	200	2000	750	65
(8000)	2660	5830	3705	2900	1550	2600	4750	150	1950	160	2760	3805	3450	1150	250	2150	850	80
(10000)	2860	6330	3955	3150	1700	2800	5200	150	2050	200	2960	4055	3900	1300	250	2350	950	80
(12000)	3060	7030	4260	3350	1800	3000	5900	150	2200	200	3160	4360	4600	1530	300	2500	1050	100
(15000)	3360	7365	4560	3650	1950	3300	6200	150	2400	200	3460	4660	4900	1630	300	2725	1150	100
(16500)	3560	7665	4995	3900	2100	3500	6500	150	2600	200	3660	5095	5100	1700	350	2925	1200	125
(18000)	3660	7915	5145	4050	2200	3600	6750	150	2700	200	3760	5245	5350	1780	400	3050	1250	125
(20000)	3760	8315	5295	4200	2300	3700	7150	150	2900	200	3860	5395	5750	1910	400	3175	1300	125

¹ DN/...PN 16/PN 40

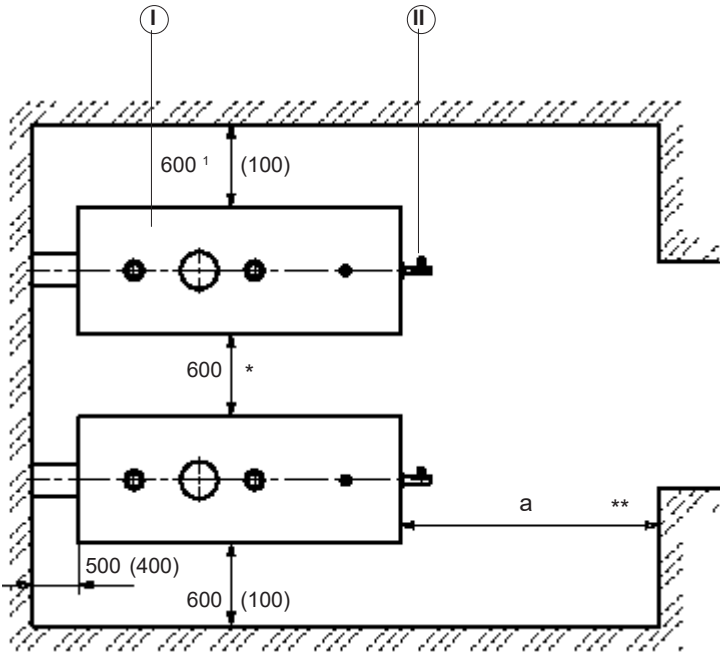
³ Diameter for standard ΔT = 20 K, other dimensions on request

⁴ without armature tube

Space requirements

Installation

(Dimensions in mm)



- I

Boiler
- II

Burner
- *

Consider control panel
- **

Flame tube length (cleaning)
- ¹

600-900, depending on local standards

To facilitate installation and maintenance the given measures should be kept; in case of limited space the minimal spaces (measures in brackets) are sufficient.

Positioning

- No air pollution through halogenated hydrocarbon (contained e.g. in sprays, paints, solvents and cleaners)
- No large amounts of dust
- No high atmospheric humidity
- Frost-resistant and well ventilated
- Otherwise errors and damages to the installation may occur.
- The boiler may only be installed in rooms where air pollution through halogenated hydrocarbon can occur if sufficient measures are taken ensuring the supply of unpolluted combustion air.

aqua3 E

Type	(1000) mm	(2000) mm	(3000) mm	(4000) mm	(5000) mm	(6000) mm	(8000) mm	(10000) mm	(12000) mm	(15000) mm	(16500) mm
a	2200	3000	3600	4000	4400	4700	5100	5500	6200	6500	6800

aqua3 E

Type	(18000) mm	(20000) mm
a	7100	7500

Rules and regulations

The following rules and regulations have to be respected:

- Hoval technical information and installation guide.
- hydraulic and control technical regulations, to guarantee the min. admissible boiler temperature and the conditions for a safe operation according to national regulations.
- fire protection regulations
- national regulations concerning permission, installation and operation of boiler appliances. Boiler appliances have to be installed according to national laws and regulations and accessories requirements.
- Besides the national and local regulations the project specific circumstances of the boiler supplier have to be considered for every application.

Water treatment/water quality

- The quality of the boiler water has to be guaranteed according to Hoval technical information and national regulations.
- Hoval boilers must only be operated with treated water. For the treatment of water apply for the values to be kept refer to the Hoval guide lines.
- Requested water quality: see supplement.
- Do not use chemical additives such as anti-freeze, inhibitors, etc. without written confirmation from Hoval.
- Old and new installations must be well flushed before filling.
- The water quality should be monitored and recorded.

Planning, operation and maintenance

- National and local rules and regulations have to be considered for the fuel supply.
- Safety and exhaust valve connections must be able to discharge the system pressure without any risk.
- Filters and strainers have to be cleaned periodically, especially if installed in front of control devices.
- The components containing heat and the pipes are to be insulated in order to reduce radiation losses.

Combustion air

- The supply of combustion air must be guaranteed for a safe and economic operation. There must be no possibility to close the air supply opening.
- Aeration and ventilation of the boiler house has to be secured.
- In the installation room no negative pressure larger than 3 N/m² is allowed. To adhere to this demand, plan a cross free section for the air supply opening of at least 200 cm², resp. 2 cm² per kW output. The aspect ratio for rectangular openings should not be more than 1.5 : 1. If the opening is trellised an adequate surcharge is needed. National laws have to be respected.
- Boiler houses have to be fitted with the relevant outer pressure relief surface.
- Boilers are not to be installed in rooms where halogen compounds occur which can enter the combustion air. (e.g. laundries, drying, etc.).

Noise level reduction

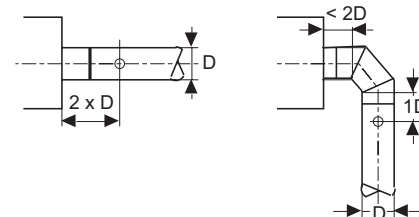
The following measures for noise level reduction are possible:

- Solid construction of heating room walls, ceiling and floor, installation of silencer in fresh air supply, noise insulation for support and bracket of pipes.
- Installation of sound attenuation cowl for burner.
- A substantial part of the sound caused in the combustion chamber and in the top heating surfaces is radiated from the flue gas system as sound transmitted by air. In addition to this, resonance features, depending on chimney dimensioning and inlet, may occur which are triggered by the oscillation of the combustion noises (snooping). These sounds can be reduced by burner-lateral measures, e.g. changes of flame geometry, atomisation characteristics or fuel throughput.
- Flue gas sound absorbers cause a substantial sound level reduction as well. These sound absorbers should usually be tuned at low frequencies of 60 - 250 Hz. Flue gas sound absorbers function according to the principle of sound absorption. The kinetic energy of the exhaust gases is consumed by friction requiring an increase in chimney draft in the flue gas system. This has to be considered for burner dimensioning. The connection piece from the boiler to the flue gas sound absorber has to be gas-tight because the draft- and pressure-zero point is behind the flue gas sound absorber.
- The necessary space requirement of approx. 2 m for the later installation of a flue gas sound absorber should already be included when planning.

Chimney/flue gas system

Flue gas line

- The flue gas connection pipe between the boiler and the vertical part of the flue gas line should be routed into the vertical part with a 30-45° incline.
- Thermal insulation is required with a length of more than 1 m.
- The insertion of the connection tube into the chimney must be carried out in such a way that no condensate can flow into the boiler
- A closable flue gas test port with a circular internal diameter of between 10-21 mm must be installed in the connection tube. The port must protrude beyond the thermal insulation.



Flue gas system

- The flue gas system must be humidity-insensitive and acid-proof and admitted for flue gas temperatures up to >200 °C.
- For existing flue gas systems the restoration must be carried out according to the instructions of the chimney constructor.
- Calculation of the chimney section based on EN 13384 and EN 1443.
- Planning a bypass air flap as a chimney limitation is recommended.

Start-up condensate from the boiler

- When commissioning a cold boiler, condensate always occurs within the boiler. This collects in the lower area of the boiler (flue gas collector) and is then evaporated through the boiler's continued heating up.
- The boiler should therefore – due also to this reason – only be started up without “network acceptance”, so that the condensation temperature threshold (approx. 55 °C) is exceeded as quickly as possible.
- If necessary, the condensate which occurs can be drained via the flue gas collector's cleaning fitting (remove cap on the drain connection before starting the burner, connect ball valve and temperature-resistant drain hose).

Remarks

- When draining the condensate, it must be ensured that no uncontrolled escape of flue gas occurs in the installation room (do not keep the ball valve open “constantly”, but only drain off the condensate “intermittently”).
- The locally valid waste water regulations must be observed when disposing of the condensate!

- As soon as the boiler has reached its minimum temperature and this can be kept stable via the return boost, the burner should be shut off briefly and the closure cap mounted on the cleaning drain connection again.
- The drain connection on the boiler's flue gas collector is not intended for the permanent connection of a drainage line – frequent condensation in the area of the boiler is impermissible!

Boiler water specifications

Boiler water - general

Boiler water must be free of hardness components. pH-value should be above neutral level. Please refer to following tables for water composition.

During a BOSB-operation feed- and boiler water have to be checked every 72 h, without BOSB- operation daily checks are necessary! The values must be recorded in the operating log book!

Make up water for hot water boilers (table 1)

Parameter	Unit	Make-up water for hot water boilers
Operating pressure	bar (0.1 MPa)	total range
Appearance	-	clear, free from suspended solids and foam
Direct conductivity at 25 °C	µS/cm	not specified, only guide values for boiler water relevant
pH value at 25 °C ¹⁾	-	> 7.0
Total hardness ³⁾ (Ca + Mg)	mmol/l	< 0.02
Iron (Fe) concentration	mg/l	< 0.2
Copper (Cu) concentration	mg/l	< 0.1
Silica (SiO ₂) concentration	mg/l	not specified, only guide values for boiler water relevant, see table 2
Oxygen (O ₂) concentration	mg/l	-
Oil/grease concentration (see EN 12953-6)	mg/l	< 1
Organic substances (as TOC) concentration	-	see footnote ²⁾

¹⁾ With copper alloys in the system the pH value shall be maintained in the range 8.7 to 9.2.

²⁾ Organic substances are generally a mixture of several different compounds. The composition of such mixtures and the behaviour of their individual components under the conditions of boiler operation are difficult to predict. Organic substances may be decomposed to form carbonic acid or other acidic decomposition products which increase the acid conductivity and cause corrosion or deposits. They also may lead to foaming and/or priming which shall be kept as low as possible.

³⁾ Noted in the past as °dH, conversion factor: 1 mmol/l = 5.6°dH (German hardness)

Source: EN12953-10:2003 (E) + Hoval handbook

Boiler water specifications

Boiler water for hot water boilers (table 2)

Parameter	Unit	Boiler water for hot water boilers
Operating pressure	bar (0.1 MPa)	total range
Appearance	-	clear, free from suspended solids and foam
Direct conductivity at 25 °C	µS/cm	< 1 500 ⁶⁾
pH value at 25 °C	-	9.0 to 11.5 ¹⁾
Total hardness (Ca + Mg) ⁶⁾	mmol/l	< 0.02
Composite alkalinity ⁴⁾	mmol/l	< 5
Silica (SiO ₂) concentration	mg/l	pressure dependent, according to figure 1 ⁷⁾
Phosphate (PO ₄) ^{2), 5)}	mg/l	10 to 30
Sodium Sulphite (Na ₂ SO ₃) ⁵⁾	mg/l	5 to 10
Iron (Fe) concentration	mg/l	< 0.2
Copper (Cu) concentration	mg/l	< 0.1
Oxygen (O ₂) concentration) ⁸⁾	mg/l	< 0.02
Oil/grease concentration (see EN 12953-6)	mg/l	< 1
Organic substances	-	see footnote ³⁾

¹⁾ If non-ferrous materials are present in the system, e. g. aluminium, they may require lower pH value and direct conductivity, however, the protection of the boiler has priority.

²⁾ If coordinated phosphate treatment is used; considering all other values higher PO₄-concentrations are acceptable (see clause 4 of EN 12953-10 for details).

³⁾ See ²⁾ at table 1

⁴⁾ Noted in the past as p-value, conversion factor: KS 8.2 = 1 according p-value = 1

⁵⁾ Measuring only necessary if dosing chemicals are used which contains these composition

⁶⁾ For level electrodes minimum conductivity = > 5 µS/cm

⁷⁾ It's not necessary to make continuous control of following parameters: Silica (SiO₂) concentration

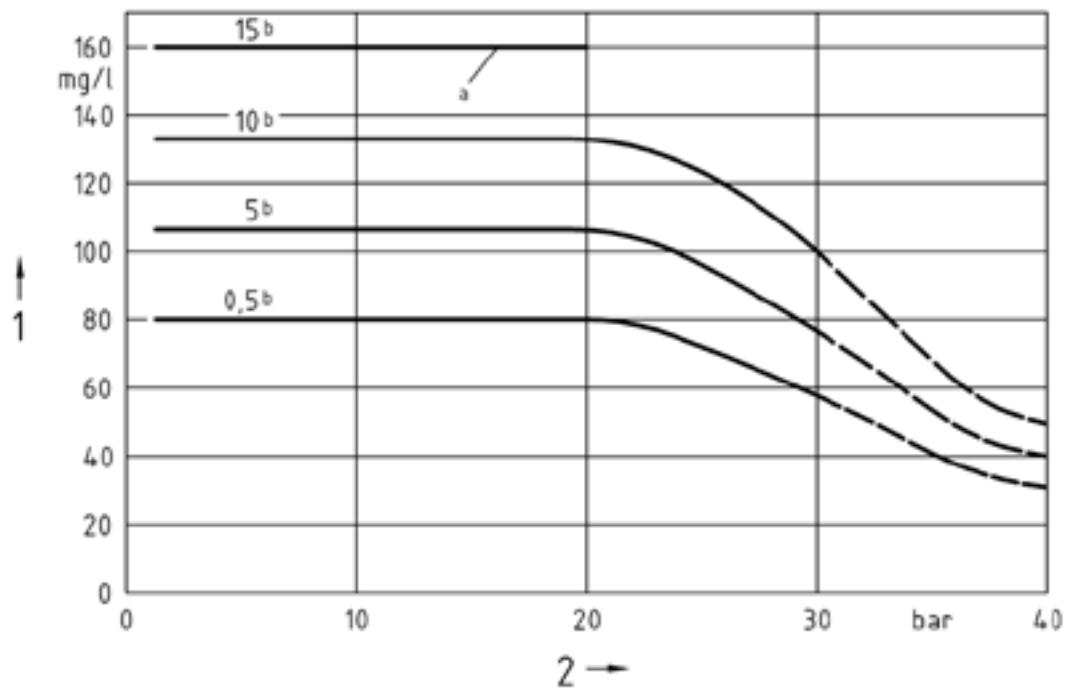
⁸⁾ Value for continuous operation and/or if a deaerator is used; if the operation is discontinuous or without deaerator film forming agents and/or excess of oxygen scavenger shall be used.

Source: EN12953-10:2003 (E) + Hoval handbook

Boiler water specifications

Fig. 1 Maximum acceptable silica content (SiO_2) of the boiler water dependent on the pressure

Source: EN12953-10:2003 (E)



1 Maximum silica content (SiO_2)

2 Operating pressure

a This level of alkalinity is not permissible > 20 bar

b Alkalinity in mmol/l

Important notice

Hoval recommends that a water treatment specialist is employed to carry out routine monitoring of the supply water in order to ensure it remains within specification.

THD-U

Hoval steam boiler

The Hoval high output steam boilers are made of high quality steel and are distinguished by their solid, robust and flexible design, particularly by their ease of operation, their easy maintenance and an optimal efficiency. The client receives an economical, environmentally friendly compact unit, ready for installation. The boilers are constructed for oil or gas firing.

Boiler type THD-U

The type THD-U classical 3 pass flame tube wet back boiler with reverse flame tube and an inner completely water cooled flue gas reversal chamber guarantees high efficiency. The boiler consists of a cylindric shell, the two end plates, the reverse flame tube including the back flue gas reversal chamber with water cooled finned tube wall, the dimple flue gas tubes which increase the heat transfer (Hoval patent) and the fitting pipe, placed either on the right (standard) or on the left. The boiler door is insulated and flue gas proof for burner mounting. The boiler is completely electrically welded and provided with all required inspection openings.

The spacious flame tube with low thermal heat release results in an excellent combustion and reduced emissions. The large water content gives steady state boiler operation and thus reduces the number of boiler starts.

Admissible max. safety valve pressure

Standard pressures: 8.5, 11.5 and 13.6 bar

Safety valve pressures: 10, 13 and 16 bar

Higher operating pressure on request.

Thermal insulation

The boiler is fully insulated including the flue gas collector with mineral wool insulation. The casing is made of stucco aluminium plate. Sockets and cuttings are nicely framed.

Connection fittings and sockets

The connection fittings and sockets on the boiler and on the fitting pipe are meant for the attachment of:

water level regulation and water level control, water level indicator (reflection indicator), pressure switch for pressure regulation and pressure supervision, pressure gauge set, main steam valve, safety valve(s), boiler feed, sludge/drainage, desalting.

Large equipment

- 2 boiler base supports in heavy construction
- 1 flue gas collector with integrated horizontal flue gas connection with cleaning door and integrated bleeder valve
- 1 boiler door for burner mounting, thermally insulated and designed flue gas proof, placed on left and right swivelable hinges for the flue gas side cleaning of boiler
- 1 feed water distribution pipe
- 1 boiler plate
- 1 low water mark NW
- 1 water separator
- 1 flue gas tube cleaning kit

High efficiency

Due to the above technical facts an efficiency of up to 90 % resp. and up to 94 % with economiser, can be achieved. Thus continuous fuel costs are kept to a minimum. The sources of energy are used more efficiently and Hoval benefits the environment.



Construction guiding, quality approval

The boiler is designed with all necessary inspection doors.

Construction and production is made acc. to the European Pressure Directive Equipment (PED) 2014/68/EU - EN 12953, with CE-approval.

The local official approval and inspection is carried out by TÜV or an independent test authority. The ISO 9001:2000 certification and the quality approval at our factory with our Hoval quality performance department guarantees the highest product quality. For installation and operation of the boiler the local laws and norms are to be respected.

Control panel

The control panel for the Hoval boiler is equipped with the required control units and indicators for control and supervision of boiler and burner. The operation and alarm reports are shown as fault indication. The control panel will be made upon customer requirements and depending on burner to be used.

Feed water quality

For operation the Hoval and the country specific feed and boiler water regulations have to be respected and local waste water regulations have to be paid attention to.

Detailed information for the feed water quality can be found in the appendix.

Delivery

The pressure body is provided with a primer paint finish. Due to transport reasons the insulation can be fixed at the factory. Burner and control panel are either pre-mounted (if transport is possible) or packed in a separate box. The mounting and wiring can be done at the factory or at site. Connection openings are capped.

On request

- Second safety valve
- Second water level meter
- Visible boiler lockout display
- Second feed water pump
- Modulating feed water control
- Quick action blow down valve
- Automatic boiler blow down
- Economiser
- PLC (programmable logic controller) S7-200/300
- Volt-free contacts for BMS (Building Management System)

THD-U (500-1600)

Technical data without economiser

Type		(500)	(650)	(800)	(1000)	(1200)	(1600)
• Saturated steam output (oil- and gas-fired)	kg/h	500	650	800	1000	1200	1600
• Heat conduction	kW	326	424	522	652	783	1044
• Feed water temperature	°C	103	103	103	103	103	103
• Safety valve pressure	bar	10	10	10	10	10	10
	bar	13	13	13	13	13	13
	bar	16	16	16	16	16	16
• Boiler efficiency without economiser (10 bar)	%	89.1	89.4	89.3	89.4	89.7	89.6
• Flue gas resistance	mbar	3.1	3.3	3.6	4.2	4.7	5.5
• Water content	up to low water	l	871	997	1211	1328	1647
	full	l	1054	1247	1601	1775	2165
• Flue gas temperature after boiler without economiser	at 10 bar °C	243	236	240	239	231	237

Data economiser (only with gas - or diesel oil possible)

Type		(500)	(650)	(800)	(1000)	(1200)	(1600)
• Additional output economiser	kW	17	21	27	33	36	52
• Boiler efficiency with economiser	%	94	94	94	94	94	94
• Flue gas resistance economiser	mbar	3.0	3.0	3.0	3.0	3.0	3.0
• Feed water temperature	inlet °C	103	103	103	103	103	103
	outlet °C	132	130	131	131	129	130
• Flue gas temperature after economiser	°C	140	140	140	140	140	140

Dimensions and weights (without economiser)

Type		(500)	(650)	(800)	(1000)	(1200)	(1600)
• Diameter boiler body, without insulation	mm	1100	1150	1250	1250	1300	1400
• Boiler length (pressure body)	mm	1600	1750	1900	2150	2500	2600
• Diameter (inner) flame tube	mm	575	575	650	650	700	725
• Flame tube length	mm	1495	1645	1795	2045	2395	2495
• Boiler length with insulation, without burner	mm	2285	2435	2585	2835	3185	3285
• Boiler width with insulation, with pump	mm	1935	1985	2085	2085	2135	2235
• Boiler height with insulation, with armatures	mm	1950	2000	2100	2100	2150	2250
•							
• Diameter flue gas outlet	mm	200	200	250	250	300	350
• Transport weight at 10 bar, without equipment	kg	1590	1960	2330	2720	3260	3680

THD-U (500-1600)

Armatures

Type		(500)	(650)	(800)	(1000)	(1200)	(1600)
• 1 flue gas tube cleaning equipment		yes	yes	yes	yes	yes	yes
• 1 main steam valve	10 bar	DN 40	DN 40	DN 50	DN 50	DN 65	DN 65
	13 bar	DN 32	DN 40	DN 50	DN 50	DN 50	DN 65
	16 bar	DN 32	DN 32	DN 40	DN 50	DN 50	DN 50
• 2 safety valves	10 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40
	13 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40
	16 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40
• 2 water level gauge valves		DN 20	DN 20	DN 20	DN 20	DN 20	DN 20
• 2 reflection indicators		M=320	M=320	M=320	M=320	M=320	M=320
• 1 sample taking valve		DN 15	DN 15	DN 15	DN 15	DN 15	DN 15
• 1 purge shut-off valve		DN 25	DN 25	DN 32	DN 32	DN 32	DN 32
• 1 purge ball valve		DN 25	DN 25	DN 32	DN 32	DN 32	DN 32
• 1 pressure gauge with three-way valve		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 3 feed water/pump valves		DN 25	DN 25	DN 25	DN 25	DN 25	DN 25
• 3 feed water backstroke/non return valves		DN 25	DN 25	DN 25	DN 25	DN 25	DN 25
• 2 strainers (pump suction side)		DN 25	DN 25	DN 25	DN 40	DN 40	DN 40
• 2 ball valves (pump suction side)		DN 25	DN 25	DN 25	DN 40	DN 40	DN 40
• 1 pressure gauge pump with shut-off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 feed water pumps, Grundfos		CR	CR	CR	CR	CR	CR
Motor rating	10 bar	1.1 kW	1.1 kW	1.1 kW	1.1 kW	1.1 kW	1.5 kW
• 2 feed water pumps, Grundfos		CR	CR	CR	CR	CR	CR
Motor rating	13 bar	1.5 kW	1.5 kW	1.5 kW	1.5 kW	1.5 kW	2.2 kW
• 2 feed water pumps, Grundfos		CR	CR	CR	CR	CR	CR
Motor rating	16 bar	1.5 kW	1.5 kW	2.2 kW	2.2 kW	2.2 kW	3.0 kW

THD-U (2000-5000)

Technical data without economiser

Type		(2000)	(2500)	(3000)	(3500)	(4000)	(4500)	(5000)
• Saturated steam output (oil- and gas-fired)	kg/h	2000	2500	3000	3500	4000	4500	5000
• Heat conduction	kW	1304	1631	1957	2283	2609	2935	3261
• Feed water temperature	°C	103	103	103	103	103	103	103
• Safety valve pressure	bar	10	10	10	10	10	10	10
	bar	13	13	13	13	13	13	13
	bar	16	16	16	16	16	16	16
• Boiler efficiency without economiser (10 bar) %		89.6	89.5	89.4	89.5	89.7	89.7	89.8
• Flue gas resistance	mbar	5.7	6.5	6.7	5.0	7.3	6.9	6.9
• Water content	up to low water	I	2254	2636	3074	3952	4261	4783
	full	I	2914	3353	4162	5426	6436	7253
• Flue gas temperature after boiler without economiser at 10 bar	°C	238	238	241	240	234	233	234

Data economiser

Type		(2000)	(2500)	(3000)	(3500)	(4000)	(4500)	(5000)
• Additional output economiser	kW	65	81	101	116	125	139	156
• Boiler efficiency with economiser	%	94	94	94	94	94	94	94
• Flue gas resistance economiser	mbar	3.0	3.0	3.0	3.0	3.0	3.0	3.0
• Feed water temperature	inlet	°C	103	103	103	103	103	103
	outlet	°C	130	130	131	131	129	129
• Flue gas temperature after economiser	°C	140	140	140	140	140	140	140

Dimensions and weights (without economiser)

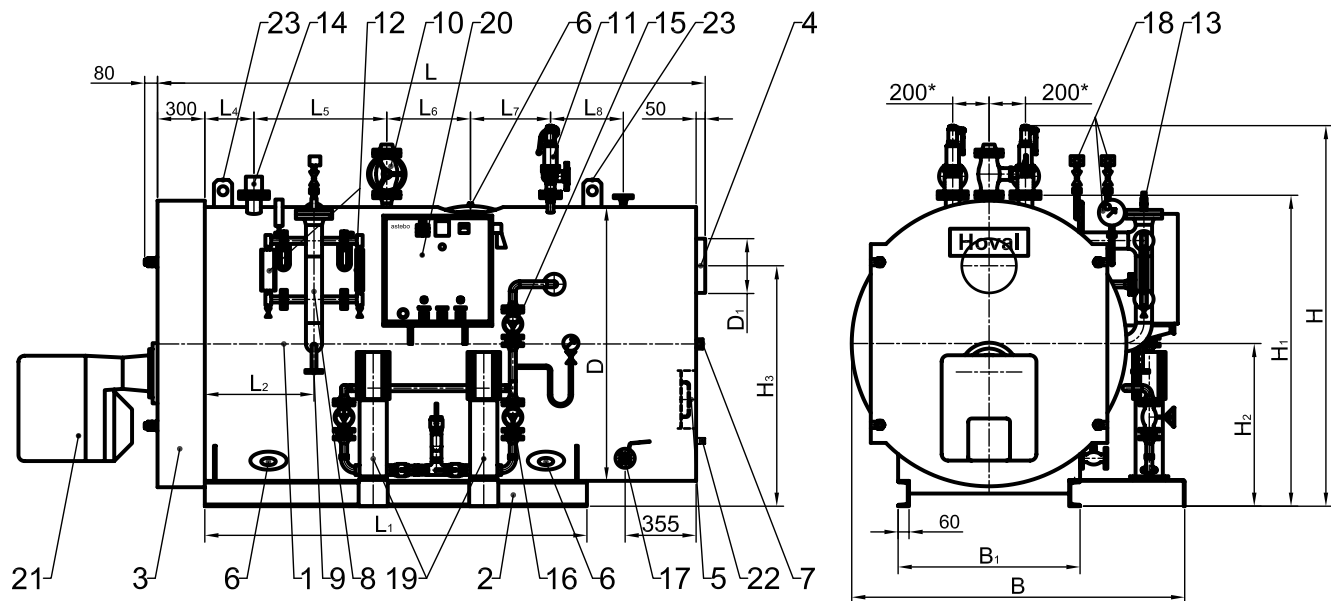
Type		(2000)	(2500)	(3000)	(3500)	(4000)	(4500)	(5000)
• Diameter boiler body, without insulation	mm	1500	1600	1750	1950	1950	2000	2100
• Boiler length (pressure body)	mm	2650	2750	3000	300	3500	3500	3500
• Diameter (inner) flame tube	mm	850	925	975	1100	1100	1150	1200
• Flame tube length	mm	2540	2640	2890	2890	3390	3390	3390
• Boiler length with insulation, without burner	mm	3335	3435	3685	3685	4185	4185	4185
• Boiler width with insulation, with pump	mm	2335	2435	2585	2785	2785	2835	2935
• Boiler height with insulation, with armatures	mm	2410	2510	2660	2950	2950	3000	3150
• Diameter flue gas outlet	mm	350	400	450	500	500	550	600
• Transport weight at 10 bar, without equipment	kg	4700	5560	6150	8415	9230	9860	10520

THD-U (2000-5000)

Armatures

Type		(2000)	(2500)	(3000)	(3500)	(4000)	(4500)	(5000)
• 1 flue gas tube cleaning equipment		yes	yes	yes	yes	yes	yes	yes
• 1 main steam valve	10 bar	DN 80	DN 100	DN 100	DN 100	DN 100	DN 125	DN 125
	13 bar	DN 65	DN 80	DN 80	DN 100	DN 100	DN 100	DN 100
	16 bar	DN 65	DN 65	DN 80	DN 80	DN 100	DN 100	DN 100
• 2 safety valve	10 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 32/50	DN 32/50	DN 32/50
	13 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 32/50	DN 32/50
	16 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 24/40
• 2 water level gauge valves		DN 20	DN 20	DN 20	DN 20	DN 20	DN 20	DN 20
• 2 reflection indicators		M=320	M=320	M=450	M=450	M=450	M=450	M=450
• 1 sample taking valve		DN 15	DN 15	DN 15	DN 15	DN 15	DN 15	DN 15
• 1 purge-shut-off valve		DN 40	DN 40	DN 40	DN 40	DN 40	DN 40	DN 40
• 1 purge-ball valve		DN 40	DN 40	DN 40	DN 40	DN 40	DN 40	DN 40
• 1 pressure gauge with three-way valve		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 3 feed water/pump valves		DN 25	DN 32	DN 32	DN 32	DN 32	DN 32	DN 32
• 3 feed water backstroke/ non return valves		DN 25	DN 32	DN 32	DN 32	DN 32	DN 32	DN 32
• 2 strainers (pump suction side)		DN 40	DN 50	DN 50	DN 50	DN 50	DN 50	DN 50
• 2 ball valves (pump suction side)		DN 40	DN 50	DN 50	DN 50	DN 50	DN 50	DN 50
• 1 pressure gauge pump with shut-off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 feed water pumps, Grundfos		CR	CR	CR	CR	CR	CR	CR
Motor rating	10 bar	2.2 kW	3.0 kW	3.0 kW	3.0 kW	3.0 kW	4.0 kW	4.0 kW
• 2 feed water pumps, Grundfos		CR	CR	CR	CR	CR	CR	CR
Motor rating	13 bar	2.2 kW	4.0 kW	4.0 kW	4.0 kW	4.0 kW	4.0 kW	4.0 kW
• 2 feed water pumps, Grundfos		CR	CR	CR	CR	CR	CR	CR
Motor rating	16 bar	3.0 kW	4.0 kW	4.0 kW	5.5 kW	5.5 kW	5.5 kW	5.5 kW

THD-U without economiser - subject to construction-caused alterations



- | | | |
|---------------------------------------|--------------------------------------|--------------------------------|
| 1 Boiler | 9 Continuous blowdown valve | 17 Blow down/purge valve |
| 2 Boiler base | 10 Steam valve | 18 Pressure gauge and manostat |
| 3 Hinged front door | 11 Safety valve(s) | 19 Feed water pump(s) |
| 4 Flue gas outlet | 12 Water level gauge | 20 Electric control panel |
| 5 Explosion flap and cleaning opening | 13 Water level control | 21 Burner |
| 6 Inspection opening | 14 Water insufficiency control 1 + 2 | 22 Condensate drain nozzle |
| 7 Inspection glass (flame tube) | 15 Boiler feed socket - valve group | 23 Crane hooks |
| 8 Fitting pipe | 16 Boiler feed pump(s) - valve group | |

Capacity kg/h	Main dimensions				Connecting dimensions							Base frame		Flue gas connection		Required space B x H (for transport)			
	L	B **	H	D	L ₂	L ₄	L ₅	L ₆	L ₇	H ₁	H ₂	L ₁	B ₁	H ₃	D ₁	with armatures		without armatures	
500	2205	1935	1950	1300	350	200	300	350	350	1560	800	1250	850	1150	200	2050	2100	1750	1750
650	2355	1985	2000	1350	350	200	300	350	350	1610	825	1400	900	1200	200	2200	2150	1800	1800
800	2505	2085	2100	1450	400	200	400	400	400	1710	875	1550	1000	1300	250	2300	2250	1900	1900
1000	2755	2085	2100	1450	500	250	500	450	450	1710	875	1800	1000	1300	250	2300	2250	1900	1900
1200	3105	2135	2150	1500	500	250	500	600	600	1760	900	2150	1050	1350	300	2350	2300	1950	1950
1600	3205	2235	2250	1600	500	250	500	600	600	1860	950	2250	1150	1400	350	2450	2400	2050	2050
2000	3255	2335	2410	1700	650	300	500	600	600	1960	1000	2300	1250	1500	350	2550	2550	2150	2150
2500	3355	2435	2510	1800	650	300	500	600	600	2060	1050	2400	1350	1550	400	2650	2650	2250	2250
3000	3355	2585	2660	1950	750	350	600	650	650	2210	1125	2650	1450	1675	450	2800	2800	2400	2400
3500	3605	2785	2950	2150	750	350	600	650	650	2410	1225	2650	1650	1825	500	3000	3100	2600	2600
4000	4105	2785	2950	2150	950	350	600	850	850	2410	1225	3150	1650	1825	500	3000	3100	2600	2600
4500	4105	2835	3000	2200	950	350	600	850	850	2460	1250	3150	1700	1825	550	3050	3150	2650	2650
5000	4105	2935	3150	2300	950	350	600	850	850	2560	1300	3150	1700	1925	600	3150	3300	2750	2750

* From THD-U 2000 (and higher) distance = 250 mm

** Dimension may vary to used pumps

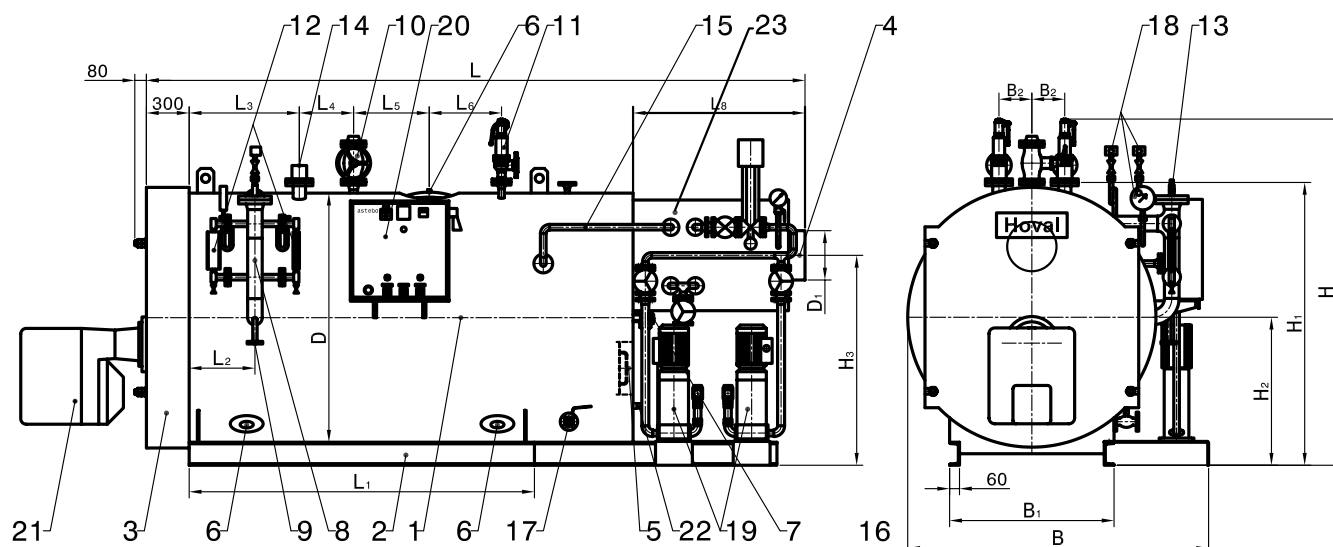
Design pressure 10, 13 and 16 bar (gauge)

Other pressure levels on request!

Transport dimensions for design pressure 10 bar

Add 40 mm to H₁ for crane hooks
Dimensions incl. 100 mm insulation.

THD-U with economiser - subject to construction-caused alterations



- | | | |
|---------------------------------------|--------------------------------------|--------------------------------|
| 1 Boiler | 9 Continuous blowdown valve | 17 Blow down/purge valve |
| 2 Boiler base | 10 Steam valve | 18 Pressure gauge and manostat |
| 3 Hinge | 11 Safety valve(s) | 19 Feed water pump(s) |
| 4 Flue gas outlet | 12 Water level gauge | 20 Electric control panel |
| 5 Explosion flap and cleaning opening | 13 Water level control | 21 Burner |
| 6 Inspection opening | 14 Water insufficiency control 1 + 2 | 22 Condensate drain nozzle |
| 7 Inspection glass (flame tube) | 15 Boiler feed socket - valve group | 23 Economiser |
| 8 Fitting pipe | 16 Boiler feed pump(s) - valve group | |

Capacity kg/h	Main dimensions				Connecting dimensions								Base frame		Flue gas connection		Required space B x H (for transport)			
	L	B **	H	D	L ₂	L ₃	L ₄	L ₅	L ₆	L ₈	H ₁	H ₂	L ₁	B ₁	H ₃	D ₁	with armatures		without armatures	
500	3162	1935	1950	1300	350	200	300	350	350	1007	1560	800	1250	850	1130	150	2050	2100	1750	1750
650	3312	1985	2000	1350	350	200	300	350	350	1007	1610	825	1400	900	1160	150	2200	2150	1800	1800
800	3500	2085	2100	1450	400	200	400	400	400	1045	1710	875	1550	1000	1250	200	2300	2250	1900	1900
1000	3750	2085	2100	1450	500	250	500	450	450	1045	1710	875	1800	1000	1250	200	2300	2250	1900	1900
1200	4137	2136	2150	1500	500	250	500	600	600	1082	1760	900	2150	1050	1270	250	2350	2300	1950	1950
1600	4275	2235	2250	1600	500	250	500	600	600	1120	1860	950	2250	1150	1370	300	2450	2400	2050	2050
2000	4325	2335	2410	1700	650	300	500	600	600	1120	1960	1000	2300	1250	1400	300	2550	2550	2150	2150
2500	4462	2435	2510	1800	650	300	500	600	600	1157	2060	1050	2400	1350	1500	350	2650	2650	2250	2250
3000	4750	2585	2660	1950	750	350	600	650	650	1195	2210	1125	2650	1450	1600	400	2800	2800	2400	2400
3500	4750	2785	2950	2150	750	350	600	650	650	1195	2410	1225	2650	1650	1700	400	3000	3100	2600	2600
4000	5287	2785	2950	2150	950	350	600	850	850	1232	2410	1225	3150	1650	1760	450	3000	3100	2600	2600
4500	5325	2835	3000	2200	950	350	600	850	850	1270	2460	1250	3150	1700	1760	500	3050	3150	2650	2650
5000	5325	2935	3150	2300	950	350	600	850	850	1270	2560	1300	3150	1700	1830	550	3150	3300	2750	2750

* From THD-U 2000 (and higher) distance = 250 mm

** Dimension may vary to used pumps

Design pressure 10, 13 and 16 bar (gauge)

Other pressure levels on request!

Transport dimensions for design pressure 10 bar

Add 40 mm to H₁ for crane hooks
Dimensions incl. 100 mm insulation.

Rules and regulations

The following rules and regulations have to be respected:

- Hoval technical information and installation guide
- hydraulic and control technical regulations, to guarantee the min. admissible boiler temperature and the conditions for a safe operation according to national regulations
- fire protection regulations
- national regulations concerning permission, installation and operation of boiler appliances
- Boiler appliances have to be installed according to national laws and regulations and accessories requirements.
- Besides the national and local regulations the project specific circumstances of the boiler supplier have to be considered for every application.

Water treatment/water quality

- The quality of the boiler water has to be guaranteed according to Hoval technical information and national regulations.
- Hoval boilers may only be operated with treated water. The national regulations for the treatment of water apply for the values to be kept.
- Required water quality see attachment.
- Don't use chemical additives like anti-freeze etc. Except chemicals which are necessary for normal boiler operation (see water quality specification).
- Old and new installations must be well flushed before filling.
- The water quality has to be checked daily.

Planning, operation and maintenance

- The heating of the feed water and the degassing takes place in the feed water tank.
- To increase the efficiency, especially for natural gas operation, an economiser can be added to preheat the feed water.
- Pumps (especially horizontal rotary pumps and hot water/condensate pumps, NPSH pumps) need to be installed with the necessary flow, return pipework and positive suction pressure according to requirements. The installation has to be completely free of tension (anti-vibration proof).
- National and local rules and regulations have to be considered for the fuel supply.
- The operation and water analysis data are to be recorded daily in the operation booklet.
- Safety valves and blow-off pipes must discharge the system overpressure riskless.
- Filters and strainers have to be cleaned periodically, especially if installed in front of control devices.
- The drain of the desalting, blow down, drainage, overflow, etc. has to be safely discharged into a dislodging tank.
- All heating components and pipework are to be insulated in order to reduce radiation losses.

Combustion air

- The supply of combustion air must be guaranteed for a safe and economic operation. There must be no possibility of the air supply being shut off.
- Ventilation of the boiler house has to also be provided.
- In the installation room no negative pressure larger than 3 N/m² is allowed. To adhere to this demand, plan a free area for the air supply opening of at least 200 cm², plus 2 cm² per kW output. The aspect ratio for rectangular openings should not be more than 1.5 : 1. If the opening is louvred ensure the free area is sufficient. National laws have to be respected.
- Boiler houses have to be fitted with the relevant outer pressure relief surface.
- Steam boilers are not to be installed in rooms where halogen compounds occur which can enter the combustion air. (e.g. laundries, drying and hobby rooms, etc.).

Noise level reduction

The following measures for noise level reduction are possible:

- Solid construction of heating room walls, ceiling and floor, installation of silencer in fresh air supply, noise insulation for support and bracket of pipes.
- Installation of sound attenuation cowl for the burner.
- A substantial part of the sound caused in the combustion chamber and in the top heating surfaces is radiated from the flue outlet as sound transmitted by air. In addition to this, resonance features, depending on chimney dimensioning and inlet, may occur which are triggered by the oscillation of the combustion process. These sounds can be reduced by burner-lateral measures, e.g. changes of flame geometry, atomisation characteristics or fuel throughput.
- Flue gas attenuators cause a substantial sound level reduction as well. These sound absorbers should usually be tuned at low frequencies of 60-250 Hz. Flue gas attenuators function according to the principle of sound absorption. The kinetic energy of the exhaust gases is reduced by friction requiring an increase in chimney draft in the flue system. This has to be considered for burner sizing. The connection piece from the boiler to the flue gas sound absorber has to be gas-tight.
- The necessary space requirement of approx. 2 m for the later installation of a flue gas sound absorber should be included when planning.

Chimney/flue gas system

- A properly designed chimney/flue arrangement must be provided to match each particular application.
- To achieve a smooth discharge of the exhaust gases from the boiler into the chimney, the flue connection must enter the chimney at approx. 30-45 °.
- From a length of greater than 1 m thermal insulation is necessary.
- Adequate provision should be made to drain of condensate from the base of the chimney ensuring condensate does not run back into the boiler smokebox.

Boiler and feed water specifications for steam boiler plants

Boiler water - general

Boiler water must be free of hardness components. pH-value should be above neutral level. Please refer to following tables for water composition.

During a BOSB-operation feed- and boiler water have to be checked every 72 h, without BOSB- operation daily checks are necessary! The values must be recorded in the operating log book!

Feed water specifications for natural circulating boilers – shell boilers (table 1)

Parameter	Unit	Feed water for steam boilers	
Operating pressure	bar (0.1 MPa)	> 0.5 to 20	> 20
Appearance	-	clear, free from suspended solids and foam	
Direct conductivity at 25 °C	µS/cm	not specified, only guide values relevant for boiler water - see table 2	
pH value at 25 °C ¹⁾	-	> 9.2 ²⁾	> 9.2 ²⁾
Total hardness ^{3), 6)} (Ca + Mg)	mmol/l	< 0.01 ³⁾	< 0.01
Iron (Fe) concentration	mg/l	< 0.3	< 0.1
Copper (Cu) concentration	mg/l	< 0.05	< 0.03
Silica (SiO ₂) concentration	mg/l	not specified, only guide values for boiler water relevant, see table 2	
Oxygen (O ₂) concentration	mg/l	< 0.05 ⁴⁾	< 0.02
Oil/grease concentration (see EN 12953-6)	mg/l	< 1	< 1
Organic substances (as TOC) concentration	-	see footnote ⁵⁾	

¹⁾ With copper alloys in the system the pH value shall be maintained in the range 8.7 to 9.2.

²⁾ With softened water pH value > 7.0 the pH value of boiler water according to table 2 should be considered.

³⁾ At operating pressure < 1 bar total hardness max. 0.05 mmol/l shall be acceptable.

⁴⁾ Value for continuous operation and/ or if a deaerator is used; if the operation is discontinuous or without deaerator film forming agents and/or excess of oxygen scavenger shall be used.

⁵⁾ Organic substances are generally a mixture of several different compounds. The composition of such mixtures and the behaviour of their individual components under the conditions of boiler operation are difficult to predict. Organic substances may be decomposed to form carbonic acid or other acidic decomposition products which increase the acid conductivity and cause corrosion or deposits. They also may lead to foaming and/or priming which shall be kept as low as possible.

⁶⁾ Noted in the past as °dH, conversion factor: 1 mmol/l = 5.6°dH (German hardness)

Source: EN12953-10:2003 (E) + Hoval handbook

Boiler and feed water specifications for steam boiler plants

Boiler water specifications for natural circulating boilers – shell boilers - (table 2)

Parameter	Unit	Boiler water for steam boilers using		
		Feedwater direct conductivity > 30 µS/cm	Feedwater direct conductivity ≤ 30 µS/cm	
Operating pressure	bar (0.1 MPa)	> 0.5 to 20	> 20	> 0.5
Appearance	-	clear, free from suspended solids and foam		
Direct conductivity at 25 °C ⁸⁾	µS/cm	< 6 000 ¹⁾	see figure 1 ¹⁾	< 1 500
pH value at 25 °C	-	10.5 to 12.0	10.5 to 11.8	10.0 to 11.0 ^{2), 3)}
Total hardness ^{10), 11)} (Ca + Mg)	mmol/l	< 0.01		
Composite alkalinity ⁷⁾	mmol/l	1 to 15 ¹⁾	1 to 10 ¹⁾	0.1 to 1.0 ³⁾
Silica (SiO ₂) concentration ⁹⁾	mg/l	pressure dependent, according to figure 2		
Phosphate (PO ₄) ^{4), 6)}	mg/l	10 to 30	10 to 30	6 to 15
Sodium Sulphite (Na ₂ SO ₃) ⁶⁾	mg/l	5 to 10	5 to 10	5 to 10
Organic substances (as TOC) concentration	-	see footnote ⁵⁾		

¹⁾ With super heater consider 50 % of the indicated upper value as maximum value.

²⁾ Basic pH adjustment by injecting Na₃PO₄, additional NaOH injection only if the pH value is < 10.

³⁾ If the acid conductivity of the boiler feedwater is < 0.2 µS/cm, and its Na + K concentration is < 0.010 mg/l, phosphate injection is not necessary. Under the conditions AVT (all volatile treatment, feedwater pH ≥ 9.2 and boiler water pH ≥ 8.0) can be applied, in this case the acid conductivity of the boiler water is < 5 µS/cm.

⁴⁾ If coordinated phosphate treatment is used; considering all other values higher PO₄-concentrations are acceptable (see clause 4 of EN 12953-10 for details).

⁵⁾ See ⁵⁾ in table 1.

⁶⁾ Measuring only necessary if dosing chemicals are used which contains these composition

⁷⁾ Noted in the past as p-value, conversion factor: KS 8.2 = 1 according p-value = 1

⁸⁾ For level electrodes minimum conductivity = > 5 µS/cm

⁹⁾ It's not necessary to make continuous control of following parameters: Silica (SiO₂) concentration

¹⁰⁾ At operating pressure < 1 bar total hardness max. 0.05 mmol/l shall be acceptable.

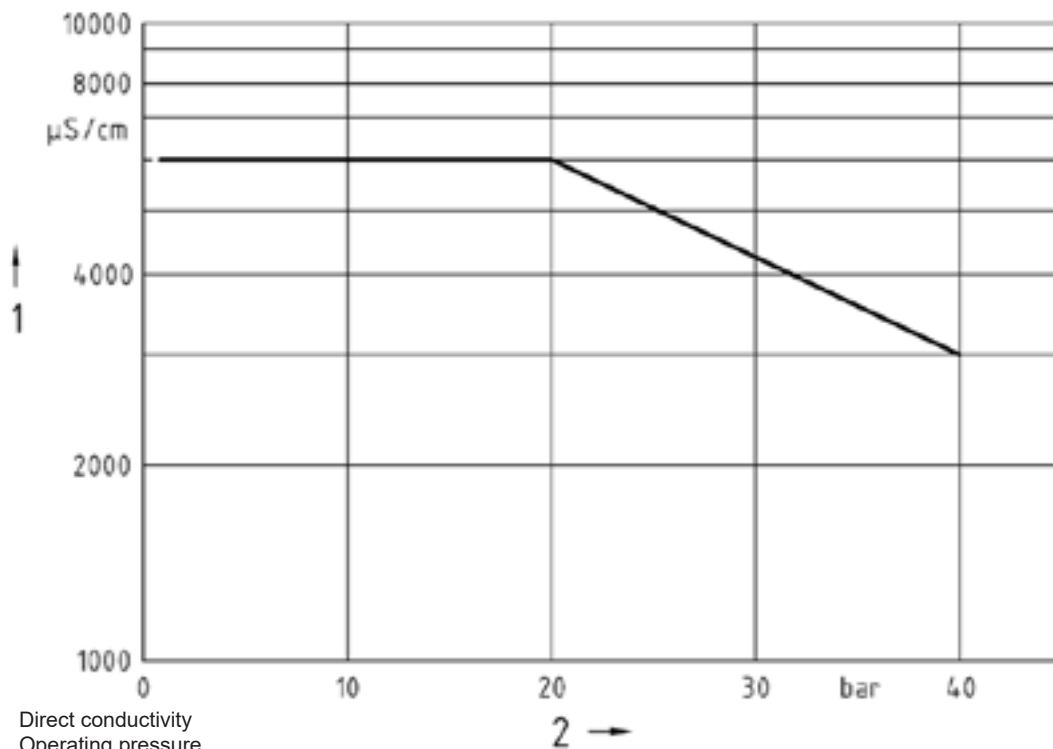
¹¹⁾ Noted in the past as °dH, conversion factor: 1 mmol/l = 5.6°dH (German hardness)

Source: EN12953-10:2003 (E) + Hoval handbook

Boiler and feed water specifications for steam boiler plants

Fig. 1 Maximum acceptable direct conductivity of the boiler water dependent on the pressure; feedwater direct conductivity > 30 $\mu\text{S}/\text{cm}$

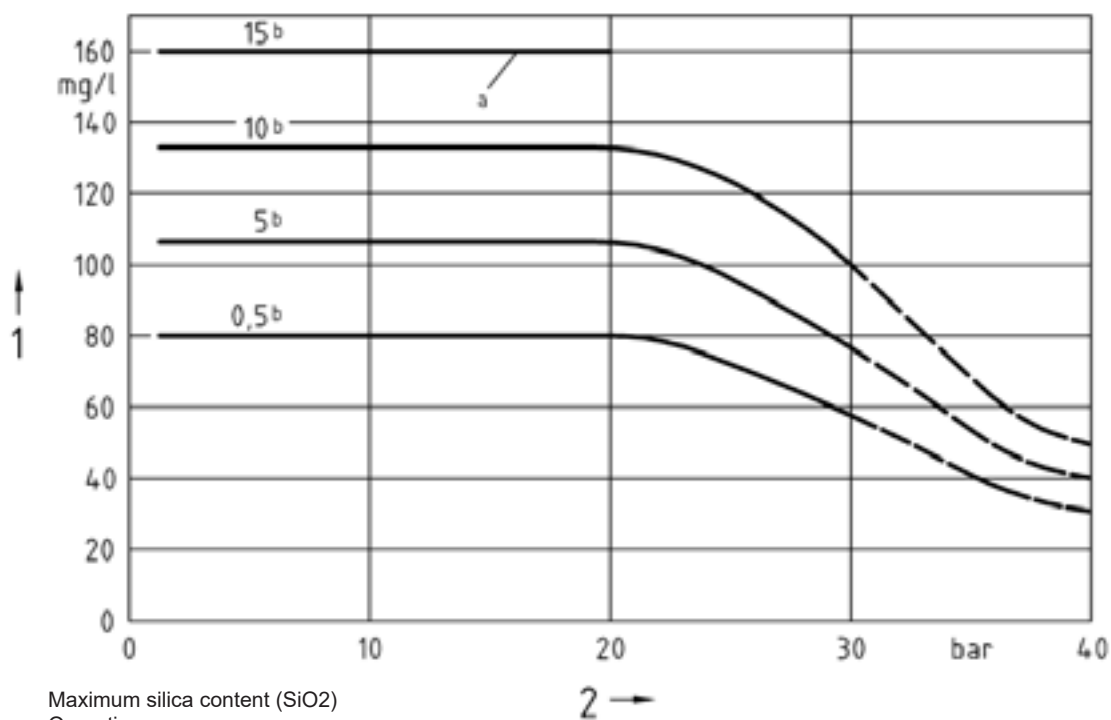
Source: EN12953-10:2003 (E)



1 Direct conductivity
2 Operating pressure

Fig. 2 Maximum acceptable silica content (SiO_2) of the boiler water dependent on the pressure

Source: EN12953-10:2003 (E)



1 Maximum silica content (SiO_2)
2 Operating pressure

a This level of alkalinity is not permissible > 20 bar
b Alkalinity in mmol/l

Important notice

Hoval recommends that a water treatment specialist is employed to carry out routine monitoring of the supply water in order to ensure it remains within specification.

THSD-I E

Hoval steam boiler

The Hoval high output steam boilers are made of high quality steel and are distinguished by their solid, robust and flexible construction, particularly by their operational ease, their easy maintenance and an optimal efficiency. The client receives an economical, environment friendly compact unit, ready for installation. The boilers are constructed for oil or gas firing.

Boiler type THSD-I E without economiser

The type THSD-I E classical 3 pass flame tube wet back boiler with inner fully water cooled flue gas turning chamber with finned tube wall guarantees high efficiency. The boiler consists of a cylindric shell, the two head plates, the flame tube including the back flue gas turning chamber with water cooled finned tube wall, the two flue gas passes and the fitting pipe, placed either on the right (standard) or on the left. The boiler door is insulated and flue gas proof for burner mounting. The boiler is completely electrically welded and provided with all required inspection openings.

The spacious flame tube with low thermal charges results in an excellent combustion and reduced emissions. The large water content secures an even burner running time and thus reduces the number of boiler starts.

Boiler body type THSD-I E with economiser

Design according to THSD-I E **with** economiser for further reduction of flue gas temperature. Therefore a higher efficiency of up to 95 % with minimum space requirements can be achieved.

Admissible max. safety valve pressure

Standard pressures: 10, 13 and 16 bar.

Higher pressure on request.

Thermal insulation

The boiler is fully insulated with mineral wool insulation. The casing is made of structured aluminium plate. Fittings and out-cuts are properly rimmed. The flue gas collector is thermally insulated.

Connection fittings and sockets

The connection fittings and sockets on the boiler and on the fitting pipe are meant for the attachment of:

water level regulation and water level control, water level indicator (reflection indicator), manostat for pressure regulation and pressure supervision, pressure gauge set, main steam valve, safety valve(s), boiler feeding, sludging/drainage, desalting.

Large equipment

- 2 boiler supports in heavy construction
- 1 flue gas collector with integrated flue gas exit backwards with cleaning door and integrated bleeder valve.
- 1 boiler door for burner mounting, thermally insulated and designed flue gas proof, placed on left and right swivelable hinges for the flue gas sided cleaning of boiler
- 1 feed water distribution pipe
- 1 boiler plate
- 1 low water mark NW
- 1 water separator
- 1 flue gas tube cleaning kit

High efficiency

Due to the above technical facts an efficiency of up to 90 % resp. up to 95 % with economiser, can be achieved. Thus continuous working costs are kept low. The sources of energy are used more efficiently and Hoval spares the environment.



Construction guiding, quality approval

The boiler is designed with all necessary inspection doors.

Construction and production is done acc. to the European Pressure Equipment Directive (PED) 2014/68/EU - EN 12953 with CE-conformity. The quality approval at our factory is done by TÜV or a national authorised quality institution. The ISO 9001:2000 certification and the quality approval at our factory with our Hoval quality performance department guarantees the highest product quality.

For installation and operation of the boiler the local laws and norms are to be respected. If gas fired the value Nitrogen oxides (NO_x) < 100 mg/Nm³ is guaranteed at nominal output.

Control panel

The control panel for the Hoval boiler can be equipped with the required control units and indicators for control and supervision of boiler and burner. The operation and alarm reports may be shown as fault indication. The control panel will be made upon customer requirements and depending on the burner to be used.

Feed water quality

For operation the Hoval and the country specific feed and boiler water regulations have to be respected and local waste water regulations have to be paid attention to.

Detailed information for the feed water quality can be found in the appendix.

Delivery

The pressure body is provided with a primer. Due to transport reasons the insulation can be fixed at the factory. Burner armatures and control panel are either pre-mounted (as far as transport technically possible) or packed loosely in a separate box. The mounting and wiring can be done at the factory or at site. Connection openings are covered.

On request

- Second safety valve
- Second water level indicator
- Second feed water pump
- Modulating feed water control
- Automatic boiler blow down
- Economiser
- PLC (programmable logic controller) S7-1200/300
- Volt-free contacts for BMS (Building Management System)

THSD-I E (25/20-90/80)

Technical data without economiser

Type			(25/20)	(30/25)	(35/30)	(45/40)	(55/50)	(70/60)	(90/80)
• Steam output (oil- and gas-fired)	kg/h		2500/2000	3000/2500	3500/3000	4500/4000	5500/5000	7000/6000	9000/8000
• Output	at 10 bar	kW	1630/1304	1956/1630	2283/1956	2934/2608	3586/3260	4564/3912	5868/5216
	at 13 bar	kW	1635/1308	1963/1635	2290/1963	2944/2617	3596/3271	4579/3925	5888/5234
	at 16 bar	kW	1639/1311	1967/1639	2295/1967	2951/2623	3606/3278	4590/3934	5901/5246
• Feed water temperature	°C		103	103	103	103	103	103	103
• Safety valve pressure	bar		10	10	10	10	10	10	10
	bar		13	13	13	13	13	13	13
	bar		16	16	16	16	16	16	16
• Boiler efficiency without economiser									
Natural gas	at 10 bar	%	89.4/89.9	89.3/89.7	89.2/89.6	89.2/89.5	89.7/89.9	89.8/90.2	89.3/89.6
	at 13 bar	%	88.9/89.4	88.9/89.3	88.7/89.2	88.7/89.1	89.2/89.5	89.4/89.8	88.8/89.2
	at 16 bar	%	88.5/89.0	88.4/88.9	88.3/88.8	88.4/88.7	88.8/89.1	89.0/89.4	88.5/88.8
Diesel oil	at 10 bar	%	90.0/90.5	90.0/90.4	89.9/90.3	89.9/90.2	90.4/90.6	90.5/90.8	90.0/90.3
	at 13 bar	%	89.6/90.1	89.6/90.0	89.5/89.9	89.5/89.8	89.9/90.1	90.0/90.4	89.5/89.9
	at 16 bar	%	89.2/89.7	89.2/89.6	89.1/89.5	89.1/89.4	89.5/89.8	89.7/90.0	89.2/89.5
• Flue gas resistance	mbar		11.0/8.5	12.0/9.0	12.0/9.5	12.0/10.0	12.5/10.0	13.0/10.5	13.0/11.0
• Water content *	up to LW	l	3610	4310	4790	5840	7100	7940	9970
	full	l	4500	5400	5860	7180	8790	10010	13100
• Flue gas temperature after boiler without economiser									
Natural gas	at 10 bar	°C	241/229	243/233	246/236	246/239	237/231	234/226	247/239
	at 13 bar	°C	250/238	252/242	256/245	256/248	246/241	244/235	257/249
	at 16 bar	°C	259/247	260/251	264/254	264/256	255/249	252/244	264/256
Diesel oil	at 10 bar	°C	236/225	237/228	241/231	241/234	232/227	230/222	242/235
	at 13 bar	°C	245/234	247/238	250/241	251/243	242/237	240/232	252/242
	at 16 bar	°C	254/243	255/246	259/249	259/252	250/245	248/240	259/251

* for boiler design pressure 10 bar

Technical data economiser (gas firing only)

Type			(25/20)	(30/25)	(35/30)	(45/40)	(55/50)	(70/60)	(90/80)
• Additional output economiser									
	at 10 bar	kW	92/62	114/86	136/107	170/141	192/165	237/186	355/294
	at 13 bar	kW	100/72	124/94	147/117	185/155	210/182	258/205	385/322
	at 16 bar	kW	107/77	132/101	158/126	197/166	226/196	280/224	402/337
• Boiler efficiency with economiser	%		94.4	94.4	94.4	94.4	94.4	94.4	94.4
• Flue gas resistance economiser	mbar		1.5	1.5	2.0	2.0	2.0	2.2	2.2
• Feed water temperature	inlet	°C	103	103	103	103	103	103	103
• Feed water temperature	outlet								
	at 10 bar	°C	134/130	135/132	136/133	135/133	133/131	132/129	136/134
	at 13 bar	°C	137/133	138/135	139/136	138/136	135/134	134/132	139/137
	at 16 bar	°C	139/136	140/137	141/138	140/138	138/136	137/135	141/139
• Flue gas temperature after economiser	°C		140 *	140 *	140 *	140 *	140 *	140 *	140 *

* on request: 130 °C

THSD-I E (25/20-90/80)

Dimensions and weights

Type		(25/20)	(30/25)	(35/30)	(45/40)	(55/50)	(70/60)	(90/80)
• Boiler body diameter, without insulation	mm	1750	1850	1900	2000	2100	2200	2400
• Boiler length (pressure body)	mm	2800	3000	3200	3550	4000	4200	4700
• Inner flame tube diameter	at 10 bar	mm	650	700	750	800	850	1000
	at 13 bar	mm	650	700	750	800	850	1000
	at 16 bar	mm	650	700	750	800	850	1000/1150
• Flame tube length, with turning chamber	mm	2680	2880	3080	3430	3880	4080	4580
• Boiler length with insulation, without burner	mm	3330	3530	3730	4080	4530	4830	5330
• Boiler width with insulation, without pump	mm	2255	2355	2405	2505	2605	2705	2905
• Boiler height with insulation, without armatures	mm	2290	2390	2440	2590	2690	2790	2990
• Flue gas outlet diameter	mm	400	450	450	550	600	650	750
• Transport weight without burner and without economiser incl. accessories	at 10 bar	kg	5000	6000	7000	8000	9500	11000
	at 13 bar	kg	5500	6500	7500	8500	10500	12500
	at 16 bar	kg	6000	7000	8000	9500	11000	13500

Armatures

Type		(25/20)	(30/25)	(35/30)	(45/40)	(55/50)	(70/60)	(90/80)
• 1 flue gas tube cleaning equipment		yes	yes	yes	yes	yes	yes	yes
• 1 main steam valve	10 bar	DN 80	DN 100	DN 100	DN 125	DN 125	DN 150	DN 150
	13 bar	DN 80	DN 80	DN 80	DN 100	DN 125	DN 125	DN 150
	16 bar	DN 65	DN 65	DN 80	DN 100	DN 100	DN 125	DN 125
• 1 vent valve		DN 25	DN 25	DN 25	DN 25	DN 25	DN 25	DN 25
• 2 safety valves	10 bar	DN 25/40	DN 25/40	DN 25/40	DN 32/50	DN 32/50	DN 40/65	DN 40/65
	13 bar	DN 25/40	DN 25/40	DN 25/40	DN 32/50	DN 32/50	DN 32/50	DN 40/65
	16 bar	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 25/40	DN 32/50	DN 32/50
• 2 water level gauge valves		DN 20	DN 20	DN 20	DN 20	DN 20	DN 20	DN 20
• 2 reflection indicators		M=420	M=420	M=420	M=420	M=420	M=420	M=420
• 1 sample taking and desalting shut-off valve		DN 15	DN 15	DN 15	DN 15	DN 15	DN 15	DN 15
• 1 purge shut-off valve		DN 40	DN 40	DN 40	DN 40	DN 40	DN 40	DN 40
• 1 purge ball valve		DN 40	DN 40	DN 40	DN 40	DN 40	DN 40	DN 40
• 1 pressure gauge with three-way valve		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 3 feed water/pump valves		DN 25	DN 25	DN 25	DN 32	DN 32	DN 40	DN 40
• 3 feed water backstroke/no return valves		DN 25	DN 25	DN 25	DN 32	DN 32	DN 40	DN 40
• 2 strainers (pump suction side)		DN 40	DN 40	DN 40	DN 50	DN 50	DN 65	DN 65
• 2 ball valve pumps (suction side)		DN 40	DN 40	DN 40	DN 50	DN 50	DN 65	DN 65
• 1 pressure gauge pump with shut-off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 feed water pumps	10 bar	CR	CR	CR	CR	CR	CR	CR
Motor rating	10 bar	2.2	3.0	3.0	4.0	4.0	5.5	7.5
• 2 feed water pumps	13 bar	CR	CR	CR	CR	CR	CR	CR
Motor rating	13 bar	3.0	4.0	4.0	4.0	5.5	7.5	11.0
• 2 feed water pumps	16 bar	CR	CR	CR	CR	CR	CR	CR
Motor rating	16 bar	4.0	4.0	5.5	5.5	7.5	7.5	11.0

THSD-I E (110/100-220/200)

Technical data without economiser

Type			(110/100)	(130/120)	(150/140)	(170/160)	(190/180)	(220/200)
• Steam output (gas-fired) - 10 bar	kg/h		11000/10000	13000/12000	15000/14000	17000/16000	19000/18000	21450/20000
• Steam output (oil-fired) - 10 bar	kg/h		10960/10000	12044/12044	12966/12966	13920/13920	14860/14860	16750/16750
• Output	at 10 bar	kW	7120/6520	8476/7824	9780/9128	11084/10432	12364/11736	13962/13040
	at 13 bar	kW	7196/6542	8505/7850	9813/9159	11121/10467	12409/11776	13896/13084
	at 16 bar	kW	7213/6557	8524/7868	9835/9180	11147/10491	12442/11802	13838/13114
• Feed water temperature	°C		103	103	103	103	103	103
• Safety valve pressure	bar		10	10	10	10	10	10
	bar		13	13	13	13	13	13
	bar		16	16	16	16	16	16
• Boiler efficiency without economiser								
Natural gas	at 10 bar	%	89.1/89.4	89.5/89.7	89.2/89.5	89.3/89.5	89.2/89.4	89.5/89.7
	at 13 bar	%	88.7/89.0	89.1/89.3	88.9/89.1	88.9/89.1	88.8/89.0	89.0/89.2
	at 16 bar	%	88.4/89.0	88.7/88.9	88.4/88.7	88.5/88.7	88.4/88.6	88.7/88.8
Diesel oil	at 10 bar	%	90.1/90.4	90.4/90.4	90.3/90.3	90.5/90.5	90.6/90.6	90.8/90.8
	at 13 bar	%	89.4/89.7	89.8/90.0	89.8/89.8	90.0/90.0	90.1/90.1	90.4/90.4
	at 16 bar	%	89.1/89.4	89.5/89.6	89.4/89.4	89.6/89.6	89.7/89.7	90.0/90.0
• Flue gas resistance	mbar		15.0/13.0	15.0/13.0	15.0/13.0	15.0/13.0	15.0/13.0	15.0/13.0
• Water content *	up to LW	l	13400	13520	17610	19310	21860	22980
	full	l	17700	19220	24030	26300	29750	31930
• Flue gas temperature after boiler without economiser								
Natural gas	at 10 bar	°C	250/244	243/238	249/244	248/244	250/246	245/240
	at 13 bar	°C	260/253	251/246	257/252	256/252	258/254	254/250
	at 16 bar	°C	267/260	260/255	265/261	265/261	266/262	262/258
Diesel oil	at 10 bar	°C	246/239	234/234	235/235	231/231	230/230	226/226
	at 13 bar	°C	255/249	246/242	247/247	243/243	241/241	235/235
	at 16 bar	°C	262/256	254/251	255/255	251/251	249/249	243/243

* for boiler design pressure 10 bar

Technical data economiser (gas firing only)

Type			(110/100)	(130/120)	(150/140)	(170/160)	(190/180)	(220/200)
• Additional output economiser								
	at 10 bar	kW	435/374	505/444	580/519	670/608	771/707	840/741
	at 13 bar	kW	473/408	529/468	617/556	712/648	817/752	991/809
	at 16 bar	kW	494/429	566/503	660/595	768/694	871/803	972/866
• Boiler efficiency with economiser	%		94.4	94.4	94.4	94.4	94.4	94.4
• Flue gas resistance economiser	mbar		2.5	2.5	2.5	3.0	3.0	3.0
• Feed water temperature	inlet	°C	103	103	103	103	103	103
• Feed water temperature	outlet							
	at 10 bar	°C	136/135	136/134	136/134	136/135	137/136	136/134
	at 13 bar	°C	139/138	137/136	138/137	138/137	139/138	139/137
	at 16 bar	°C	141/139	140/138	140/139	141/140	142/141	141/140
• Flue gas temperature after economiser	°C		140 *	140 *	140 *	140 *	140 *	140 *

* on request: 130 °C

THSD-I E (110/100 - 220/200)

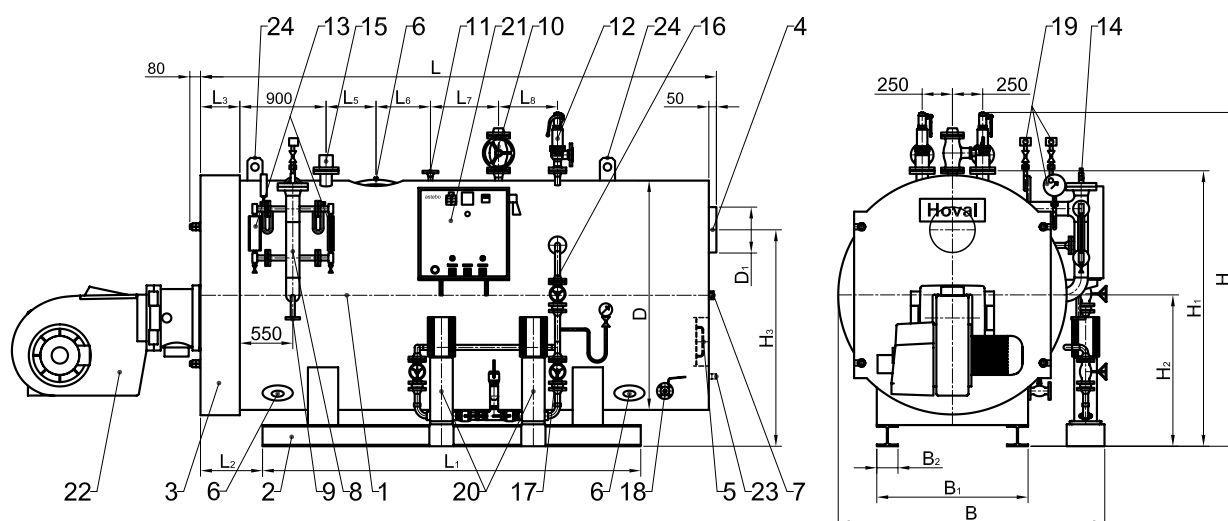
Dimensions and weights

Type		(110/100)	(130/120)	(150/140)	(170/160)	(190/180)	(220/200)
• Boiler body diameter, without insulation	mm	2600	2800	2900	3000	3100	3200
• Boiler length (pressure body)	mm	5100	5500	5800	6100	6300	6800
• Inner flame tube diameter	at 10 bar mm	1050	1100	1150	1200	1250	1300/1450
	at 13 bar mm	1050	1100/1250	1150/1300	1200/1350	1250/1400	1300/1450
	at 16 bar mm	1050/1200	1100/1250	1150/1300	1200/1350	1250/1400	1300/1450
• Flame tube length, with turning chamber	mm	4930	5330	5630	5930	6130	6630
• Boiler length with insulation, without burner	mm	5850	6180	6480	6650	7015	7515
• Boiler width with insulation, with pump	mm	3105	3305	3405	3505	3605	3705
• Boiler height with insulation, without armatures	mm	3200	3410	3510	3610	3710	3810
• Flue gas outlet diameter	mm	850	950	1000	1050	1100	1200
• Transport weight without burner and without economiser incl. accessories	at 10 bar kg	17500	22000	26000	28500	30500	34000
	at 13 bar kg	19000	23000	26500	29000	31000	36500
	at 16 bar kg	19500	24500	28500	31500	35500	40000

Armatures

Type		(110/100)	(130/120)	(150/140)	(170/160)	(190/180)	(220/200)
• 1 flue gas tube cleaning equipment		yes	yes	yes	yes	yes	yes
• 1 main steam valve	10 bar	DN 200	DN 200	DN 200	DN 200	DN 250	DN 250
	13 bar	DN 150	DN 150	DN 200	DN 200	DN 200	DN 250
	16 bar	DN 150	DN 150	DN 150	DN 200	DN 200	DN 200
• 1 vent valve		DN 25	DN 25	DN 25	DN 25	DN 25	DN 25
• 2 safety valves	10 bar	DN 50/80	DN 50/80	DN 65/100	DN 65/100	DN 65/100	DN 65/100
	13 bar	DN 40/65	DN 50/80	DN 50/80	DN 50/80	DN 65/100	DN 65/100
	16 bar	DN 40/65	DN 40/65	DN 50/80	DN 50/80	DN 50/80	DN 50/80
• 2 water level gauge valves		DN 20	DN 20	DN 20	DN 20	DN 20	DN 20
• 2 reflection indicators		M=420	M=420	M=420	M=420	M=420	M=420
• 1 sample taking and desalting shut-off valve		DN 15	DN 15	DN 15	DN 15	DN 15	DN 15
• 1 purge shut-off valve		DN 40	DN 40	DN 40	DN 40	DN 40	DN 40
• 1 purge ball valve		DN 40	DN 40	DN 40	DN 40	DN 40	DN 40
• 1 pressure gauge with three-way valve		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 2 feed water/pump valves		DN 50	DN 50	DN 50	DN 50	DN 65	DN 65
• 2 feed water backstroke/no return valves		DN 50	DN 50	DN 50	DN 50	DN 65	DN 65
• 1 strainers (pump suction side)		DN 80	DN 80	DN 80	DN 100	DN 100	DN 100
• 1 ball valve pump (suction side)		DN 80	DN 80	DN 80	DN 100	DN 100	DN 100
• 1 pressure gauge pump with shut-off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 feed water pumps	10 bar	CR	CR	CR	CR	CR	CR
Motor rating	10 bar	7.5	11.0	11.0	11.0	15.0	15.0
• 2 feed water pumps	13 bar	CR	CR	CR	CR	CR	CR
Motor rating	13 bar	11.0	11.0	15.0	15.0	18.5	18.5
• 2 feed water pumps	16 bar	CR	CR	CR	CR	CR	CR
Motor rating	16 bar	15.0	15.0	18.5	18.5	22.0	22.0

Steam boiler THSD-I E without economiser



- | | | |
|---------------------------------------|--------------------------------------|--------------------------------|
| 1 Boiler | 9 Continuous blowdown valve | 17 Feed water valve(s) |
| 2 Boiler base | 10 Steam valve | 18 Blow down/purge valve |
| 3 Hinged front door | 11 Vent valve | 19 Pressure gauge and manostat |
| 4 Flue gas outlet | 12 Safety valve(s) | 20 Feed water pump(s) |
| 5 Explosion flap and cleaning opening | 13 Water level gauge | 21 Electrical control panel |
| 6 Inspection opening | 14 Water level control | 22 Burner |
| 7 Inspection glass (flame tube) | 15 Water insufficiency control 1 + 2 | 23 Condensate drain nozzle |
| 8 Fitting pipe | 16 Feed water piping | 24 Crane hooks |

Type	Main dimensions				Connecting dimensions								Base frame				Flue gas connection		Required space B x H (for transport)			
	L	B **	H	D	L ₃	L ₅	L ₆	L ₇	L ₈	H ₁	H ₂	L ₁	L ₂	B ₁	B ₂	H ₃	D ₁	with armatures		without armatures		
25/20	3330	2585	2710	1950	230	350	350	300	600	2260	1175	2200	380	1500	160	1750	400	2600	2750	2300	2300	
30/25	3530	2685	2810	2050	230	350	350	300	800	2360	1225	2400	380	1500	160	1825	450	2700	2850	2400	2400	
35/30	3730	2735	2950	2100	230	400	350	350	350	2410	1250	2600	380	1550	160	1850	450	2750	3000	2450	2500	
45/40	4080	2835	3100	2200	230	500	400	400	400	2560	1350	2950	380	1650	160	1950	550	2850	3100	2550	2600	
55/50	4530	2935	3250	2300	230	600	500	500	500	2660	1400	3400	380	1700	160	2050	600	2950	3300	2650	2700	
70/60	4830	3035	3350	2400	230	600	500	600	600	2760	1450	3600	380	1800	160	2100	650	3050	3400	2750	2800	
90/80	5330	3235	3680	2600	230	600	600	600	600	2960	1550	4100	380	1950	160	2250	750	3250	3700	2950	3000	
110/100	5850	3435	3930	2800	280	600	600	600	800	3210	1700	4500	430	2050	200	2450	850	3450	3950	3150	3250	
130/120	6180	3635	4220	3000	280	600	600	700	1000	3410	1800	4900	430	2200	200	2650	950	3650	4250	3350	3450	
150/140	6480	3735	4320	3100	280	600	600	800	1100	3510	1850	5200	430	2250	200	2675	1000	3750	4350	3450	3550	
170/160	6680	3835	4420	3200	280	600	600	900	1200	3610	1900	5400	430	2300	200	2750	1050	3850	4450	3550	3650	
190/180	7015	3935	4630	3300	315	600	600	1000	1300	3710	1950	5700	430	2400	200	2800	1100	3950	4650	3650	3750	
220/200	7515	4035	4730	3400	315	600	600	1100	1400	3810	2000	6000	430	2500	200	2850	1200	4050	4750	3750	3850	

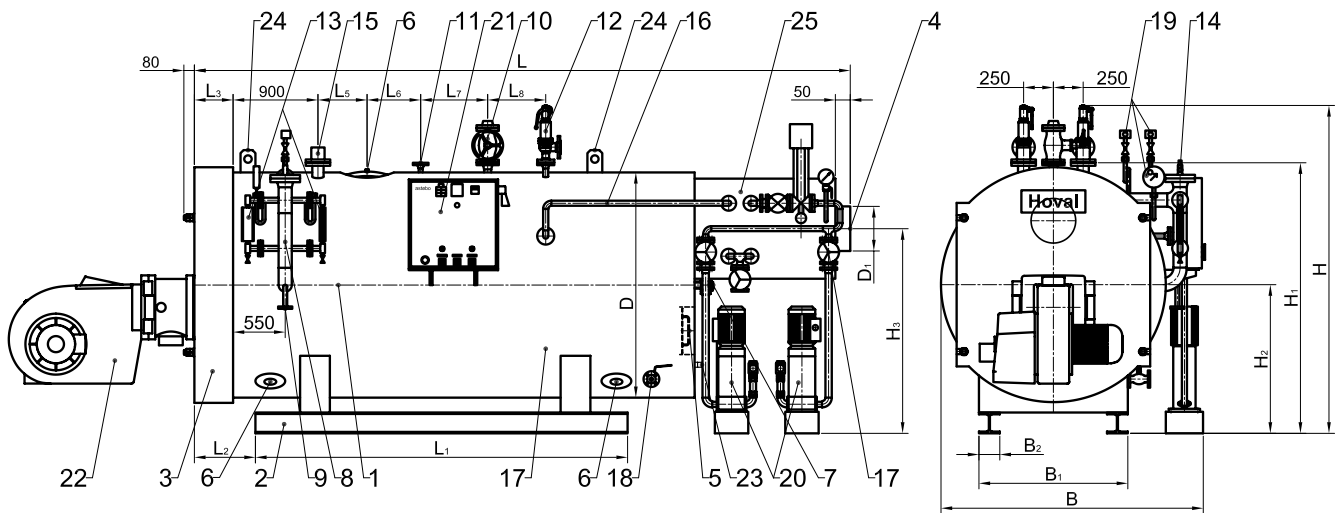
Design pressure 10, 13 and 16 bar (gauge).
Other pressure levels on request!

Add 100 mm to H₁ for crane hooks.
Dimensions incl. 100 mm isolation.

Transport dimensions for design pressure 10 bar

** Dimension may vary to used pumps

Steam boiler THSD-I E with economiser



- | | | |
|---------------------------------------|--------------------------------------|--------------------------------|
| 1 Boiler | 9 Continuous blowdown valve | 17 Feed water valve(s) |
| 2 Boiler base | 10 Steam valve | 18 Blow down/purge valve |
| 3 Hinged front door | 11 Vent valve | 19 Pressure gauge and manostat |
| 4 Flue gas outlet | 12 Safety valve(s) | 20 Feed water pump(s) |
| 5 Explosion flap and cleaning opening | 13 Water level gauge | 21 Electrical control panel |
| 6 Inspection opening | 14 Water level control | 22 Burner |
| 7 Inspection glass (flame tube) | 15 Water insufficiency control 1 + 2 | 23 Condensate drain nozzle |
| 8 Fitting pipe | 16 Feed water piping | 24 Crane hooks |
| | | 25 Economiser |

Type	Main dimensions				Connecting dimensions							Base frame				Flue gas connection		Required space B x H (for transport)			
	L	B **	H	D	L ₃	L ₅	L ₆	L ₇	L ₈	H ₁	H ₂	L ₁	L ₂	B ₁	B ₂	H ₃	D ₁	with armatures		without armatures	
25/20	4437	2585	2710	1950	230	350	350	300	600	2260	1175	2200	380	1500	160	1540	350	2600	2750	2300	2300
30/25	4637	2685	2810	2050	230	350	350	300	800	2360	1225	2400	380	1500	160	1645	350	2700	2850	2400	2400
35/30	4875	2735	2950	2100	230	400	350	350	350	2410	1250	2600	380	1550	160	1655	400	2750	3000	2450	2500
45/40	5262	2835	3100	2200	230	500	400	400	400	2560	1350	2950	380	1650	160	1720	450	2850	3100	2550	2600
55/50	5750	2935	3250	2300	230	600	500	500	500	2660	1400	3400	380	1700	160	1795	500	2950	3300	2650	2700
70/60	6087	3035	3350	2400	230	600	500	600	600	2760	1450	3600	380	1800	160	1845	550	3050	3400	2750	2800
90/80	6662	3235	3680	2600	230	600	600	600	600	2960	1550	4100	380	1950	160	1965	650	3250	3700	2950	3000
110/100	7220	3435	3930	2800	280	600	600	600	800	3210	1700	4500	430	2050	200	2140	700	3450	3950	3150	3250
130/120	7587	3635	4220	3000	280	600	600	700	1000	3410	1800	4900	430	2200	200	2295	750	3650	4250	3350	3450
150/140	7925	3735	4320	3100	280	600	600	800	1100	3510	1850	5200	430	2250	200	2330	800	3750	4350	3450	3550
170/160	8162	3835	4420	3200	280	600	600	900	1200	3610	1900	5400	430	2300	200	2365	850	3850	4450	3550	3650
190/180	8535	3935	4630	3300	315	600	600	1000	1300	3710	1950	5700	430	2400	200	2425	900	3950	4650	3650	3750
220/200	9110	4035	4730	3400	315	600	600	1100	1400	3810	2000	6000	430	2500	200	2435	1000	4050	4750	3750	3850

Design pressure 10, 13 and 16 bar (gauge).
Other pressure levels on request!

Transport dimensions for design pressure 10 bar

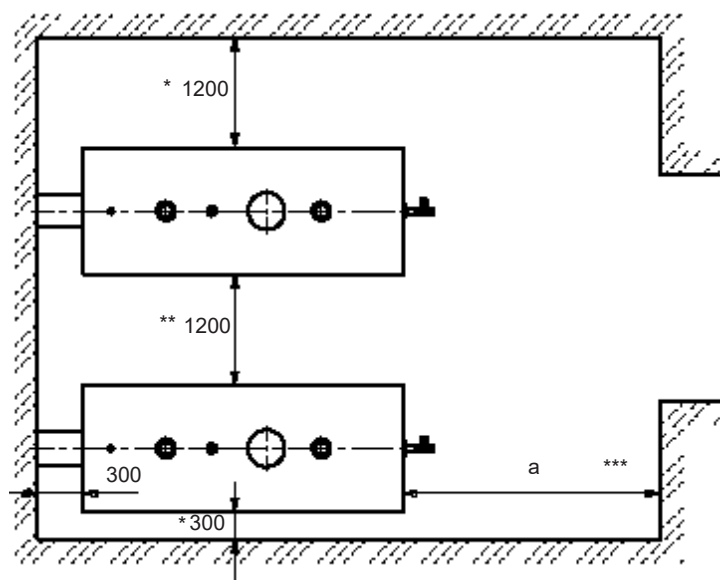
** Dimension may vary to used pumps

Add 100 mm to H₁ for crane hooks.
Dimensions incl. 100 mm isolation.

Space requirements

Installation

(Dimensions in mm)



To facilitate installation and maintenance the given measures should be kept.

Minimal space refers to boiler.
Depending on equipment (accessories) the minimal space have to be examined according to TRD 403.

Positioning

- No air pollution through halogenated hydrocarbon (contained e.g. in sprays, paints, solvents and cleaners)
- No large amounts of dust
- No high atmospheric humidity
- Frost-resistant and well ventilated

Otherwise errors and damages to the installation may occur.

The boiler may only be installed in rooms where air pollution through halogenated hydrocarbon can occur if sufficient measures are taken ensuring the supply of unpolluted combustion air.

* 300 mm/1200 mm + burner overall length (consider pivoting range/pivoting side of boiler front door too)

** Consider control panel, pump build-up

*** Flame tube length (cleaning)

Steam output (t/h)	2.5/2.0	3.0/2.5	3.5/3.0	4.5/4.0	5.5/5.0	7.0/6.0	9.0/8.0	11.5/10.0
THSD-I E a (mm)	2800	3000	3200	3550	4000	4200	4700	5100
Steam output (t/h)	13.0/12.0	15.0/14.0	17.0/16.0	19.0/18.0	22.0/20.0			
THSD-I E a (mm)	5500	5800	6100	6300	6800			

Rules and regulations

The following rules and regulations have to be respected:

- Hoval technical information and installation guide
- hydraulic and control technical regulations, to guarantee the min. admissible boiler temperature and the conditions for a safe operation according to national regulations
- fire protection regulations
- national regulations concerning permission, installation and operation of boiler appliances
- Boiler appliances have to be installed according to national laws and regulations and accessories requirements.
- Besides the national and local regulations the project specific circumstances of the boiler supplier have to be considered for every application.

Water treatment/water quality

- The quality of the boiler water has to be guaranteed according to Hoval technical information and national regulations.
- Hoval boilers may only be operated with treated water. The national regulations for the treatment of water apply for the values to be kept.
- Required water quality see attachment.
- Don't use chemical additives like anti-freeze etc. Except chemicals which are necessary for normal boiler operation (see water quality specification).
- Old and new installations must be well flushed before filling.
- The water quality has to be checked daily.

Planning, operation and maintenance

- The heating of the feed water and the degassing takes place in the feed water tank.
- To increase the efficiency, especially for natural gas operation, an economiser can be added to preheat the feed water.
- Pumps (especially horizontal rotary pumps and hot water/condensate pumps, NPSH pumps) need to be installed with the necessary flow, return pipework and positive suction pressure according to requirements. The installation has to be completely free of tension (anti-vibration proof).
- National and local rules and regulations have to be considered for the fuel supply.
- The operation and water analysis data are to be recorded daily in the operation booklet.
- Safety valves and blow-off pipes must discharge the system overpressure riskless.
- Filters and strainers have to be cleaned periodically, especially if installed in front of control devices.
- The drain of the desalting, blow down, drainage, overflow, etc. has to be safely discharged into a dislodging tank.
- All heating components and pipework are to be insulated in order to reduce radiation losses.

Combustion air

- The supply of combustion air must be guaranteed for a safe and economic operation. There must be no possibility of the air supply being shut off.
- Ventilation of the boiler house has to also be provided.
- In the installation room no negative pressure larger than 3 N/m² is allowed. To adhere to this demand, plan a free area for the air supply opening of at least 200 cm², plus 2 cm² per kW output. The aspect ratio for rectangular openings should not be more than 1.5 : 1. If the opening is louvred ensure the free area is sufficient. National laws have to be respected.
- Boiler houses have to be fitted with the relevant outer pressure relief surface.
- Steam boilers are not to be installed in rooms where halogen compounds occur which can enter the combustion air. (e.g. laundries, drying and hobby rooms, etc.).

Noise level reduction

The following measures for noise level reduction are possible:

- Solid construction of heating room walls, ceiling and floor, installation of silencer in fresh air supply, noise insulation for support and bracket of pipes.
- Installation of sound attenuation cowl for the burner.
- A substantial part of the sound caused in the combustion chamber and in the top heating surfaces is radiated from the flue outlet as sound transmitted by air. In addition to this, resonance features, depending on chimney dimensioning and inlet, may occur which are triggered by the oscillation of the combustion process. These sounds can be reduced by burner-lateral measures, e.g. changes of flame geometry, atomisation characteristics or fuel throughput.
- Flue gas attenuators cause a substantial sound level reduction as well. These sound absorbers should usually be tuned at low frequencies of 60-250 Hz. Flue gas attenuators function according to the principle of sound absorption. The kinetic energy of the exhaust gases is reduced by friction requiring an increase in chimney draft in the flue system. This has to be considered for burner sizing. The connection piece from the boiler to the flue gas sound absorber has to be gas-tight.
- The necessary space requirement of approx. 2 m for the later installation of a flue gas sound absorber should be included when planning.

Chimney/flue gas system

- A properly designed chimney/flue arrangement must be provided to match each particular application.
- To achieve a smooth discharge of the exhaust gases from the boiler into the chimney, the flue connection must enter the chimney at approx. 30-45 °.
- From a length of greater than 1 m thermal insulation is necessary.
- Adequate provision should be made to drain of condensate from the base of the chimney ensuring condensate does not run back into the boiler smokebox.

Boiler and feed water specifications for steam boiler plants

Boiler water - general

Boiler water must be free of hardness components. pH-value should be above neutral level. Please refer to following tables for water composition.

During a BOSB-operation feed- and boiler water have to be checked every 72 h, without BOSB- operation daily checks are necessary! The values must be recorded in the operating log book!

Feed water specifications for natural circulating boilers – shell boilers (table 1)

Parameter	Unit	Feed water for steam boilers	
Operating pressure	bar (0.1 MPa)	> 0.5 to 20	> 20
Appearance	-	clear, free from suspended solids and foam	
Direct conductivity at 25 °C	µS/cm	not specified, only guide values relevant for boiler water - see table 2	
pH value at 25 °C ¹⁾	-	> 9.2 ²⁾	> 9.2 ²⁾
Total hardness ^{3), 6)} (Ca + Mg)	mmol/l	< 0.01 ³⁾	< 0.01
Iron (Fe) concentration	mg/l	< 0.3	< 0.1
Copper (Cu) concentration	mg/l	< 0.05	< 0.03
Silica (SiO ₂) concentration	mg/l	not specified, only guide values for boiler water relevant, see table 2	
Oxygen (O ₂) concentration	mg/l	< 0.05 ⁴⁾	< 0.02
Oil/grease concentration (see EN 12953-6)	mg/l	< 1	< 1
Organic substances (as TOC) concentration	-	see footnote ⁵⁾	

¹⁾ With copper alloys in the system the pH value shall be maintained in the range 8.7 to 9.2.

²⁾ With softened water pH value > 7.0 the pH value of boiler water according to table 2 should be considered.

³⁾ At operating pressure < 1 bar total hardness max. 0.05 mmol/l shall be acceptable.

⁴⁾ Value for continuous operation and/ or if a deaerator is used; if the operation is discontinuous or without deaerator film forming agents and/or excess of oxygen scavenger shall be used.

⁵⁾ Organic substances are generally a mixture of several different compounds. The composition of such mixtures and the behaviour of their individual components under the conditions of boiler operation are difficult to predict. Organic substances may be decomposed to form carbonic acid or other acidic decomposition products which increase the acid conductivity and cause corrosion or deposits. They also may lead to foaming and/or priming which shall be kept as low as possible.

⁶⁾ Noted in the past as °dH, conversion factor: 1 mmol/l = 5.6°dH (German hardness)

Source: EN12953-10:2003 (E) + Hoval handbook

Boiler water specifications for natural circulating boilers – shell boilers - (table 2)

Parameter	Unit	Boiler water for steam boilers using		
		Feedwater direct conductivity > 30 µS/cm		Feedwater direct conductivity ≤ 30 µS/cm
Operating pressure	bar (0.1 MPa)	> 0.5 to 20	> 20	> 0.5
Appearance	-	clear, free from suspended solids and foam		
Direct conductivity at 25 °C ⁸⁾	µS/cm	< 6 000 ¹⁾	see figure 1 ¹⁾	< 1 500
pH value at 25 °C	-	10.5 to 12.0	10.5 to 11.8	10.0 to 11.0 ^{2), 3)}
Total hardness ^{10), 11)} (Ca + Mg)	mmol/l	< 0.01		
Composite alkalinity ⁷⁾	mmol/l	1 to 15 ¹⁾	1 to 10 ¹⁾	0.1 to 1.0 ³⁾
Silica (SiO ₂) concentration ⁹⁾	mg/l	pressure dependent, according to figure 2		
Phosphate (PO ₄) ^{4), 6)}	mg/l	10 to 30	10 to 30	6 to 15
Sodium Sulphite (Na ₂ SO ₃) ⁶⁾	mg/l	5 to 10	5 to 10	5 to 10
Organic substances (as TOC) concentration	-	see footnote ⁵⁾		

¹⁾ With super heater consider 50 % of the indicated upper value as maximum value.

²⁾ Basic pH adjustment by injecting Na₃PO₄, additional NaOH injection only if the pH value is < 10.

³⁾ If the acid conductivity of the boiler feedwater is < 0.2 µS/cm, and its Na + K concentration is < 0.010 mg/l, phosphate injection is not necessary. Under the conditions AVT (all volatile treatment, feedwater pH ≥ 9.2 and boiler water pH ≥ 8.0) can be applied, in this case the acid conductivity of the boiler water is < 5 µS/cm.

⁴⁾ If coordinated phosphate treatment is used; considering all other values higher PO₄-concentrations are acceptable (see clause 4 of EN 12953-10 for details).

⁵⁾ See ⁵⁾ in table 1.

⁶⁾ Measuring only necessary if dosing chemicals are used which contains these composition

⁷⁾ Noted in the past as p-value, conversion factor: KS 8.2 = 1 according p-value = 1

⁸⁾ For level electrodes minimum conductivity = > 5 µS/cm

⁹⁾ It's not necessary to make continuous control of following parameters: Silica (SiO₂) concentration

¹⁰⁾ At operating pressure < 1 bar total hardness max. 0.05 mmol/l shall be acceptable.

¹¹⁾ Noted in the past as °dH, conversion factor: 1 mmol/l = 5.6°dH (German hardness)

Source: EN12953-10:2003 (E) + Hoval handbook

Fig. 1 Maximum acceptable direct conductivity of the boiler water dependent on the pressure; feedwater direct conductivity > 30 µS/cm

Source: EN12953-10:2003 (E)

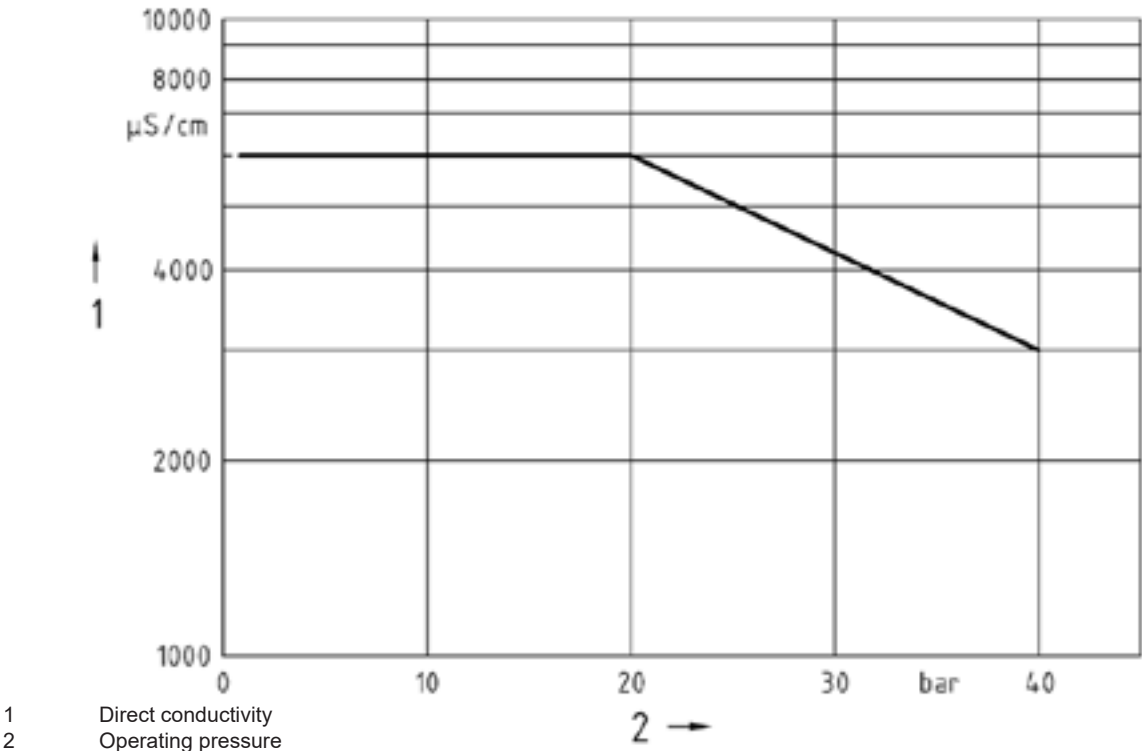
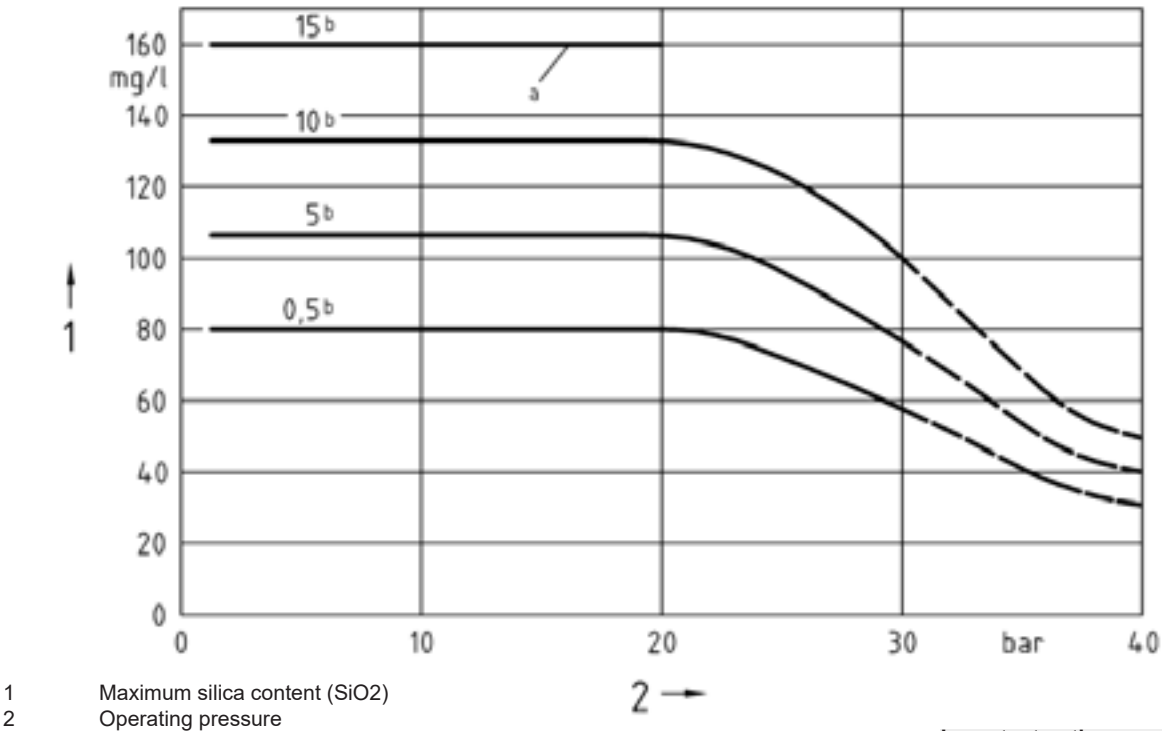


Fig. 2 Maximum acceptable silica content (SiO2) of the boiler water dependent on the pressure

Source: EN12953-10:2003 (E)



- 1 Maximum silica content (SiO2)
- 2 Operating pressure
- a This level of alkalinity is not permissible > 20 bar
- b Alkalinity in mmol/l

Important notice
Hoval recommends that a water treatment specialist is employed to carry out routine monitoring of the supply water in order to ensure it remains within specification.

SPW-D

Feed water tank pressureless
SPW-D (500) - SPW-D (3000)

Description

SPW-D

Feed water tank SPW-D

The Hoval feed water tank type SPW-D is made of steel sheet St 37.2. The pressureless tank with ventilation into the atmosphere is completely electrically welded and provided with all necessary links. The tank must be positioned approx. 2-3 metres above boiler level. Installed in the container is a heat up feature, consisting of a special heating tube for a direct steam heat up of the tank.

Admissible operating temperature

Operating temperature: 95 °C

Thermal insulation

The tank is completely insulated with mineral wool. The casing is made of structured aluminium plate. Fittings and out-cuts are properly rimmed.

Armatures

The feed water tank will be supplied with the following armatures:

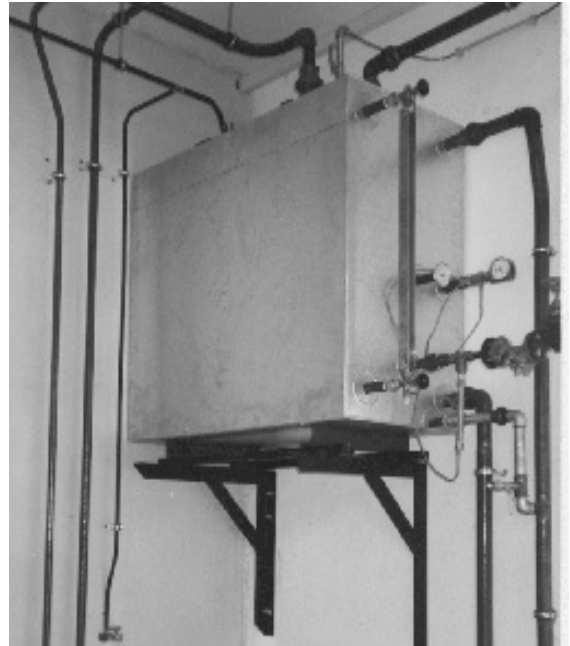
- 1 water level indicator with glass protection
- 1 drain valve
- 1 thermometer diameter 100 mm
- 1 shut-off valve (water)
- 1 additional water backfeed with float valve
(on request solenoid valve)

Armatures for heat up equipment:

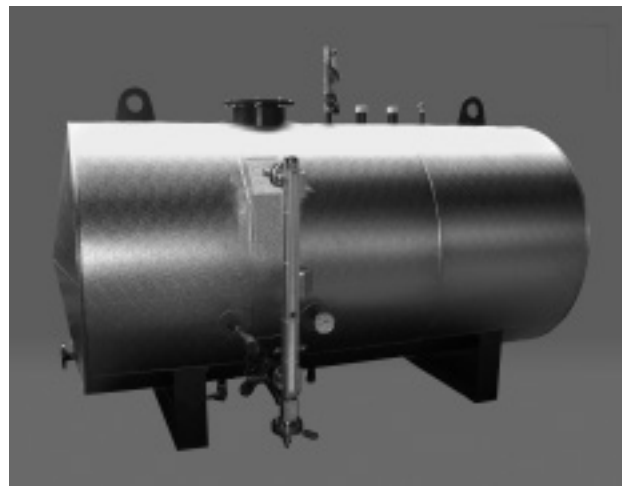
- 1 temperature regulator with capillar pipe and impulse connection line
- 1 steam regulator valve (shut-off valve)
- 1 strainer (steam)
- 1 shut-off valve (steam)
- 1 metering valve

Delivery

The feed water tank is provided with a primer. The insulation and the armatures are either mounted or packed loosely in a separate box according to size.



SPW-D 500 L - 1500 L



SPW-D 2000 L - 3000 L

SPW-D 500 L - 1500 L, angular
SPW-D 2000 L - 3000 L, round

Type		(500)	(1000)	(1500)	(2000)	(3000)
• Water content	l	500	1000	1500	2000	3000
• Construction		angular	angular	angular	angular	angular
• Material		St 37.2	St 37.2	St 37.2	St 37.2	St 37.2
• Wall thickness	mm	5	5	5	4	4
• Regenerated water amount max.	m³/h	0.5	1.0	1.5	2.0	3.0
• Heating steam output						
from 15 °C to 95 °C	kW	47	93	140	185	279
Saturated steam	kg/h	84	168	252	336	504
• Length without insulation	mm	1100	1650	2100	2100	2900
• Height without insulation	mm	1000	1000	1000	1725	1725
• Width without insulation	mm	500	700	700	-	-
• Diameter without insulation	mm	-	-	-	1350	1350
• Length with insulation, without armatures	mm	1280	1830	2280	2180	2980
• Height with insulation, without armatures	mm	1340	1340	1340	1725	1725
• Width with insulation, without armatures	mm	600	800	800	1450	1450

Sockets

Type	(500)	(1000)	(1500)	(2000)	(3000)
• Socket for thermostat	R 2"	R 2"	R 2"	R 2"	R 2"
• Socket for condensate return	R 2"	R 2"	R 2"	R 2"	R 2"
• Socket for venting	R 2"	R 2"	R 2"	R 2"	R 2"
• Socket for over flow	R 5/4"	R 5/4"	R 5/4"	R 5/4"	R 5/4"
• Socket for boiler feeding	R 6/4"	R 6/4"	R 6/4"	R 6/4"	R 6/4"

Fine armatures with float valve

Type	(500)	(1000)	(1500)	(2000)	(3000)
• 1 fluid level indicator	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 thermometer	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 draining	R 1"	R 1"	R 1"	R 1"	R 1"
• 1 dosing ball valve	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 float valve	R 1/2"	R 1/2"	R 3/4"	R 3/4"	R 1"
• 1 shut-off valve	R 1/2"	R 1/2"	R 3/4"	R 3/4"	R 1"

Fine armatures with magnetic valve

Type	(500)	(1000)	(1500)	(2000)	(3000)
• 1 fluid level indicator	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 thermometer	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 draining	R 1"	R 1"	R 1"	R 1"	R 1"
• 1 dosing ball valve	R 1/2"	R 1/2"	R 1/2"	R 1/2"	R 1/2"
• 1 solenoid valve	R 1/2"	R 1/2"	R 3/4"	R 3/4"	R 1"
• 1 shut-off valve	R 1/2"	R 1/2"	R 3/4"	R 3/4"	R 1"
• 1 two step control	DN 20	DN 20	DN 20	DN 20	DN 20

SPW-D 500 L - 1500 L, angular
SPW-D 2000 L - 3000 L, round

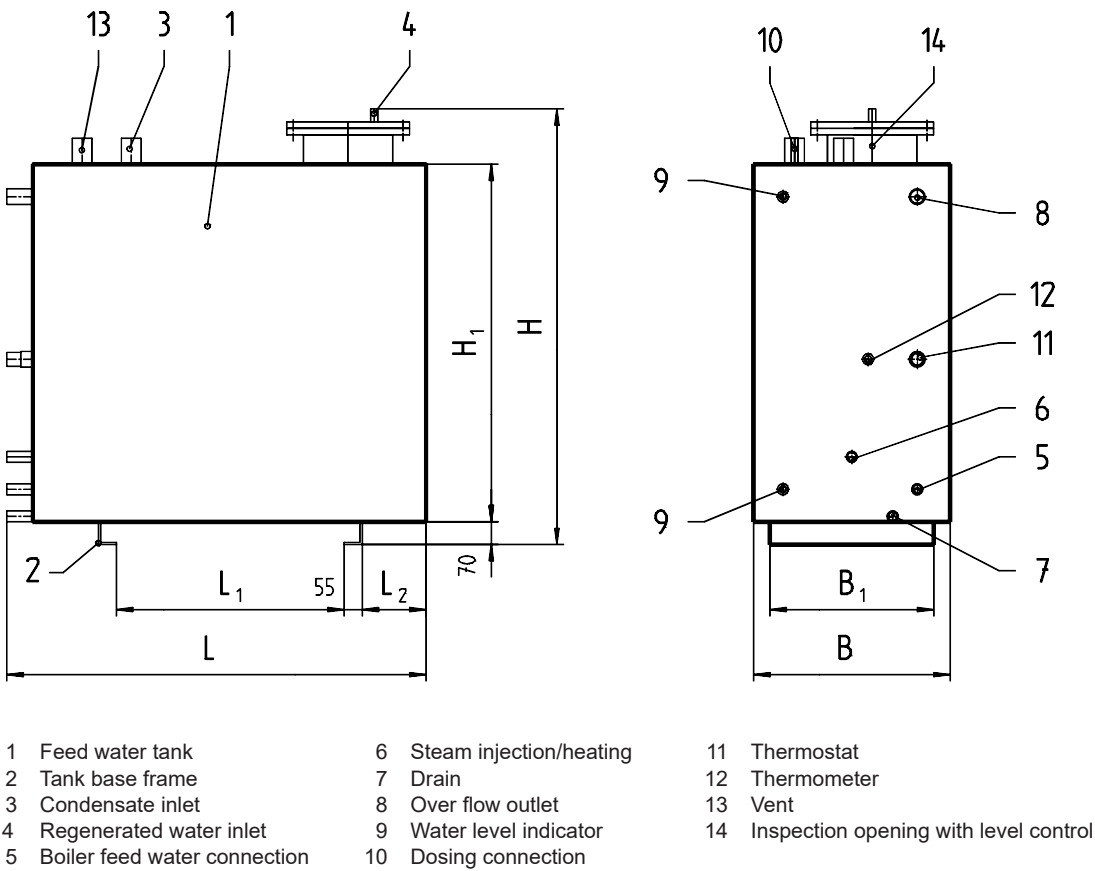
Direct heat up equipment

Type	(500)	(1000)	(1500)	(2000)	(3000)
• 1 nozzle pipe	yes	yes	yes	yes	yes

Fine armatures, heating steam

Type		(500)	(1000)	(1500)	(2000)	(3000)
• 1 shut-off valve incl. temperature regulator						
	0.5 bar	R 1"	DN 40	DN 50	DN 65	DN 65
	6 bar	R ½"	R ½"	R ¾"	DN 25	DN 25
	10 bar	R ½"	R ½"	R ½"	DN 20	DN 25
	13 bar	R ½"	R ½"	DN 15	DN 15	DN 32
	16 bar	R ½"	R ½"	DN 15	DN 15	DN 32
• 1 shut-off valve						
	0.5 bar	R 5/4"	R 2"	DN 65	DN 80	DN 80
	6 bar	DN 20	DN 25	DN 32	DN 40	DN 50
	10 bar	DN 15	DN 20	DN 25	DN 32	DN 40
	13 bar	DN 15	DN 20	DN 25	DN 25	DN 32
	16 bar	DN 15	DN 20	DN 20	DN 25	DN 32
• 1 strainer						
	0.5 bar	R 5/4"	R 2"	DN 65	DN 80	DN 80
	6 bar	DN 20	DN 25	DN 32	DN 40	DN 50
	10 bar	DN 15	DN 20	DN 25	DN 32	DN 40
	13 bar	DN 15	DN 20	DN 25	DN 25	DN 32
	16 bar	DN 15	DN 20	DN 20	DN 25	DN 32

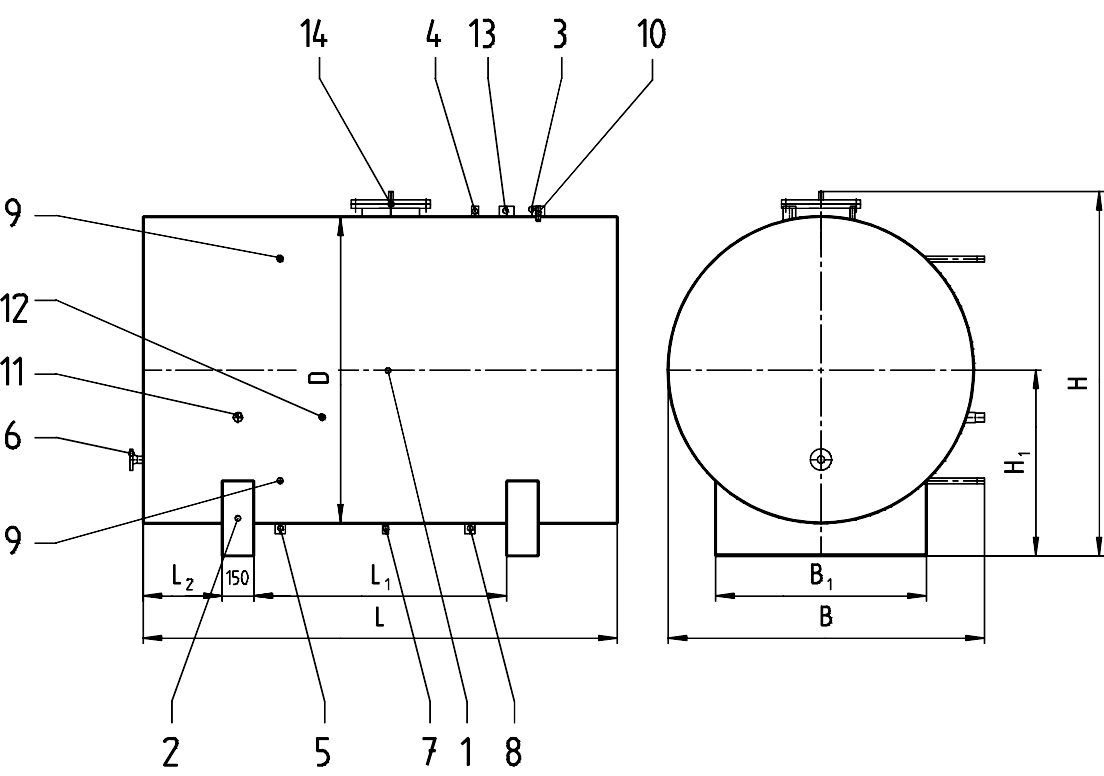
SPW-D 500 L - 1500 L, angular



Content [litres]	Main dimensions				Base frame		
	L	B	H	H ₁	L ₁	L ₂	B ₁
(500)	1280	600	1340	1000	695	195	500
(1000)	1830	800	1340	1000	945	345	700
(1500)	2280	800	1340	1000	1195	445	700

Dimensions incl. 50 mm insulation.

SPW-D 2000 L - 3000 L, round



- 1

2

3

4

5
- 6

7

8

9

10
- 11

12

13

14
- Feed water tank

Tank base frame

Condensate inlet

Regenerated water inlet
(not if float valve)

Boiler feed water connection

Steam injection (direct)
(optional) indirect heat up

Drain

Over flow outlet

Water level indicator

Dosing connection

Thermostat

Thermometer

Vent

Inspection opening with
level control by electrode (optional)
level control by float valve

Content [litres]	Main dimensions					Base frame		
	L	B	H	H ₁	D	L ₁	L ₂	B ₁
(2000)	2650	1150	1400	750	1100	1200	500	700
(3000)	2980	1450	1725	870	1350	1750	400	900

Dimensions incl. 50 mm insulation.

SPW-E**Feed water tank SPW-E**

The Hoval feed water tank type SPW-E is made of steel St 37.2. The tank is completely electrically welded and provided with all necessary links. The tank must be positioned approx. 2-4 meters above boiler level (sub-construction to be made on site). Installed in the tank is a bottom heating equipment consisting of a special heating tube for a direct steam heat up of the tank. The trickle plate deaerator is made of special Inox high quality steel 1.4301. It consists of all the required fixtures, as well as the linking fittings with attachment flange.

Admissible operating pressure/temperature

Max. operating temperature: 110 °C

Max. operating pressure: 0.5 bar

Thermal insulation

The tank is completely insulated with mineral wool. The casing is made of structured aluminium plate. Fittings and out-cuts are properly rimmed.

Armatures

The feed water tank will be supplied with the following armatures:

- 1 magnetic level indicator
- 1 drainage ball valve
- 1 boiler feed water valve
- 1 safety valve
- 1 thermometer diameter 100 mm
- 1 pressure gauge set
- 1 overflow with condensate discharger
- 1 vapour valve made of quality steel

Delivery

The feed water tank is provided with a primer. The accessories are supplied loosely in a separate box.

Level regulation

- 2 magnetic switches for magnetic valve on/off
- 1 electronic control panel for wall mounting

**Additional water group**

- 1 magnetic valve
- 1 shut-off/surrounding set (ball valves)

Condensate group

- 1 condensate shut-off valve
- 1 condensate non-return valve

Heating steam group

- 1 medium control mechanical pressure regulator
- 1 strainer heat steam
- 1 shut-off valve heat steam
- 1 manual shut-off valve - bottom heat up
- 1 non-return valve - bottom heat up

SPW-E

Feed water tank 0.5 bar

Type		(3000)	(4000)	(5000)	(6000)	(8000)	(10000)	(12000)
• Water content	l	3000	4000	5000	6000	8000	10000	12000
• Construction		round	round	round	round	round	round	round
• Material		St 37.2	St 37.2	St 37.2	St 37.2	St 37.2	St 37.2	St 37.2
• Wall thickness	mm	4	4	5	5	5	6	6
• Weight	kg	510	560	800	1020	1330	1600	1660
• Length without insulation	mm	2875	3275	3700	4400	5000	5200	5400
• Diameter without insulation	mm	1250	1250	1400	1400	1600	1600	1600
• Length with insulation, without armatures	mm	2925	3325	3750	4450	5050	5250	5450
• Height with insulation, without armatures	mm	1725	1725	1870	1870	2100	2100	2100
• Width with insulation, without armatures	mm	1450	1450	1600	1600	1800	1800	1800

Fine armatures tank

Type		(3000)	(4000)	(5000)	(6000)	(8000)	(10000)	(12000)
• 1 fluid level indicator		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 anti vacuum valve		DN 15	DN 15	DN 15	DN 15	DN 15	DN 15	DN 15
• 1 dosing ball valve		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 draining		R 2"	R 2"	R 2"	R 2"	R 2"	R 2"	R 2"
• 1 thermometer		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 pressure gauge with three-way valve		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 boiler feed water ball valve		R 2"	R 2"	R 2 ½"	R 2 ½"	R 3"	R 3"	R 3"
• 1 condensate trap		R 2"	R 2"	R 2"	R 2"	R 2"	R 2"	R 2"
• 1 condensate trap ball valve		R 2"	R 2"	R 2"	R 2"	R 2"	R 2"	R 2"
• 1 magnetic level gauge		yes	yes	yes	yes	yes	yes	yes

SPW-E

Feed water tank 0.5 bar

Type		(14000)	(16000)	(20000)	(25000)	(30000)
• Water content	l	14000	16000	20000	25000	30000
• Construction		round	round	round	round	round
• Material		St 37.2	St 37.2	St 37.2	St 37.2	St 37.2
• Wall thickness	mm	6	6	8	10	10
• Weight	kg	1710	2300	3500	4700	5000
• Length without insulation	mm	5430	5650	6100	5520	6200
• Diameter without insulation	mm	1600	2000	2200	2500	2500
• Length with insulation, without armatures	mm	5700	5700	6150	5570	6250
• Height with insulation, without armatures	mm	2100	2470	2470	2870	2870
• Width with insulation, without armatures	mm	1800	2200	2200	2650	2650

Fine armatures tank

Type		(14000)	(16000)	(20000)	(25000)	(30000)
• 1 fluid level indicator		R ½"	R ½"	R ½"	R ½"	R ½"
• 1 anti vacuum valve		DN 15	DN 15	DN 15	DN 15	DN 15
• 1 dosing ball valve		R ½"	R ½"	R ½"	R ½"	R ½"
• 1 draining		R 2"	R 2"	R 2"	R 2"	R 2"
• 1 thermometer		R ½"	R ½"	R ½"	R ½"	R ½"
• 1 pressure gauge with three-way valve		R ½"	R ½"	R ½"	R ½"	R ½"
• 1 boiler feed water ball valve		DN 100	DN 100	DN 125	DN 150	DN 150
• 1 condensate trap		R 2"	R 2"	R 2"	R 2"	R 2"
• 1 condensate trap ball valve		R 2"	R 2"	R 2"	R 2"	R 2"
• 1 magnetic level gauge		yes	yes	yes	yes	yes

SPW-E (3000-12000)

Deaerator 0.5 bar - condensate 50 %

Type		(3000)	(4000)	(6000)	(8000)	(10000)	(12000)
• Deaerator output	kg/h	3000	4000	6000	8000	10000	12000
• Construction		round	round	round	round	round	round
• Material		1.4301	1.4301	1.4301	1.4301	1.4301	1.4301
• Wall thickness	mm	3	3	3	3	3	3
• Weight	kg	165	186	186	258	264	276
• Cylindric height	mm	1350	1430	1490	1600	1600	1650
• Diameter	mm	700	700	700	900	900	900
• Width without armatures	mm	1020	1020	1020	1220	1220	1220
• Length without armatures	mm	1020	1020	1020	1250	1250	1250
• Height without armatures of flange	mm	1490	1570	1630	1740	1740	1790

Fine armatures exhaust vapour

• 1 exhaust vapour valve	DN 15	DN 25	DN 25	DN 25	DN 25	DN 32
--------------------------	-------	-------	-------	-------	-------	-------

Additional water group

Type		(3000)	(4000)	(6000)	(8000)	(10000)	(12000)
• Regenerated water amount	m³/h	1	2	3	4	5	6
• Heating up output from 10 to 107 °C	kW	113	226	338	451	564	677
• Heating steam output	kg/h	204	407	611	815	1019	1222

Fine armatures

• 1 magnetic valve	R 1"	R 1"	R 1"	R 5/4"	R 5/4"	R 6/4"
• 3 bypass ball valve	R 1"	R 1"	R 1"	R 5/4"	R 5/4"	R 6/4"
• 1 non-return valve	R 1"	R 1"	R 1"	R 5/4"	R 5/4"	R 6/4"

Condensate group

Type		(3000)	(4000)	(6000)	(8000)	(10000)	(12000)
• Condensate water amount	m³/h	1	2	3	4	5	6
• Heating up output from 80 to 107 °C	kW	31	63	94	126	157	188
• Heating steam output	kg/h	57	113	170	227	284	340

Fine armatures

• 1 condensate shut-off valve	DN 25	DN 25	DN 25	DN 32	DN 32	DN 40
• 1 condensate non-return valve	DN 25	DN 25	DN 25	DN 32	DN 32	DN 40

SPW-E (3000-12000)

Deaerator 0.5 bar - condensate 50 %

Type		(16000)	(20000)	(25000)	(30000)
• Deaerator output	kg/h	16000	20000	25000	30000
• Construction		round	round	round	round
• Material		1.4301	1.4301	1.4301	1.4301
• Wall thickness	mm	3	3	3	3
• Weight	kg	300	321	400	420
• Cylindric height	mm	1650	1650	2000	1890
• Diameter	mm	900	1100	1250	1250
• Width complete without armatures	mm	1220	1420	1570	1570
• Length complete without armatures	mm	1250	1500	1650	1650
• Height complete without armatures of flange	mm	1790	1790	2030	2030

Fine armatures exhaust vapour

• 1 exhaust vapour valve	DN 32	DN 40	DN 40	DN 40
--------------------------	-------	-------	-------	-------

Additional water group

Type		(16000)	(20000)	(25000)	(30000)
• Regenerated water amount	m ³ /h	8	10	12.5	15
• Heating up output from 10 to 107 °C	kW	902	1128	1410	1692
• Heating steam output	kg/h	1630	2037	2546	3056

Fine armatures

• 1 magnetic valve	R 6/4"	R 2"	R 2"	R 2"
• 3 bypass ball valve	R 6/4"	R 2"	R 2"	R 2"
• 1 non-return valve	R 6/4"	R 2"	R 2"	R 2"

Condensate group

Type		(16000)	(20000)	(25000)	(30000)
• Condensate water amount	m ³ /h	8	10	12.5	15
• Heating up output from 80 to 107 °C	kW	251	314	393	471
• Heating steam output	kg/h	454	567	708	851

Fine armatures

• 1 condensate shut-off valve	DN 40	DN 50	DN 50	DN 50
• 1 condensate non-return valve	DN 40	DN 50	DN 50	DN 50

SPW-E (3000-12000)

Deaerator 0.5 bar - condensate 50 %

Heating steam group

Type			(3000)	(4000)	(6000)	(8000)	(10000)	(12000)
• Heating steam amount								
	at 10 bar	kg/h	260	521	781	1042	1302	1562
	at 13 bar	kg/h	260	521	781	1042	1302	1562
	at 16 bar	kg/h	260	521	781	1042	1302	1562
• 1 steam pressure reducing valve (partially with range limiter)								
	at 10 bar		DN 25	DN 32	DN 32	DN 40	DN 50	DN 50
	at 13 bar		DN 25	DN 25	DN 32	DN 32	DN 40	DN 50
	at 16 bar		DN 25	DN 25	DN 25	DN 32	DN 32	DN 40
• Q_{adjusted}								
	at 10 bar	kg/h	350	700	900	1200	1400	1800
	at 13 bar	kg/h	350	700	900	1200	1400	1800
	at 16 bar	kg/h	350	700	900	1200	1400	1800
• 2 shut-off valves								
	at 10 bar		DN 25	DN 32	DN 32	DN 40	DN 50	DN 50
	at 13 bar		DN 25	DN 25	DN 32	DN 32	DN 40	DN 50
	at 16 bar		DN 25	DN 25	DN 32	DN 32	DN 40	DN 50
• 1 strainer								
	at 10 bar		DN 25	DN 32	DN 32	DN 40	DN 50	DN 50
	at 13 bar		DN 25	DN 25	DN 32	DN 32	DN 40	DN 50
	at 16 bar		DN 25	DN 25	DN 32	DN 32	DN 40	DN 50
• 1 valve - floor heat-up								
	at 10 bar		DN 15	DN 15	DN 15	DN 25	DN 25	DN 25
	at 13 bar		DN 15	DN 15	DN 15	DN 15	DN 25	DN 25
	at 16 bar		DN 15	DN 15	DN 15	DN 15	DN 15	DN 25
• Q_{max}								
	at 10 bar	kg/h	403	403	403	857	857	857
	at 13 bar	kg/h	538	538	538	538	1142	1142
	at 16 bar	kg/h	672	672	672	672	672	1428
• 1 non-return valve								
	at 10 bar		DN 15	DN 15	DN 15	DN 25	DN 25	DN 25
	at 13 bar		DN 15	DN 15	DN 15	DN 15	DN 25	DN 25
	at 16 bar		DN 15	DN 15	DN 15	DN 15	DN 15	DN 25
• 1 safety valve 0.5 bar								
	at 10 bar		DN 50/80	DN 65/100	DN 65/100	DN 80/125	DN 80/125	DN 100/150
	at 13 bar		DN 50/80	DN 65/100	DN 65/100	DN 80/125	DN 80/125	DN 100/150
	at 16 bar		DN 80/125	DN 80/125	DN 80/125	DN 80/125	DN 80/125	DN 100/150
• Output necessary								
	at 10 bar	kg/h	753	1103	1303	2057	2257	2657
	at 13 bar	kg/h	888	1238	1438	1738	2542	2942
	at 16 bar	kg/h	1730	1730	1730	2352	2352	3228

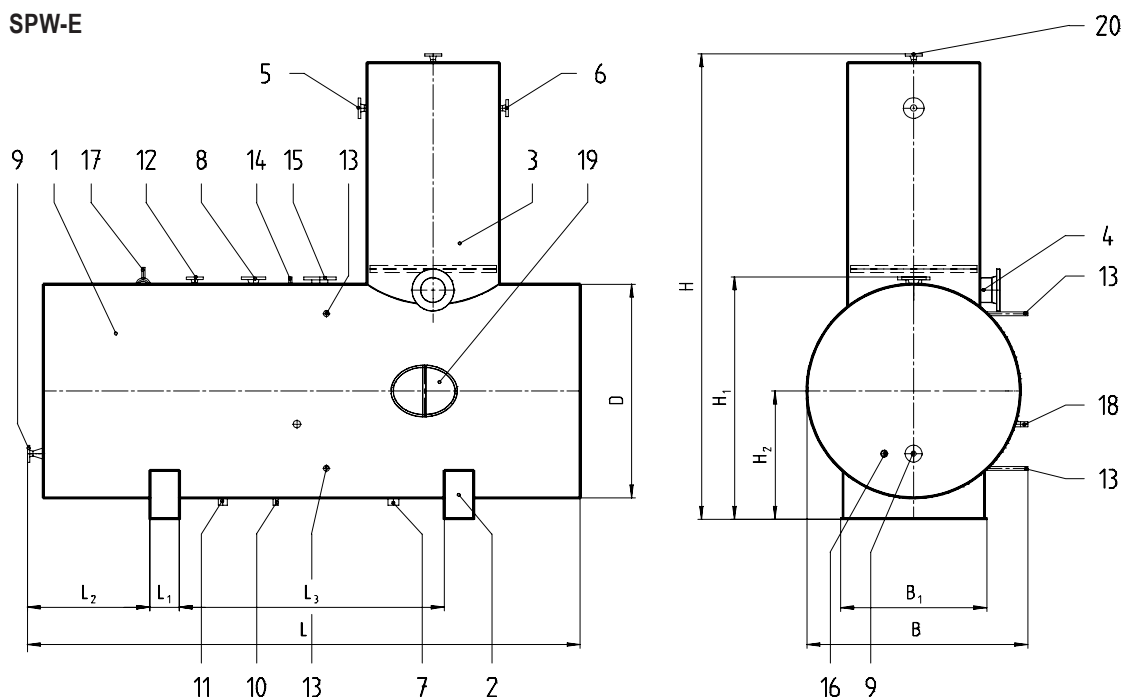
SPW-E (16000-30000)

Deaerator 0.5 bar - condensate 50 %

Heating steam group

Type			(16000)	(20000)	(25000)	(30000)
• Heating steam amount						
	at 10 bar	kg/h	2038	2604	3255	3906
	at 13 bar	kg/h	2038	2604	3255	3906
	at 16 bar	kg/h	2038	2604	3255	3906
• 1 steam pressure reducing valve (partially with range limiter)						
	at 10 bar		DN 65	DN 65	DN 80	DN 80
	at 13 bar		DN 50	DN 65	DN 65	DN 65
	at 16 bar		DN 50	DN 50	DN 65	DN 65
• Q_{adjusted}	at 10 bar	kg/h	2200	2800	3500	4100
	at 13 bar	kg/h	2200	2800	3500	4100
	at 16 bar	kg/h	2200	2800	3500	4100
• 2 shut-off valves	at 10 bar		DN 65	DN 65	DN 80	DN 80
	at 13 bar		DN 50	DN 65	DN 65	DN 65
	at 16 bar		DN 50	DN 65	DN 65	DN 65
• 1 strainer	at 10 bar		DN 65	DN 65	DN 80	DN 80
	at 13 bar		DN 50	DN 65	DN 65	DN 65
	at 16 bar		DN 50	DN 65	DN 65	DN 65
• 1 valve - floor heat-up	at 10 bar		DN 32	DN 32	DN 32	DN 32
	at 13 bar		DN 25	DN 32	DN 32	DN 32
	at 16 bar		DN 25	DN 25	DN 32	DN 32
• Q_{max}	at 10 bar	kg/h	1613	1613	1613	1613
	at 13 bar	kg/h	1142	2150	2150	2150
	at 16 bar	kg/h	1428	1428	2688	2688
• 1 non-return valve	at 10 bar		DN 32	DN 32	DN 32	DN 32
	at 13 bar		DN 25	DN 32	DN 32	DN 32
	at 16 bar		DN 25	DN 25	DN 32	DN 32
• 1 safety valve 0.5 bar	at 10 bar		DN 100/150	2xDN 100/150	2xDN 100/150	2xDN 100/150
	at 13 bar		DN 100/150	2xDN 100/150	2xDN 100/150	2xDN 100/150
	at 16 bar		DN 100/150	2xDN 100/150	2xDN 100/150	2xDN 100/150
• Output necessary	at 10 bar	kg/h	3813	4413	5113	5713
	at 13 bar	kg/h	3342	4950	5600	6250
	at 16 bar	kg/h	3628	4228	6188	6788

SPW-E



- | | | |
|----------------------------------|---------------------------------------|-------------------------------|
| 1 Feed water tank | 8 Safety valve socket | 15 Level control socket |
| 2 Tank base frame | 9 Steam floor heat up/Steam injection | 16 Thermostat |
| 3 Deaerator | 10 Drain | 17 Pressure gauge |
| 4 Deaerator heat up steam socket | 11 Over flow outlet | 18 Thermometer |
| 5 Condensate inlet | 12 Anti vacuum valve socket | 19 Inspection opening |
| 6 Regenerated water inlet | 13 Water level indicator | 20 Exhaust steam valve socket |
| 7 Boiler feed water connection | 14 Dosing connection | |

Tank content [litres]	Deaerator output [m³/h]	Main dimensions						Base frame			
		L	B	H	H ₁	H ₂	D	L ₁	L ₂	L ₃	B ₁
(3000)	3	2925	1450	3225	1725	870	1350	150	735	1800	900
(4000)	4	3325	1450	3225	1725	870	1350	150	735	2200	900
(5000)	5	3750	1600	3450	1870	870	1500	200	735	2600	1000
(6000)	6	4450	1600	3500	1870	870	1500	200	735	3000	1000
(8000)	8	5050	1800	3850	2100	1050	1700	200	1050	2450	1200
(10000)	10	5250	1800	3850	2100	1050	1700	200	1050	2650	1200
(12000)	12	5450	1800	3900	2100	1050	1700	300	1050	2850	1200
(16000)	16	5700	2200	4275	2470	1200	2100	300	735	3200	1400
(20000)	20	6150	2200	4275	2470	1200	2300	300	735	3750	1600
(25000)	25	5570	2650	4900	2870	1450	2600	500	735	3300	1900
(30000)	30	6250	2650	4900	2870	1450	2600	500	735	3980	1900

The total height in this data sheet refer to 50% condensate and 50 % fresh water.
For other deaerator outputs (relation condensate/fresh water) please see deaerator data sheet!

Operating pressure max. 0.5 bar (overpressure)

Dimensions incl. 50 mm insulation.

KDS

Condensate station KDS

The Hoval condensate station type KDS is made of stainless steel 1.4301. The pressureless tank with ventilation into the atmosphere is completely electrically welded and provided with all necessary sockets and tank supports.

Thermal insulation

The tank is completely insulated with mineral wool. The casing is made of structured aluminium plate. Fittings and out-cuts are properly rimmed.

Control panel

The control panel for the condensate station is equipped with all required control units and indicators for the control and supervision of the tank.

Armatures

The condensate station will be supplied with the following armatures:

- 1 water level indicator
- 1 thermometer
- 1 drainage valve

Regulation:

- 1 level electrode with switch amplifier or magnetic level indicator for condensate pump on/off
- 1 contact with low water cut-off
- 1 contact for over flow alarm



Delivery

The tank is completely insulated. Armatures and pumps are mounted up to a content of 3000 litres. Above 3000 litres the tank is insulated. Armatures and pumps are packed loosely in a separate box.

Condensate pump station:

- 2 condensate pumps
- 2 ball valve pumps (suction side)
- 2 strainers
- 2 ball valve pumps (pressure side)
- 2 non-return valves
- 1 pressure gauge set

KDS (500-3000)

Condensate tank

Type		(500)	(1000)	(1500)	(2000)	(2500)	(3000)
• Content	l	500	1000	1500	2000	2500	3000
• Construction		angular	angular	angular	round	round	round
• Material		1.4301	1.4301	1.4301	1.4301	1.4301	1.4301
• Wall thickness	mm	3	3	3	3	3	3
• Weight	kg	120	200	270	300	320	380
• Length without insulation without pump set	mm	920	1570	2020	1950	2350	2750
• Height without insulation	mm	1200	1200	1200	-	-	-
• Width without insulation	mm	500	700	700	-	-	-
• Diameter without insulation	mm	-	-	-	1250	1250	1250
• Length with insulation, without armat., with pump approx.	mm	1920	2520	2970	2750	3150	3650
• Length with insulation, without armat., without pump approx.	mm	-	-	-	-	-	-
• Height with insulation, without armatures	mm	1300	1300	1300	1725	1725	1725
• Width with insulation, without armatures	mm	600	800	800	1450	1450	1450

Fine armatures

Type		(500)	(1000)	(1500)	(2000)	(2500)	(3000)
• 1 fluid level indicator		R ½"	R ½"	R ½"	R ½"	R ½"	DN 20
• 1 thermometer		R ½"	R ½"	R ½"	R ½"	R ½"	R ½"
• 1 draining		R 1"	R 1"	R 1"	R 1"	R 1"	R 1"
• 1 two-step control		yes	yes	yes	yes	yes	yes
• 1 magnet cap indicator							yes

Condensate group

Type		(500)	(1000)	(1500)	(2000)	(2500)	(3000)
• Condensate pump output	m³/h	1	2	3	4	5	6
• 2 condensate pumps							
Grundfos 2 bar		CR	CR	CR	CR	CR	CR
Motor rating 2 bar		0.37	0.37	0.55	0.55	0.55	0.75
• 2 pump valves (pressure side)		DN 15	DN 20	DN 25	DN 25	DN 32	DN 32
• 2 non-return valves (pressure side)		DN 15	DN 20	DN 25	DN 25	DN 32	DN 32
• Pressure gauge with shut off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 ball valves (suction side)		R 1"	R 6/4"	R 2"	R 2"	R 2 ½"	R 3"
• 2 strainers (suction side)		R 1"	R 6/4"	R 2"	R 2"	R 2 ½"	R 3"

KDS (4000-10000)

Condensate tank

Type		(4000)	(5000)	(6000)	(8000)	(10000)
• Content	l	4000	5000	6000	8000	10000
• Construction		round	round	round	round	round
• Material		1.4301	1.4301	1.4301	1.4301	1.4301
• Wall thickness	mm	4	4	4	4	4
• Weight	kg	430	500	540	900	1000
• Length without insulation without pump set	mm	3150	3550	4250	4850	5050
• Height without insulation	mm	-	-	-	-	-
• Width without insulation	mm	-	-	-	-	-
• Diameter without insulation	mm	1250	1400	1400	1600	1600
• Length with insulation, without armat., with pump approx.	mm	-	-	-	-	-
• Length with insulation, without armat., without pump approx.	mm	3550	3650	4350	4950	5150
• Height with insulation, without armatures	mm	1725	1870	1870	2100	2100
• Width with insulation, without armatures	mm	1450	1600	1600	1800	1800

Fine armatures

Type		(4000)	(5000)	(6000)	(8000)	(10000)
• 1 fluid level indicator		DN 20	DN 20	DN 20	DN 20	DN 20
• 1 thermometer		R ½"	R ½"	R ½"	R ½"	R ½"
• 1 draining		R 2"	R 2"	R 2"	R 2"	R 2"
• 1 two-step control		yes	yes	yes	yes	yes
• 1 magnet cap indicator		yes	yes	yes	yes	yes

Condensate group

Type		(4000)	(5000)	(6000)	(8000)	(10000)
• Condensate pump output	m³/h	8	10	12	16	20
• 2 condensate pumps						
Grundfos 2 bar		CR	CR	CR	CR	CR
Motor rating 2 bar		1.10	1.10	2.20	2.20	3.00
• 2 pump valves (pressure side)		DN 40	DN 40	DN 50	DN 50	DN 65
• 2 non-return valves (pressure side)		DN 40	DN 40	DN 50	DN 50	DN 65
• Pressure gauge with shut off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 ball valves (suction side)		R 3"	R 3"	R 3"	DN 100	DN 125
• 2 strainers (suction side)		R 3"	R 3"	R 3"	DN 100	DN 125

KDS (12000-30000)

Condensate tank

Type		(12000)	(16000)	(20000)	(25000)	(30000)
• Content	l	12000	16000	20000	25000	30000
• Construction		round	round	round	round	round
• Material		1.4301	1.4301	1.4301	1.4301	1.4301
• Wall thickness	mm	4	5	5	5	5
• Weight	kg	1100	2000	2500	3000	3500
• Length without insulation without pump set	mm	5250	5500	5950	5400	6050
• Height without insulation	mm	-	-	-	-	-
• Width without insulation	mm	-	-	-	-	-
• Diameter without insulation	mm	1600	2000	2200	2500	2500
• Length with insulation, without armat., with pump approx.	mm	-	-	-	-	-
• Length with insulation, without armat., without pump approx.	mm	5350	5600	6050	5500	6150
• Height with insulation, without armatures	mm	2100	2470	2470	2870	2870
• Width with insulation, without armatures	mm	1800	2200	2200	2650	2650

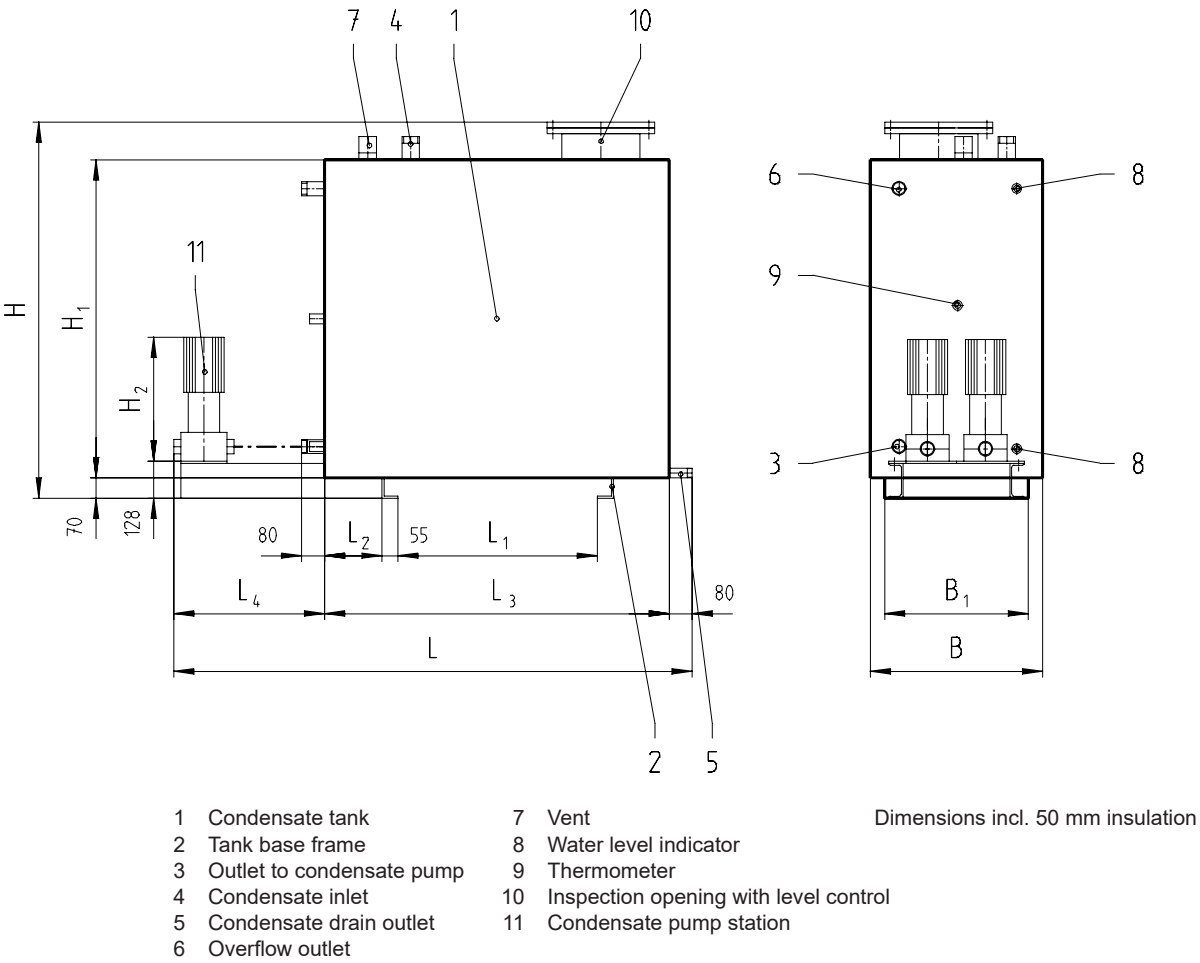
Fine armatures

Type		(12000)	(16000)	(20000)	(25000)	(30000)
• 1 fluid level indicator		DN 20	DN 20	DN 20	DN 20	DN 20
• 1 thermometer		R ½"	R ½"	R ½"	R ½"	R ½"
• 1 draining		R 2"	R 2"	R 2"	R 2"	R 2"
• 1 two-step control		yes	yes	yes	yes	yes
• 1 magnet cap indicator		yes	yes	yes	yes	yes

Condensate group

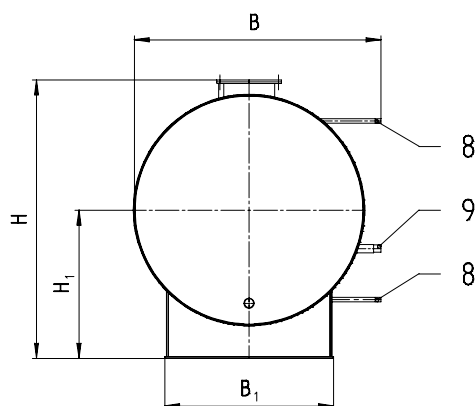
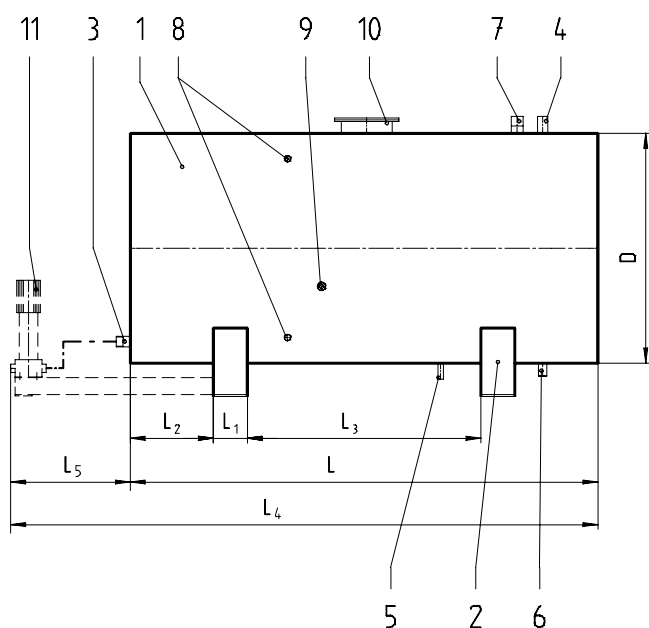
Type		(12000)	(16000)	(20000)	(25000)	(30000)
• Condensate pump output	m³/h	24	32	40	40	40
• 2 condensate pumps						
Grundfos 2 bar		CR	CR	CR	CR	CR
Motor rating 2 bar		3.00	5.50	5.50	5.50	5.50
• 2 pump valves (pressure side)		DN 65	DN 80	DN 100	DN 100	DN 100
• 2 non-return valves (pressure side)		DN 65	DN 80	DN 100	DN 100	DN 100
• Pressure gauge with shut off valve		R ¼"	R ¼"	R ¼"	R ¼"	R ¼"
• 2 ball valves (suction side)		DN 125	DN 150	DN 150	DN 150	DN 150
• 2 strainers (suction side)		DN 125	DN 150	DN 150	DN 150	DN 150

KDS 500 L - 1500 L, angular



Tank content [litres]	Main dimensions						Base frame			
	L	B	H	L ₃	L ₄	H ₁	H ₂	L ₁	L ₂	B ₁
(500)	1920	600	1300	1020	720	1100	427	700	195	500
(1000)	2520	800	1300	1670	770	1100	427	950	345	700
(1500)	2970	800	1300	2120	770	1100	427	1200	445	700

KDS 2000 L - 30000 L, round



- | | |
|-----------------------------|--|
| 1 Condensate tank | 7 Vent |
| 2 Tank base frame | 8 Water level indicator |
| 3 Outlet to condensate pump | 9 Thermometer |
| 4 Condensate inlet | 10 Inspection opening with level control |
| 5 Condensate drain outlet | 11 Condensate pump station |
| 6 Overflow outlet | |

Dimensions incl. 50 mm insulation

Tank content [litres]	Main dimensions							Base frame			
	L	B	H	L ₄	L ₅	H ₁	D	L ₁	L ₂	L ₃	B ₁
(2000)	2050	1450	1725	2750	700	870	1350	150	400	950	900
(2500)	2450	1450	1725	3150	700	870	1350	150	400	1350	900
(3000)	2850	1450	1725	3650	800	870	1350	150	400	1750	900
(4000)	3550	1450	1725	-	-	870	1350	200	475	2200	1000
(5000)	3650	1600	1870	-	-	870	1500	200	650	2600	1000
(6000)	4350	1600	1870	-	-	870	1500	200	650	3000	1000
(8000)	4950	1800	2100	-	-	1050	1700	200	950	2450	1200
(10000)	5150	1800	2100	-	-	1050	1700	200	950	2650	1200
(12000)	5350	1800	2100	-	-	1050	1700	300	950	2850	1200
(16000)	5600	2200	2470	-	-	1200	2100	300	650	3200	1400
(20000)	6050	2200	2470	-	-	1200	2300	300	650	3750	1600
(25000)	5500	2650	2870	-	-	1450	2600	500	650	3300	1900
(30000)	6150	2650	2870	-	-	1450	2600	500	650	3980	1900

1. General

- 1.1 The following Terms and Conditions shall apply to all our present and future contracts for deliveries and other services (even if the said Terms and Conditions are not specifically mentioned in verbal, telephonic or fax communications).
- 1.2 All deviations from the present Terms and Conditions, ancillary verbal agreements and subsequent contractual amendments shall only be valid if they have been confirmed by us in writing.
- 1.3 Buying terms and conditions of the client shall not be valid even if they are not specifically rejected by us. Our Standard Terms and Conditions of Delivery shall be regarded as accepted at the latest upon receipt of our goods and services by the client.
- 1.4 If a provision of the present Terms and Conditions of Delivery proves to be wholly or partially invalid, the contracting parties shall replace the aforesaid provision by a new provision which comes as close as possible to the legal and economic intention of the invalid provision.

2. Offers

- 2.1 Our offers shall be subject to change without notice.
- 2.2 Orders shall only be regarded as accepted when they have been confirmed by us in writing.
- 2.3 Illustrations, drawings and all technical details in catalogues and printed material shall be approximate values as customary within the industry. They shall only be binding if specific reference is made to them in the contract. We shall also reserve the right to make technical and design changes after the conclusion of the contract.
- 2.4 Cost estimates, drawings and other documents shall remain our property and shall be subject to copyright protection; they may not be made available to third parties.

3. Regulations in the country of destination

- 3.1 At the latest at the time of the order, the buyer shall draw our attention to the regulations and standards in force in the country of destination relating to the design of the delivered goods and the operation thereof and also to the execution of services.
- 3.2 Our deliveries and services shall comply with the regulations and standards in the country of destination provided the buyer has drawn our attention thereto in accordance with Section 3.1.
- 3.3 The buyer shall duly inform us of any special application features of goods ordered from us if these differ from our general recommendations.

4. Prices

- 4.1 Our prices shall be ex works, net, excluding packaging.
- 4.2 All ancillary costs, e.g. freight, insurance, export, transit, import and other approvals, licenses and authentications, shall be for the account of the buyer. The buyer shall also bear all taxes, charges, customs duty, etc., which are levied in connection with the contract.
- 4.3 We shall reserve the right to make price adjustments if wage rates or material prices change between the date of the order confirmation and the contractual performance of the contract. Price increases shall normally be notified three months in advance. We shall be bound to the price stated in the order confirmation for a period of three months after the effective date of the price increase.

5. Payment terms

- 5.1 Unless otherwise agreed in writing, our invoices shall be payable within thirty days with no cash discount. Payment shall be deemed to have been made when the amount in question is at our unrestricted disposal on our account in Swiss Franks.
- 5.2 Payment dates shall be observed even if any delays whatsoever occur after shipment of the goods from our works. The buyer shall not be permitted to reduce or withhold payments on account of complaints or counterclaims not recognised by us.
- 5.3 Payments shall also be made if insignificant components are missing but usage of the delivered goods is not rendered impossible as a result or if rectification work has to be carried out on the delivery. We shall be entitled to reject rectification of the defect as long as the buyer has not discharged his/its obligations to us.
- 5.4 If the buyer fails to comply with the agreed payment dates, default interest shall be paid from the agreed due date without a reminder being issued; the aforesaid interest shall be based on the interest rates prevailing at the domicile of the buyer, but shall be not less than four percent above the current discount rate of the Swiss Central Bank.
- 5.5 We shall be entitled to make deliveries of pending orders dependent upon settlement of outstanding claims.

6. Reservation of title

- 6.1 Delivered goods shall remain our property (reserved goods) pending full and complete payment of all present and future claims to which we are entitled regardless of their legal cause. This shall also apply if payments are made in settlement of specifically designated claims.
- 6.2 The buyer shall be entitled to process and sell reserved goods in the ordinary course of business.
- 6.3 If our reserved goods are combined or intermingled with other goods, the buyer shall hereby transfer his/its ownership rights in the new goods or chattels to us upon the conclusion of the contract in the amount of the invoice value of the reserved goods.
- 6.4 If the goods are resold by the buyer, he/it shall hereby transfer to us upon the conclusion of the contract with us his/its claims arising from the aforesaid resale in the amount of the invoice value of the reserved goods.
- 6.5 If the reserved goods are used by the buyer to perform a works or works delivery contract, his/its claim from the aforesaid works or works delivery contract shall hereby be assigned to us in the same amount and on the same date as for the purchase price claim (Section 6.4).
- 6.6 As long as he/it is honouring his/its payment obligations, the buyer shall, however, be authorised to collect his/its resale claim which has been assigned to us. He/it may not dispose of such claims by way of assignment to third parties, however. The empowerment of the buyer to collect the claim may be revoked by us at any time. We shall be entitled to notify third party debtors of the assignment. The buyer shall be entitled to provide us with the necessary information and documents in order to enable us to enforce our rights.
- 6.7 If the value of our securities exceeds our total claims by more than 10 %, we shall be obliged to release securities of our choice at the request of the buyer.
- 6.8 The buyer shall inform us immediately of any pledge or other impediment to our property enforced by third parties.
- 6.9 The buyer shall be obliged to collaborate in measures required to protect our title. He/it shall, in particular, empower us upon the conclusion of the contract to make entries or prior notice of the reservation of title at his/its cost in public registers, books and documents, etc., in accordance with the relevant national laws and shall perform all formalities in this respect.
- 6.10 The buyer shall maintain the reserved goods at his/its cost for the duration of the reservation of title and shall insure the said goods against theft, breakage, fire, water and other risks in our favour. He/it shall also take all steps to ensure that our property claims are neither adversely affected nor rescinded.

7. Delivery periods

- 7.1 Delivery periods and deadlines stated by us shall be approximate unless we have given an express written confirmation of a deadline as binding.
- 7.2 Delivery periods shall be deemed to have been met if notification of readiness to deliver has been sent to the buyer before the end of the delivery period.
- 7.3 The delivery period shall be prolonged if details required for the performance of the contract are not received on time or if they are subsequently changed by the buyer.
- 7.4 The delivery period shall also be reasonably prolonged if impediments arise which we cannot avert despite exercise of the necessary care (e.g. major operational disruptions, industrial disputes, delayed or defective deliveries, force majeure, etc.).
- 7.5 If an agreed delivery date is met by more than 14 days, the buyer shall be obliged to set us a reasonable period of grace. The buyer may only withdraw from the contract if our goods have not been delivered by the end of the said period of grace. Compensation claims for non-performance, delayed performance or any consequential losses shall be excluded unless there was gross negligence on our part.

8. Transfer of risk

- 8.1 Unless expressly agreed otherwise in writing, our "ex works" deliveries shall be made in accordance with the international rules on the interpretation of commercial clauses of the International Chamber of Commerce (Incoterms) in the version in force on the date of the order confirmation.
- 8.2 The transfer of risk shall be determined by the aforesaid Incoterms.
- 8.3 Insurance against damages of any kind shall be the responsibility of the buyer.

- 8.4 Complaints in connection with the transport shall be immediately notified by the buyer to the last carrier upon receipt of the delivery.
- 8.5 If despatch is delayed at the request of the buyer or for any other reasons not attributable to us, the risk shall pass to the buyer on the original date envisaged for the "ex works" delivery. We shall be entitled to demand payment from this date onwards.

9. Delivery inspection

- 9.1 The buyer shall be required to inspect deliveries immediately. If the goods do not comply with the order or the delivery note or if visible defects are identified, he/it shall be obliged to notify the aforesaid to us in writing within eight days of receipt. Later complaints shall not be recognised. (Re transport damages, cf. Section 8.4)

10. Assembly and operations

- 10.1 The assembly, putting into operation, operation and maintenance of the delivered goods shall be carried out in accordance with our guidelines. They may be executed by our staff or by appropriately trained third parties as agreed with the buyer.
- 10.2 If we require a commissioning certificate for certain product groups, warranty claims for the proper functioning of the equipment can only be enforced if a proper hand-over has been documented by a confirmed commissioning certificate received by us within one month of the hand-over.

11. Warranty

11.1 Warranty period

- 11.1.1 The general warranty period shall be 12 months from the first commissioning but no longer than 18 months from the date on which the relevant goods left our works.
If despatch is delayed for reasons not attributable to us, the warranty shall lapse no later than 18 months after notification of the readiness to deliver.

The general warranty period shall exclude electrical components for which the warranty period shall be 6 months from the first commissioning but no later than 12 months from the date of shipment from our works.

- 11.1.2 We refer to Section 11.6.1 with regard to the warranty period for third party products.

- 11.1.3 The warranty period for components which we have repaired during the warranty period or have delivered as replacement shall be 12 months from the completion of our repair or from the date of the replacement delivery but no longer than the end of a period equivalent to twice the original warranty period as per Section 11.1.1.

11.2 Liability for material, design and workmanship defects

- 11.2.1 The contractual condition of the goods shall be based on the condition upon the transfer of risk.
- 11.2.2 Defects shall be notified to us immediately in writing.
- 11.2.3 We shall be liable for all components which can be shown to have become defective or unusable before the end of the warranty period as a result of defective materials, defective design or defective workmanship, with such components being repaired or replaced ex works immediately at our choice.

11.3 Liability for warranted qualities

- 11.3.1 Warranted qualities shall only be those which are specifically designated as such in the order confirmation or in the relevant specifications.
- 11.3.2 The aforesaid assurance shall apply at the latest until the end of the warranty period. If a taking-over test has been agreed with the buyer, the assurance shall be deemed as performed if proof of the relevant qualities is furnished during the aforesaid test.
- 11.3.3 If the warranted qualities are not performed or only partially performed, the buyer shall be entitled to an immediate rectification. The buyer shall grant us the necessary time and opportunity for this purpose.
- 11.3.4 If the rectification is abortive or only partially successful, the buyer shall be entitled to a reasonable reduction of the purchase price. If the defect is so serious that it cannot be rectified within a reasonable period of time, and if deliveries or services for the notified purpose are not usable or are only usable to a much lesser extent, the buyer shall be entitled to refuse acceptance of the defective component or to withdraw from the contract if part-acceptance is economically unreasonable. We shall only be obliged to refund amounts which have been paid to us for the components affected by the aforesaid withdrawal.

11.4 Exclusion of liability for defects

- 11.4.1 Our liability shall exclude damages which cannot be proved to have been sustained as a result of defective material, defective design or defective workmanship.
- 11.4.2 Damages shall therefore be excluded for example which were caused by
- improper work of other persons with regard to planning, site preparation, assembly, operation and maintenance;
 - plant concepts and designs which do not comply with the latest state of the art;
 - non-observance of our guidelines for planning, assembly, commissioning, operations and maintenance;
 - force majeure (e.g. thunderstorms).
- 11.4.3 The following shall be excluded in particular
- corrosion damages (e.g. as a result of aggressive water, unsuitable water treatment, oxygen intakes, emptying the plant over a longer period of time, falling below the dew point, chemical or electrochemical effects, etc.);
 - damages caused by air pollution (e.g. the accumulation of intense dust, aggressive vapours, etc.);
 - damages caused by unsuitable equipment and fuels;
 - damages caused by overcharging, excessive water pressure, scaling, improper electrical connections and inadequate fuse protection.
- 11.4.4 Components shall also be excluded from the warranty which are subject to natural wear and tear (e.g. burner nozzles, combustion chamber inserts, ignition and monitoring components in contact with fire, fireclay and wall facings, fuses, seals and flexible tubes).
- 11.5 Commissioning certificate
- 11.5.1 We hereby draw attention to the due and proper hand-over and - if envisaged - the commissioning certificate in accordance with Section 10.2 as prerequisites for our warranty.
- 11.6 Deliveries and services of sub-contractors
- 11.6.1 Our liability for third party products which form a major part of the delivered goods (e.g. warehouse and conveying equipment, burners, measuring and control equipment, electrical components, flue gas and waste water cleaning equipment) shall - if permissible - be limited to an assignment of our claims against the suppliers of the said third party products.

12. Exclusion of further liability

- 12.1 The buyer shall have no rights and claims for materials, design and workmanship defects or the lack of warranted qualities unless specifically mentioned in Sections 11.1 to 11.6.
- 12.2 All claims for compensation, reduction in the contract price, rescission of the contract or withdrawal from the contract shall be excluded in particular unless these are specifically mentioned. Under no circumstances shall the buyer have any compensation claim for damages which were not sustained by the delivered goods themselves (e.g. replacement costs, cost for establishing the cause of the damage, expertises, production stoppages, production losses, lost orders, lost profit and other direct or indirect damages). The aforesaid liability exclusion shall not apply in the event of gross negligence on our part.
- 12.3 The exclusion as per Section 12.2 shall apply for all breaches of contract and all claims of the buyer regardless of why they were lodged from a legal point of view. It shall therefore also apply for a breach of any ancillary obligations (e.g. inadequate advice, etc.).

13. Jurisdiction

- 13.1 The place of jurisdiction for the buyer and for us shall be Vaduz. We shall be entitled to bring action against the buyer at his/its domicile, however.
- 13.2 The legal relationship between the parties shall be governed by the substantive laws of Switzerland. The application of the UN convention on contracts for the international sale of goods (CISG) shall be excluded.

Responsibility for energy and environment.