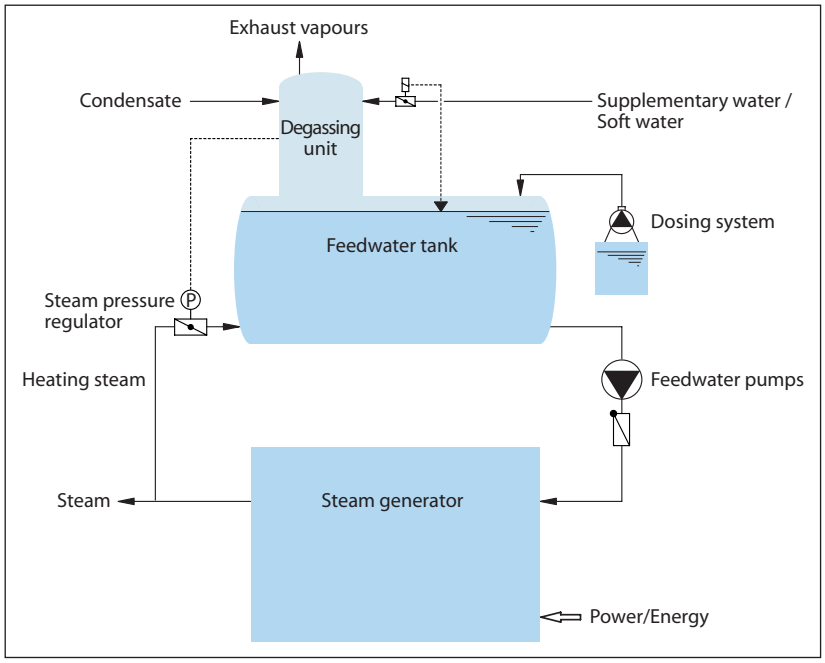
Pressure degassing systems

A degassing system consists of several components:

- **Degassing unit**
- **Feedwater tank**
- **Instrumentation and control technology**
- **Steel structures, platforms and ladders**



Feedwater treatment with thermal degassing

Degassing unit

The degassing unit (percolation degassing unit) is usually an upright, cylindrical vessel made of austenitic steel. An internal steam distribution system ensures direct contact of the heating steam with the medium to be degassed.

The feedwater, usually a mixture of condensate and supplementary water, is fed into the top section of the degassing unit via the respective connection nozzles. Even, fine distribution of the water over the entire width of the degassing unit occurs here via percolation with several percolation cups and, if necessary, other fittings. The water percolates downward in drops or fine jets, is caught by the percolation plates, redistributed and finally collected in the feedwater tank.

Steam flows against the water from all sides via the distribution system built into the degassing unit. The water heats to the boiling temperature very quickly as a result of the large surface created via percolation. The large surface benefits the outgassing of oxygen and free carbon dioxide. These gases are taken up and carried out by the steam flow and removed from the degassing unit at the exhaust vapour outlet in the top level of the degassing unit via the interior operating pressure. The fixtures are equipped with openings for guiding the steam.

The exhaust vapour quantity is limited at the exhaust vapour connection nozzle by a throttle mechanism (e.g. orifice, throttle valve).

The degassing unit is normally placed directly on the feedwater tank.

Feedwater tank

The feedwater tank is manufactured as a horizontal, cylindrical vessel, usually made of unalloyed and normally annealed steel.

Its main task is the storage of feedwater for supplying the boiler system. It also fulfils a series of tasks that are of decisive importance for the entire treatment and economical operation. It serves:

- to cover demand peaks for the boiler water supply,
- to compensate for varying quantities of condensate,
- to bridge disruptions or interruptions to the water supply,
- as a reaction vessel for supplementary chemicals,
- for acceptance or connection of control units, measuring devices and safety devices,
- Secondary deaeration for residual degassing.

The level of the feedwater tank must be such that a supply pressure to the boiler feed pumps is obtained that is sufficiently high for when the feedwater is boiling, thereby ensuring continuous cavitation-free operation. It is secured on bearing blocks or a suitable support structure.

Feedwater degassing must be protected against overpressure, underpressure and overfilling, and is also equipped with level, temperature and pressure indicators.

Constant boiling-up of the vessel contents achieves subsequent degassing in the feedwater tank. This further improves the water quality. The heating steam supply is need-based and occurs via a control unit.

Control of degassing system

If the heating steam has a higher pressure than the operating pressure, a steam pressure regulator must be installed in the steam supply line to the degassing unit. Control of the pressure regulator valve is normally pressure-dependent.

The required heating steam quantity depends on the quantities of additional water and condensate fed in and their temperature level. Regulation of the steam supply occurs automatically.

The degassing system must be set to an operating pressure exceeding the boiling point of the water at atmospheric pressure. This operating pressure (e.g. 0.2 bar overpressure) serves as the impulse for controlling the quantity of steam to be supplied.

To keep the water reserve in the feedwater tank as constant as possible, automatic supply control of the supplementary water occurs depending on the water level in the tank. The control unit is often connected directly to the feedwater tank.
To prevent sudden loads on the system and the supply network for water, steam, hot water and electricity, supply control must occur as smoothly as possible.

The level sensors, (floats, electrodes, floating switches and such like) must be set so that enough space remains between the set water level and the overflow of the tank so that condensate return peaks can be caught.
The resulting condensate (free of oil, hardness and other impurities) is fed back to the feedwater tank or degassing unit as evenly as possible.

Safety devices

The feedwater tank must be protected against overfilling and overpressure. A safety valve is used to prevent overpressure, and overflow regulation is used for overfilling.

Units carrying a possible risk of vacuum build-up due to the method of operation and construction must be protected by at least one vacuum breaker.

This is usually a check valve that is closed due to overpressure in the degassing unit or feedwater tank and opened upon the presence of a vacuum from the external overpressure. The vacuum is broken via the aeration of the tanks that results. The apparatus can also be made fully vacuum-tight to prevent denting.

Operation

In normal operation, clearly visible steam vapours can be seen to exit the exhaust vapour output of the degassing unit.

The exhaust vapour quantity (depending on the nominal load) is measured via the vapour throttle at the evaporation connection nozzle of the degassing unit in such a way that freed oxygen and carbon dioxide can be lead away to the outside air. Proper degassing is only ensured when the exhaust vapours can be released unhampered.

The degassing unit temperature and pressure must be monitored continuously.

Complete units – Design, manufacture and installation

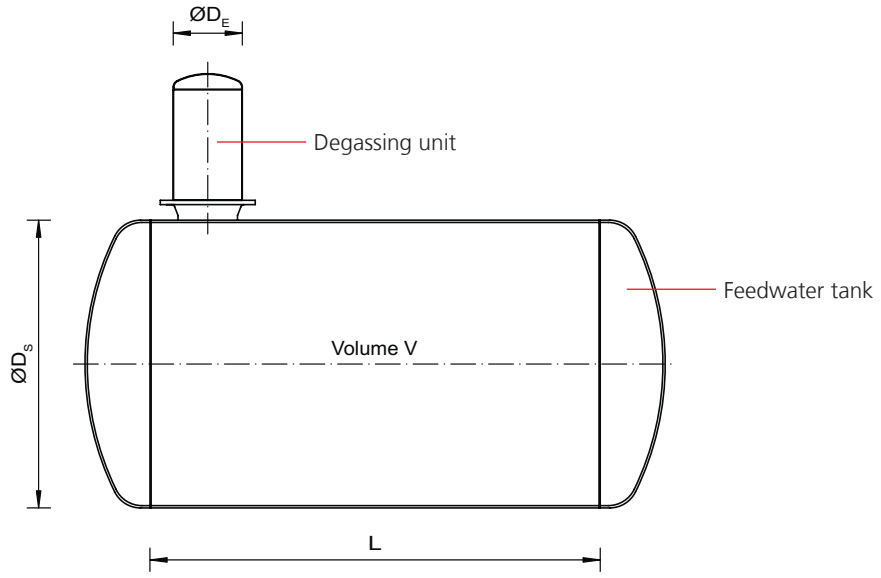
RWT GmbH dimension, manufacture and supply complete units for the treatment of boiler feedwater.

In addition to the main components, RWT GmbH also supplies all the fittings, regulators, safety equipment, dosing systems, sample coolers and examination cabinets, boiler water flash traps and condensate vessels required for operation and the necessary steel support structures, with platforms and ladders that comply with the relevant accident prevention regulations.
Only high-quality products from renowned manufacturers are used.

Performance units/standard units

Standard thermal degassing systems are complete performance units with components that are optimally matched to each other, each designed for the operating conditions described below.
The systems are dimensioned so that an operating period of 20 to 30 minutes remains without supplementary water inlet when the feedwater tank is full.

Standard sizes



Data

Degassing unit			Feedwater tank			
Type	**Diameter Ø D_E** [mm]	**Output range** [m³/h]	**Type**	**Diameter Ø D_S** [mm]	**Cylindrical length L** [mm]	**Volume** [m³]
TE1	300	2.1	**SWB1**	800	2000	1.1 *
TE1	300	2.1	**SWB2**	1000	2000	1.8
TE2	400	3.8	**SWB3**	1000	2500	2.2 *
TE2	400	3.8	**SWB4**	1250	2500	3.5
TE3	500	6.0	**SWB5**	1400	2500	4.4
TE3	500	6.0	**SWB6**	1250	4000	5.3
TE4	600	10.0	**SWB7**	1400	4000	6.7
TE4	600	10.0	**SWB8a**	1600	4000	8.8
TE5	700	11.0	**SWB8b**	1600	4000	8.8
TE6	800	13.0	**SWB8c**	1600	4000	8.8
TE6	800	13.0	**SWB9**	1600	5000	10.8
TE7	900	17.0	**SWB10**	1600	6000	12.8
TE8	1000	20.0	**SWB11**	1900	5000	15.5
TE8	1000	20.0	**SWB12**	1900	6000	18.2
TE9	1100	29.0	**SWB13**	1900	7000	21.0
TE10	1200	35.0	**SWB14**	2200	6000	25.0
TE10	1200	35.0	**SWB15**	2500	6000	32.0
TE11	1400	50.0	**SWB16a**	2500	8000	42.0
TE12	1600	60.0	**SWB16b**	2500	8000	42.0
TE13	1800	100.0	**SWB17**	2500	10000	52.0 *
TE13	1800	100.0	**SWB18**	3000	8000	62.0 *
TE14	2000	150.0	**SWB19**	3000	10000	75.0 *
TE14	2000	150.0	**SWB20**	3000	12000	89.0 *

* 20 min without supplementary water inlet

See next page for notes on configuration!

Operating conditions

The standard systems are designed for the following conditions:

- Feedwater: Approx. 105 °C and 0.2 bar overpressure
- Heating steam: Saturated steam with 180 °C and 9 bar overpressure
- Desalination rate: 3 %
- Exhaust vapour quantity: 0.3% of the rated output
- Condensate quantity: 50% of the rated output at 70 °C
- Supplementary water: 15 °C (43 % share of the mass balance)
- Max. operating overpressure: 0.5 bar
- Max. operating temperature: 110 °C

Different operating conditions require individual dimensioning (please enquire).

Connection nozzle and fitting dimensions

Heating steam

The heating steam (specific volume 1.43 m^3/kg) flows at 40 m/s into the feedwater tank.

Relief valve

Protection against overpressure is provided by a safety valve(s).

The safety valves are designed so that, with the given energy and mass balances, a safety reserve of
at least 40 % is guaranteed in the smaller systems and
at least 30 % of the heating steam requirement is guaranteed in the larger systems.

The response pressure of the relief valve is 0.5 bar (overpressure).

Negative pressure valve

The feedwater tanks are protected against impermissible negative pressures by vacuum breakers.

Connections

The nominal widths of the connections for overflow valves and suction lines to the feedwater pumps are dimensioned for a flow rate of < 1 m/s.

Manholes

Small tanks are manufactured with an oval 350 x 450 mm manhole.

Larger tanks are manufactured to factory standard with a round manhole without a swivel arm for the cover (see AD2000 data sheet 5 and appendices 1 + 2).

Boiler cradles

Boiler cradles are realised in accordance with DIN 28080.
Whereby:

- Form BV for diameter D_S = 800 to 1900 mm
- Form D for diameter D_S = 2200 to 3300 mm

Materials

S 235 JR+N, P 265 GH, stainless steel 321, stainless steel 316Ti or as selected

Approvals

Leak test with factory certification, manufactured pursuant to AD specifications and pressure equipment directive.
A configuration in accordance with DIN EN 13445 is also possible.

Components - degassing unit

The high-quality standard degassing units are manufactured using the inert gas welding process.

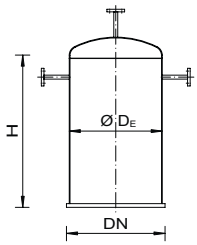
Design

The degassing units consist of:

- upper torispherical head
- also a lower torispherical head, depending on the size
- lower connecting flange
- special percolation fittings
- depending on the steam distribution configuration
- Connections for condensate, supplementary water, exhaust vapours, if applicable pulse (3/8"), Pressure gauge or pressure transducer (1/2")
- Connecting flanges:

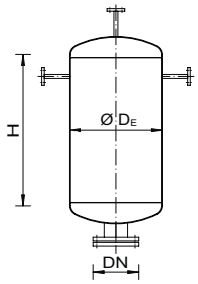
Type 1(TE1 to TE 6)	= Dome diameter
Type 2 (TE 7 and TE 8)	DN 500
Type 2 (TE 9 to TE 12)	DN 600

Degassing unit, Type 1



Type		TE1	TE2	TE3	TE4	TE5	TE6
Output	[m³/h]	0.7 - 2.1	1.2 - 3.8	2.0 - 6.0	2.8 - 10.0	3.9 - 11.0	5.0 - 13.0
Diameter Ø D_E	[mm]	323	400	500	600	700	800
Shell height H	[mm]	750	750	1000	1000	1250	1500
Total height	[mm]	995	1010	1280	1300	1570	1840
Empty weight	[kg]	85	120	175	225	290	480
Vessel connection	[DN]	300	400	500	600	700	800
Supplem.water/Condensate	[DN]	20	25	32	40	40	50
Exhaust vapours	[DN]	15	15	20	25	25	32
Exhaust surface	[m²]	0.87	1.10	1.82	2.24	3.24	4.41

Degassing unit, Type 2



Type		TE7	TE8	TE9	TE10	TE11	TE12
Output	[m³/h]	6.5 - 17.0	7.8 - 20.0	9.2 - 29.0	11.0 - 35.0	15.4 - 50.0	20.0 - 60.0
Diameter Ø D_E	[mm]	900	1000	1100	1200	1400	1600
Shell height H	[mm]	1750	2000	2000	2000	2000	2250
Total height	[mm]	2470	2765	2800	2840	2920	3270
Empty weight	[kg]	530	650	750	850	1200	1800
Vessel connection	[DN]	500	500	600	600	600	600
Supplem.water/Condensate	[DN]	50	65	65	80	100	100
Exhaust vapours	[DN]	32	32	40	50	65	65
Exhaust surface	[m²]	6.8	8.5	9.6	10.7	13.0	16.8

Type		TE13	TE14
Output	[m³/h]	25.0 - 100.0	31.4 - 150.0
Diameter Ø D_E	[mm]	1800	2000
Shell height H	[mm]	2500	2500
Total height	[mm]	3600	3680
Empty weight	[kg]	2200	2600
Vessel connection	[DN]	600	600
Supplem.water/Condensate	[DN]	125	150
Exhaust vapours	[DN]	80	100
Exhaust surface	[m²]	20.9	24.0

Operating and design data

Operating pressure	0.2 bar (overpressure)
operating temperature	105 °C
permissible working overpressure	0.5 bar (overpressure)
permissible operating temperature	110 °C

Corrosion protection

Tanks and fittings: pickled and passivated
Steel parts: primed

Materials

Jacket, head, stainless steel 321 insert
Tank surface made of S 235 JR+N plated

Accessories (optional)

- Stainless steel check valves and shutoff valves for supplementary water and condensate
- Stainless steel exhaust vapour baffle and exhaust vapour valve
- Manometer or pressure transducer, with pressure gauge tap pursuant to DIN and siphon
- Stainless steel supplementary water regulator valve
- Exhaust vapours condenser as tube bundle heat exchanger
  Advantages:
  - Most of the exhaust vapour heat reclaimed (low heating steam requirement)
  - Condensing of the exhaust vapours

Approvals

Leak test with factory certification,
manufactured pursuant to AD specifications and pressure equipment directive,
optionally:
- Designed pursuant to DIN EN 13445
- Acceptance certificate
- Non-destructive test

Special versions or non-standard versions possible on request.

Components - feedwater tanks

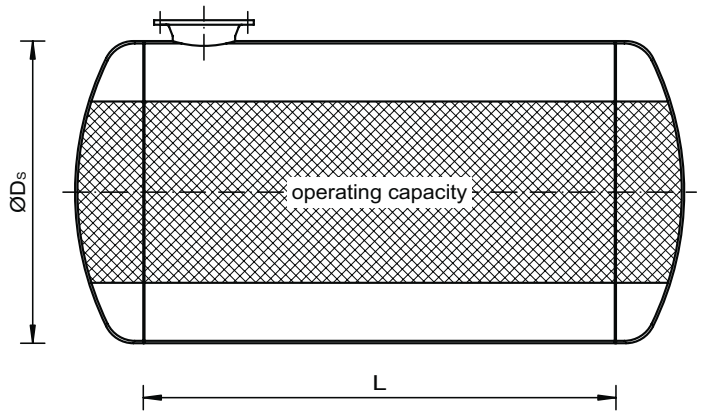
The high-quality horizontal standard feedwater tanks (max. 0.5 bar (overpressure), 100 °C) are manufactured using the inert gas welding process.

Structure

The feedwater tanks consist of:

- torispherical heads / tank bottoms convex on both sides
- cylindrical jacket with flange at top for degassing unit
- 2 boiler cradles at the bottom
- internal steam distribution system via a perforated distributor pipe at the bottom
  optional: via a distributor pipe at the top with lances
- Connections for steam infeed, safety valve, vacuum breaker, overflow, draining, outlet, feed water pump return, reserve, manhole, water level measurement, collars for dosing and thermometer (1/2“)

Design



Data

Typ		SWB1	SWB2	SWB3	SWB4	SWB5	SWB6
Gross volume	[m³]	1.10	1.77	2.16	3.46	4.41	5.27
Net volumen	[m³]	0.83	1.33	1.62	2.60	3.31	3.95
Diameter Ø D_S	[mm]	800	1000	1000	1250	1400	1250
Shell length L	[mm]	2000	2000	2500	2500	2500	4000
Total length	[mm]	2380	2460	2960	3050	3110	4530
Empy weight	[kg]	390	480	555	710	975	870
Operating weight	[t]	1.2	1.8	2.2	3.3	4.3	4.8
Degassing unit connection	[DN]	300	300	400	400	500	500
Steam entry	[DN]	50	50	65	65	80	80
Safety valve	[DN]	40	40	50	50	65	65
Vacuum breaker	[DN]	40	40	50	50	65	65
Overflow	[DN]	32	32	40	40	50	50
Draining	[DN]	25	25	25	25	32	32
Outlet	[DN]	32	32	40	40	50	50
Feedwater pump return	[DN]	25	25	25	25	25	25
Exterior surface	[m²]	6.3	8.3	9.8	12.9	18.8	14.9

Typ		SWB7	SWB8a	SWB8b	SWB8c	SWB9	SWB10
Gross volume	[m³]	6.68	8.82	8.82	8.82	10.8	12.8
Net volumen	[m³]	5.01	6.62	6.62	6.62	8.10	9.59
Diameter Ø D_S	[mm]	1400	1600	1600	1600	1600	1600
Shell length L	[mm]	4000	4000	4000	4000	5000	6000
Total length	[mm]	4610	4800	4800	4800	5800	6800
Empy weight	[kg]	1170	1605	1620	1655	1915	2160
Operating weight	[t]	6.2	8.2	8.2	8.3	10.0	11.8
Degassing unit connection	[DN]	600	600	700	800	800	500
Steam entry	[DN]	100	100	100	125	125	150
Safety valve	[DN]	80	80	80	100	100	100
Vacuum breaker	[DN]	100	100	125	125	125	150
Overflow	[DN]	65	65	65	65	65	80
Draining	[DN]	32	40	40	40	40	40
Outlet	[DN]	65	65	65	65	65	80
Feedwater pump return	[DN]	32	32	32	32	32	32
Exterior surface	[m²]	21.5	25.2	25.2	25.2	30.2	35.2

Typ		SWB11	SWB12	SWB13	SWB14	SWB15	SWB16a
Gross volume	[m³]	15.5	18.2	21.1	24.8	32.4	42.0
Net volumen	[m³]	11.6	13.7	15.8	18.6	24.3	31.5
Diameter Ø D_S	[mm]	1900	1900	1900	2200	2500	2500
Shell length L	[mm]	5000	6000	7000	6000	6000	8000
Total length	[mm]	5820	6820	7820	6950	7070	9070
Empy weight	[kg]	2890	3300	3815	4245	5965	7505
Operating weight	[t]	14.5	17.0	19.6	22.8	30.3	39.0
Degassing unit connection	[DN]	500	500	600	600	600	600
Steam entry	[DN]	150	150	200	200	200	250
Safety valve	[DN]	100	100	150	150	150	2 x 125
Vacuum breaker	[DN]	150	150	200	200	200	150
Overflow	[DN]	100	100	100	125	125	150
Draining	[DN]	50	50	65	65	80	80
Outlet	[DN]	100	100	100	125	125	150
Feedwater pump return	[DN]	40	40	40	40	40	50
Exterior surface	[m²]	37.0	43.0	48.9	51.1	59.5	75.2

Typ		SWB16b	SWB17	SWB18	SWB19	SWB20
Gross volume	[m³]	42.0	51.7	61.6	75.5	89.4
Net volumen	[m³]	31.5	38.8	46.2	56.6	67.0
Diameter Ø D_S	[mm]	2500	2500	3000	3000	3000
Shell length L	[mm]	8000	10000	8000	10000	12000
Total length	[mm]	9070	11070	9280	11280	13280
Empy weight	[kg]	7515	9180	10775	13610	15525
Operating weight	[t]	39.0	48.0	57.0	70.2	82.5
Degassing unit connection	[DN]	600	600	600	600	600
Steam entry	[DN]	250	350	350	450	450
Safety valve	[DN]	2 x 150	3 x 150	3 x 150	4 x 150	4 x 150
Vacuum breaker	[DN]	200	200	200	250	250
Overflow	[DN]	150	200	200	250	250
Draining	[DN]	80	80	100	100	100
Outlet	[DN]	150	200	200	250	250
Feedwater pump return	[DN]	50	80	80	80	80
Exterior surface	[m²]	75.2	90.9	93.2	112.1	130.9

Operating and design data	Operating pressure	0.2 bar (overpressure)
	operating temperature	105 °C
	permissible operating pressure	0.5 bar (overpressure)
	permissible operating temperature	110 °C

Corrosion protection	Inside:	None
	Outside:	First coat with rust primer

Materials
Standard S 235 JR+N plated
(optionally P 265 GH, 321, 316Ti)

Accessories (optional)
Thermometer, safety valve, vacuum breaker, overflow regulation, steam pressure regulator, level measurement, supply control, dosing system, sample cooler, control technology, steel structures, various shutoff valves

Approvals
Leak test with factory certification, manufactured pursuant to AD specifications and pressure equipment directive,
optionally:
- Designed pursuant to DIN EN 13445
- Acceptance certificate
- Non-destructive test

Special versions or non-standard versions possible on request.

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