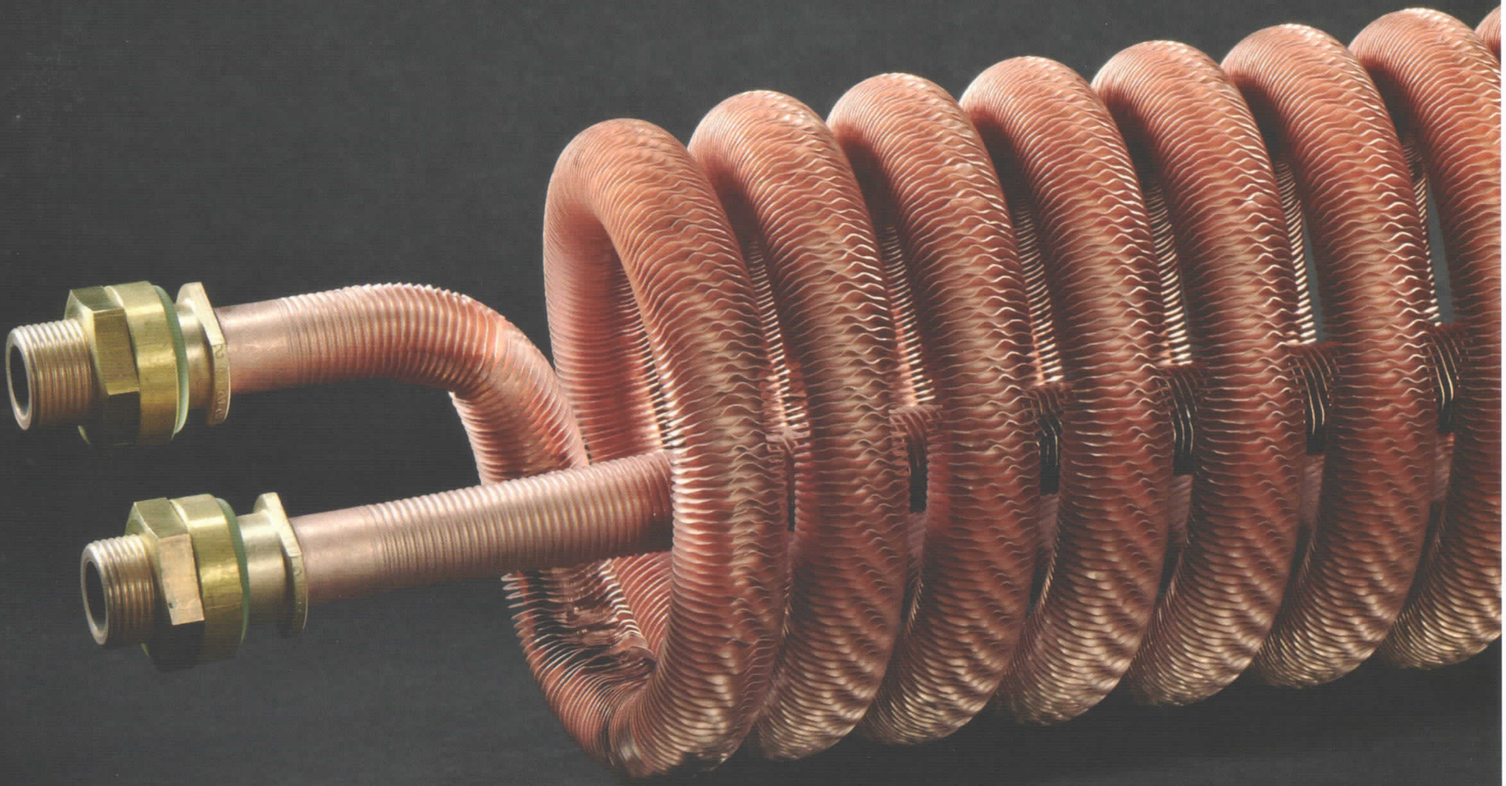
BW-Finned Tube Heating Coils

For hot water tanks



- → High thermal performance output from high-performance Trufin® W/H finned tubes made of copper
- → Low pressure drop on the inside of the tube
- → Outer surface is electroplated with tin to protect downstream galvanized steel pipes
- → On request fitted with electrically insulated connection fittings to protect enamel or plastic-coated hot water tanks
- → Available at short notice in two versions and various output capacities

SCHMÖLE

We change Energy.

The Product range

Finned tubes and heat exchangers

- rolled finned tubes
- laser welded finned tubes
- brazed finned tubes
- swirl tubes
- finned tube coils
- finned tube coils with fittings
- coaxial heat exchangers
- heat exchangers up to 150 kW
- special designs

Tube systems and surface heat exchangers

- tubes of various dimensions and profiles
- tube registers
- tube registers with connection fitting
- tube registers on carrier material
- modules with additional options
- modules with insulation
- space solutions

Quality Management System Certification

Our company has been certified by an independent authorized body as compliant with the Quality Standards ISO 9001:2008 and PED 97/23/EG.
An awareness of quality which has been passed on for decades has earned the company a worldwide reputation as a reliable supplier.

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We change Energy.

Highest Efficiency Meets Effectiveness.

BW Finned Tube Heating Coils are suitable for heating of hot water tanks using the following heating media:

heating water, remote heating water and heat transfer with glycol additives

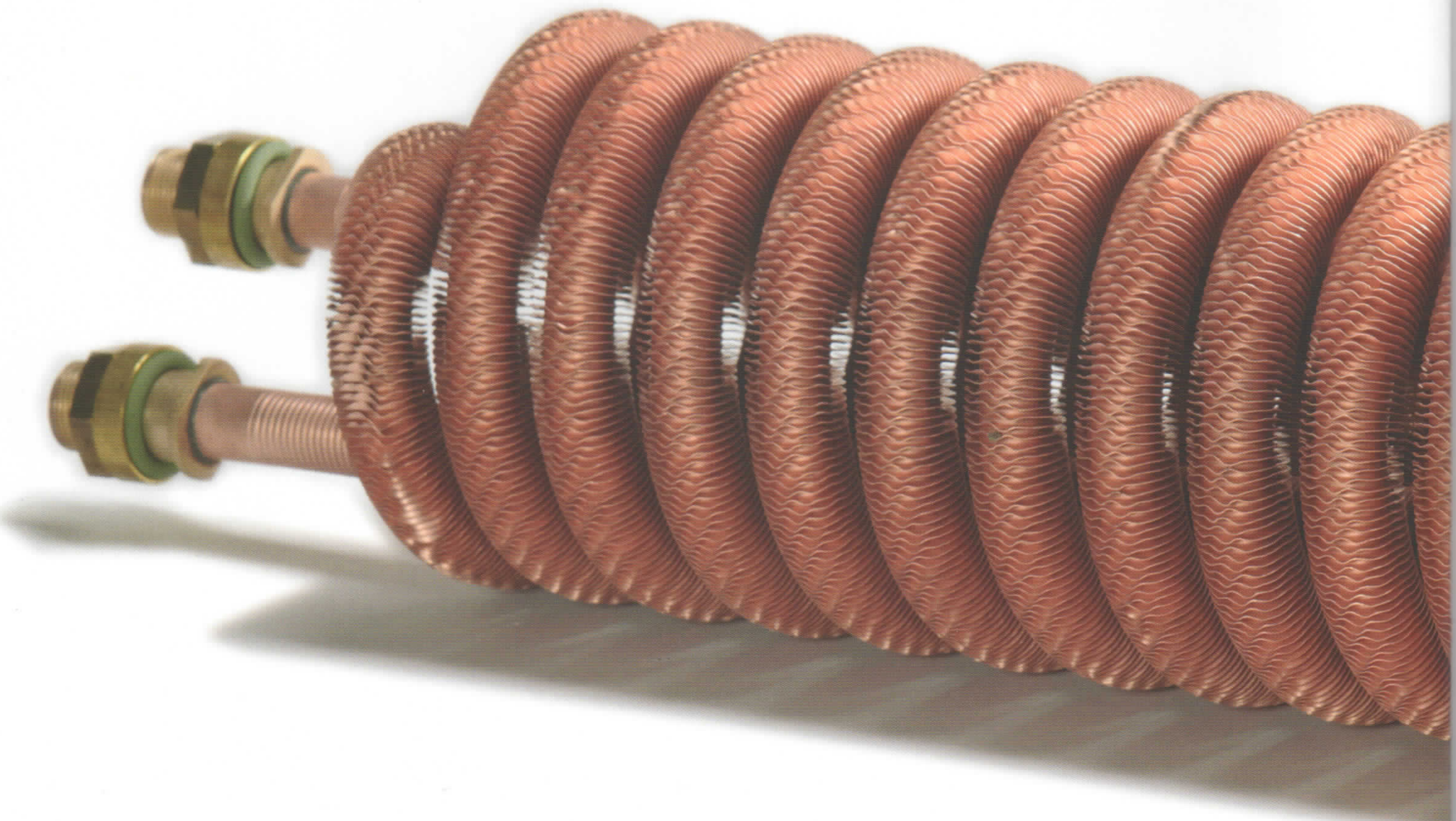
Materials and field of application

The following materials are used in BW Finned Tube Heating Coils:

Component	Material	Standard
Finned Tube*	Cu-DHP	DIN EN 12451
Connection fitting	CuZn39Pb3	DIN EN 12164
Washer	CuZn39Pb3	DIN EN 12164
Hex nut	CuZn39Pb3	DIN EN 12164
0-ring seal	FPM 70	
Solder	CP 102	DIN EN 1044

* tin-plated outer surface

Operating conditions	Permitted field of application
	O-ring material
	FPM 70
Pressure	≤ 10 bar
Temperature	≤ 150 °C



BW Finned Tube Heating Coils

for optimum heating of hot water tanks

Description

Ready-to-install BW Finned Tube Heating Coils for hot water tanks made from Trufin® W/H finned tubes are available in 13 output capacities.

Trufin®-W/H finned tubes are manufactured from seamless copper tubes using a rolling process.
Connection fittings are used for sealing and insulating BW Finned Tube Heating Coils to the flange plate or tank wall.

- ➔ All joints are brazed using silver solder. After brazing the outside of the BW Finned Tube Heating Coil is electroplated with tin.

- ➔ The compact design enables the high-performance BW Finned Tube Heating Coil to be positioned in the lower most part of the hot water tank.
- ➔ This ensures optimum heat absorption over the total volume of the hot water tank.
- ➔ This also achieves the most effective circulation of the tank water for optimum heat exchange.
- ➔ The BW Finned Tube Heating Coil is also characterized by the low pressure drop on the inside of the tube.

In general a circulating pump that circulates the heating medium between the heat source and the BW Finned Tube Heating Coil is required for heating the tank. The temperature of the water in the tank can be controlled by switching the circulating pump on and off.

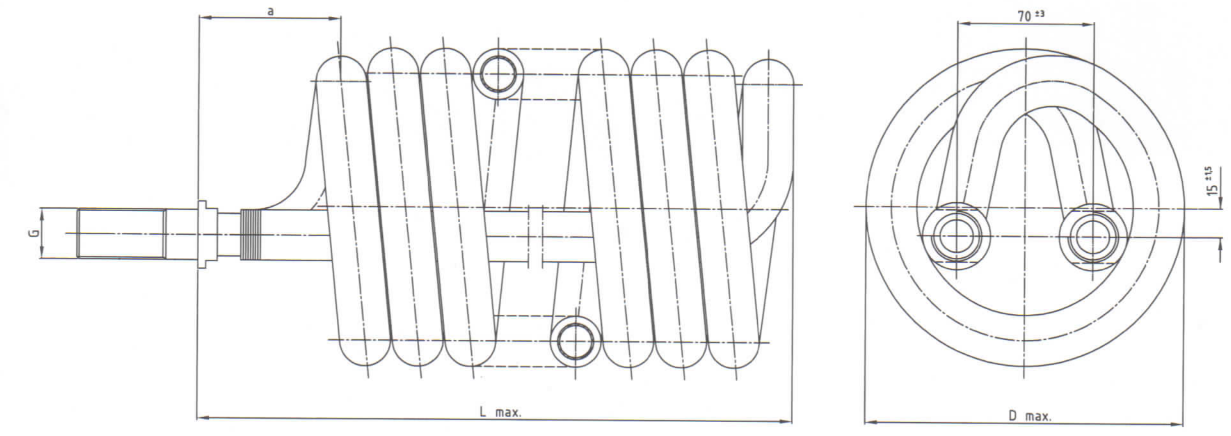
The dimensions and the standard output of BW Finned Tube Heating Coils are given in the figures and tables on pages 6 and 7.

Schmöle can also supply BW Finned Tube Heating Coils for economic lot sizes in forms and dimensions according to your requirements. This also applies to the installation of flange plates which can be supplied free-issue by the customer or supplied by Schmöle.

Schmöle SBW Finned Tube Instantaneous Water Heaters for domestic water heating in boilers and storage tanks can be supplied from stock (see brochure 864).

Single Coil BW Finned Tube Heating Coils

with E 16 to E 22 type connection fittings



Finned Heating Coils	BW-10-1	BW13-1	BW-18-1	BW-23-1	BW-26-1
Fitting	E 16	E 18	E 22	E 22	E22
Standard output[1)] $\dot{Q}_a$ kW / $\dot{Q}_e$ kW	22 / 6	27 / 9	38 / 12	49 / 15	55 / 15
Continuous output[2)] $\dot{Q}_d$ kW	17	21	33	39	41
Heating time t min	80	65	40	35	30
Heating water-flow rate $\dot{V}_W$ m³/h	0,56	0,73	1,38	1,38	1,38
Schmöle code-no. Trufin® W/H	35-11 12 100	35-11 14 100	37-11 18 100	37-11 18 100	37-11 18 100
Finned tube length mm	5.100	5.730	6.230	8.020	8.930
Internal cross-section q_i cm²	0,87	1,23	2,13	2,13	2,13
External surface area A m²	1,0	1,2	1,8	2,3	2,5
Instal. dimensions mm a / D / L	40 / 140 / 350	50 / 147 / 410	60 / 170 / 440	60 / 170 / 540	60 / 170 / 595
Approx. weight G_{Cu} kg	3,5	4,6	6,3	8,1	9,0

1) Standard output $\dot{Q}_a$ at the beginning of the heating time
$\dot{Q}_e$ at the end of the heating time

Based on the following operating data:

- → Heating water inlet temperature ϑ_e = 60 °C
- → Storage water temperature
  - at the beginning of the heating time ϑ_{sa} = 10°C
  - at the end of the heating time ϑ_{se} = 45 °C
- → Storage content V_s = 0,3 m³

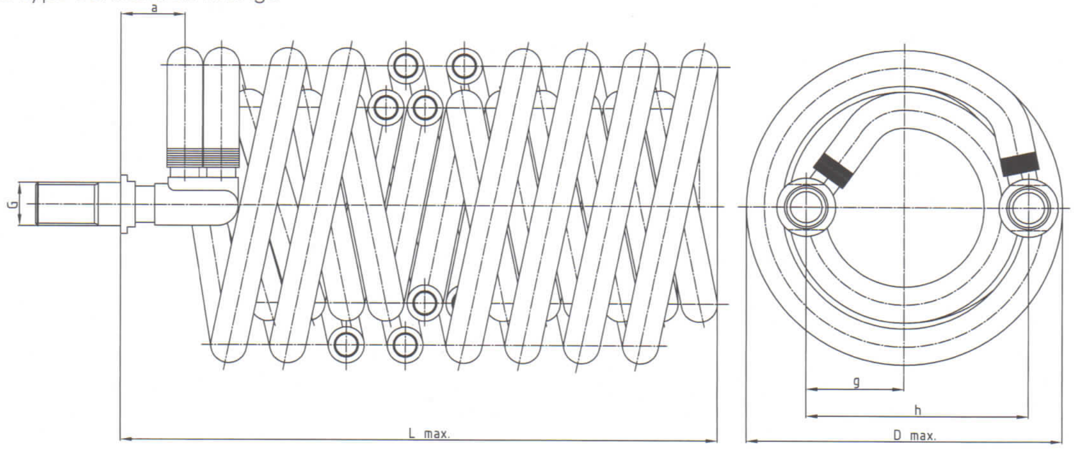
2) Continuous output $\dot{Q}_d$ acc. DIN 4708

Based on the following operating data:

- → Heating water inlet temperature ϑ_e = 80 °C
- → Domestic water inlet temperature ϑ_{we} = 10 °C
- → Domestic water outlet temperature ϑ_{wa} = 45 °C

Double Coil BW Finned Tube Heating Coils

with E 28 type connection fittings



Finned Tube Heating Coils	2 Coils (small Ø)				2 Coils (large Ø)			
	BW-26-2	BW-31-2	BW-36-2	BW-45-2	BW-36-5	BW-45-5	BW-50-5	BW-70-5
Standard output[1] $\dot{Q}_a$ kW / $\dot{Q}_e$ kW	47 / 15	58 / 18	74 / 24	88 / 30	74 / 24	88 / 30	110 / 32	155 / 42
Continuous output[2] $\dot{Q}_d$ kW	40	48	58	72	58	72	79	114
Heating time t min	28	23	20	17	20	17	16	13
Schmöle code no. Trufin® W/H	35-11 18 100	35-11 18 100	37-11 18 100	37-11 18 100	37-11 18 100	37-11 18 100	37-11 18 100	35-11 18 100
Finned tube length mm	9.300	11.000	13.300	16.880	13.300	16.880	18.700	26.100
Internal cross-section q_i cm²	4,26	4,26	4,26	4,26	4,26	4,26	4,26	4,26
External surface area A m²	2,5	3,0	3,6	4,5	3,6	4,5	5,0	7,0
Instal. dimensions mm a / g / h D / L	48 / 45 / 110 175 / 510	48 / 45 / 110 175 / 540	48 / 45 / 110 175 / 650	48 / 45 / 110 175 / 790	48 / 75 / 170 245 / 400	48 / 75 / 170 245 / 510	48 / 75 / 170 245 / 560	48 / 75 / 170 245 / 750
Approx. weight G_{Cu} kg	9,8	11,5	13,9	17,3	13,9	17,3	19,1	26,0

[1] Standard output $\dot{Q}_a$ at the beginning of the heating time
$\dot{Q}_e$ at the end of the heating time

Based on the following operating data:

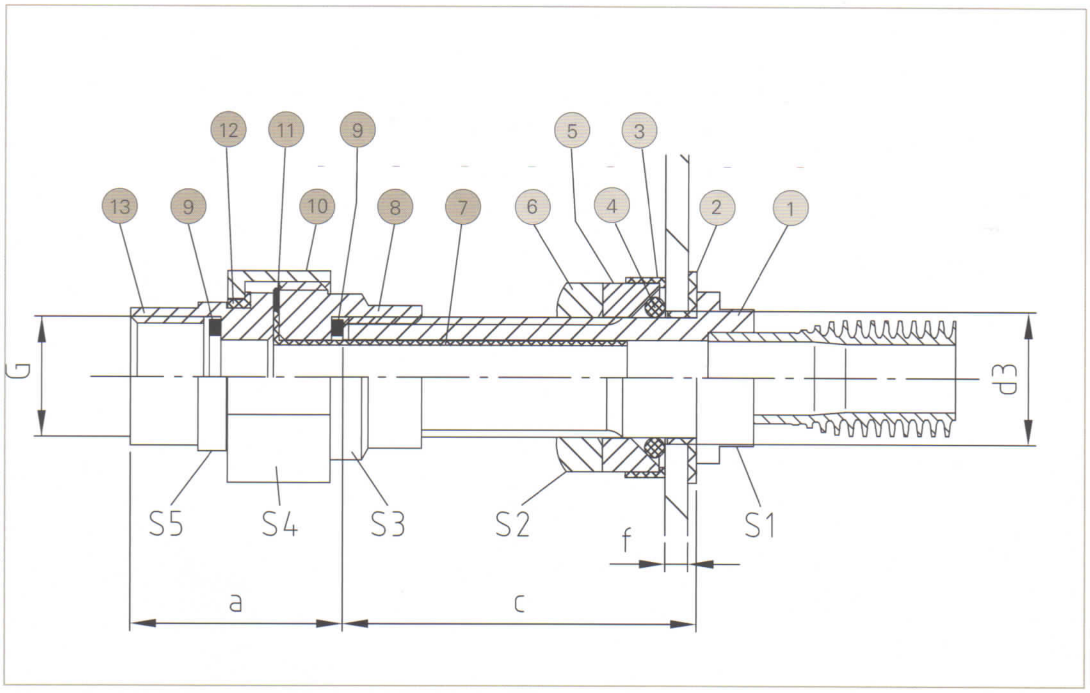
- ➔ Heating water flow rate $\dot{V}_w$ = 60 °C
- ➔ Heating water inlet temperature $\dot{\vartheta}_e$ = 60 °C
- ➔ Storage water temperature
  - at the beginning of the heating time ϑ_{sa} = 10 °C
  - at the end of the heating time ϑ_{se} = 45 °C
- ➔ Storage content V_s = 0,3 m³

[2] Continuous output $\dot{Q}_d$ acc. DIN 4708

Based on the following operating data:

- ➔ Heating water inlet temperature ϑ_e = 80 °C
- ➔ Domestic water inlet temperature ϑ_{we} = 10 °C
- ➔ Domestic water outlet temperature ϑ_{wa} = 45 °C

Electrically insulated connection fittings for BW Finned Tube Heating Coils



Flange mounted heat exchanger

① Connection fitting
② Insulating sleeve
③ Insulating ring
④ O-ring
⑤ Recessed washer
⑥ Nut

Other pre-fitted insulation

⑦ Insulation
⑧ Screw-in section
⑨ Sealing ring
⑩ Cap nut
⑪ Gasket seal
⑫ Spacer
⑬ Union end

Type fittings		E 16	E 18	E 22	E 28
Connection fitting (1)					
- Spanner size mm	S_1	24	27	27	36
- Fitting length mm	c	62	62	62	65
Screw-in section (1)					
- Thread	G	G ½	G ¾	G ¾	G 1
- Length mm	a	35	38	38	41
Spanner size mm					
- Hex nut (4)	S_2	30	36	36	46
- Union cut (7)	S_3	24	30	30	38
- Cap nut (10)	S_4	37	46	46	53
- Screw-in section (11)	S_5	26	30	30	38
Flange					
- perm. thickness, mm	f	4 – 8	8 – 12	8 – 12	8 – 12
- Bore diameter, mm	$d_3 + 0,2$	23,8	29,5	29,5	36,5

Sealing with an o-ring (4) and washer (5) on the inside is recommended from a flange thickness of 8 to 12 mm. A spacer must be fitted in front of the hex nut for flange thicknesses smaller than those given in the table.

BW Finned Tube Heating Coils require the use of two insulating sets.

Electrically insulated connection fittings

Enamelled or plastic-coated hot water tanks made of steel usually have magnesium or impressed current anodes fitted in order to protect the base metal from corrosion in insufficiently coated areas.
This cathodic corrosion protection can be put at risk by the installation of a non-insulated heating coil made of copper. In this case the anodes are consumed in a relatively short time.

Any defective areas form a galvanic cell with the noble material of the heating coils, which can result in the rapid consumption of the base metal in the defective area.

The electrically insulated connection fittings developed by Schmöle prevent the formation of a galvanic cell and therefore make an essential contribution to corrosion protection in coated steel hot water tanks.

Schmöle insulating glands isolate the heating coils from both the tank wall and the metallic connection fittings and thereby comply with the requirements of the DVGW Worksheet W511.

The design and dimensioning of the connection fittings are given in the *figure on page 8*. They consist of:

- ➔ Connection fitting (1) with elongated shank and round collar for completely uniform pressure
- ➔ insulating sleeve (2) and the insulating ring (3) which electrically isolate the connection fitting from the tank flange
- ➔ 5 mm thick O-ring seal (4)
- ➔ Recessed washer (5) for housing the O-ring seal
- ➔ Hex nut (6)
- ➔ Union end (13), spacer (12) and seal (11), which electrically isolates the cable from the connection fitting
- ➔ Cap nut (10) and screw-in section (8)

Thermal Design

When calculating the heat capacity of the BW Finned Tube Heating Coil it should be noted that both the heat transfer coefficient k and the mean logarithmic temperature difference $\Delta\vartheta_m$ change over the heating time. Here the influence of the actual temperature of the water in the tank and the inlet temperature of the heating water is significant.

***Diagrams 1 to 11* are based on the following operating data and can be used to perform satisfactorily accurate calculations:**

➔ Heating medium	=	water
➔ Heating medium flow rate velocity	v =	1.8 m/s
➔ Tank content	Vs	= 0.3 m^3
➔ Tank water temperature at the beginning of the heating time	ϑ_{sa} =	10°C

In the diagrams given the stored water temperature ϑ_s and the thermal output $\dot{Q}$ of the BW Finned Tube Heating Coil is shown as a function of the heating time t with the inlet temperature ϑ_e as the parameter.

For example, if a tank water temperature of ϑ_{se} = 55 °C is desired at the end of a heating time and the heating water inlet temperature ϑ_e = 70 °C, then, as shown in diagram 1, the heating time will be t = 80 minutes.

If the tank water temperature at the beginning of the heating time ϑ_{sa} = 25 °C, then the heating time is reduced by approximately 16 minutes.

In this case the thermal capacity of the BW Finned Tube Heating Coil BW-10-1 at the beginning of the heating time is $\dot{Q}_a$ = 21 kW, and the end of the heating time it is $\dot{Q}_e$ = 8 kW.

The average thermal capacity of the BW Finned Tube Heating Coil $\dot{Q}_m$ can be approximated with the aid of the following correlation.

$\dot{Q}_m = \sqrt{\dot{Q}_a \cdot \dot{Q}_e}$	[kW]	(1)

The heating water outlet temperature ϑ_a is given by the equation

$\vartheta_a = \vartheta_e - \dfrac{\dot{Q} \cdot 3.600}{\dot{V}_w \cdot \rho_w \cdot c_p}$	[°C]	(2)

The heating water flow rate $\dot{V}_w$ is calculated using the equation

$\dot{V}_w = v \cdot q_i \cdot 0{,}36$	[m³/h]	(3a)

or the flow rate velocity of the heating water v using the equation

$v = \dfrac{\dot{V}_w}{q_i \cdot 0{,}36}$	[m/s]	(3b)

If the heating water flow rate velocity deviates from the assumed v = 1.8 m / s and if the content of the tank to be heated is not V_s = 0,3 m³, then the heating time t_{eff} can be calculated using the following equations:

$t_{eff} = t \cdot \dfrac{V_s}{0{,}300} \cdot \dfrac{1}{f}$	[min]	(4a)
$\dot{Q}_{eff} = \dot{Q} \cdot f$	[m/s]	(4b)

The correction factors f as a function of the heating water flow rate velocity v can be taken from the following table.

Correction factor f for deviating heating water flow rate velocities v								
v	m/s	1,7	1,5	1,3	1,1	0,9	0,7	0,5
f	-	0,98	0,94	0,90	0,85	0,78	0,70	0,55

These factors represent average values for all BW Finned Tube Heating Coils.
This results in slight differences compared with an exact computer analysis.

Continuous output

The continuous output $\dot{Q}_d$ of BW Finned Tube Heating Coils according to DIN 4708, which is defined as the output resulting after prolonged water removal from the tank at a constant tap temperature of 45 °C, can be taken from *Diagrams 1 to 11* for a tank water temperature of ϑ_s = 45 °C and a heating water inlet temperature of ϑ_e.

Pressure loss

The pressure loss Δp_w, for BW Finned Tube Heating Coils depending on the heating water flow rate $\dot{V}_w$ can be taken from *Diagram 12.*

As common heating circulation pumps can overcome a discharge head of up to 0.45 bar, the pressure loss in the heating coils should be limited to 0.2 to 0.25 bar.

Corrosion protection in mixed installations

If copper comes into contact with water copper ions are released into the water.

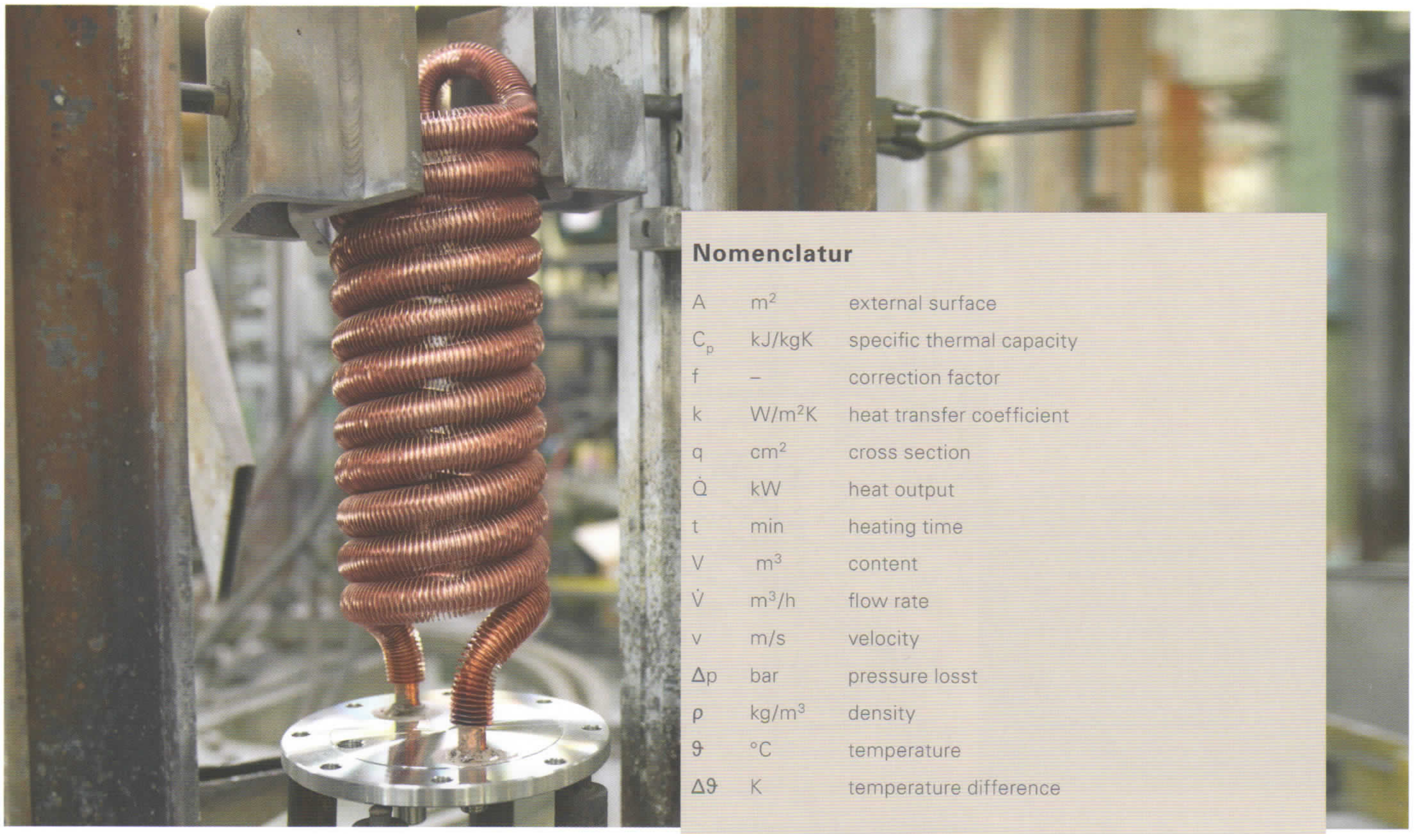
The copper tubes are not at risk because after a short time a thick adherent surface layer is formed.

However, in downstream galvanized steel pipes the copper ions released into the water can quickly lead to corrosion damage.

To avoid the corrosion problems associated with mixed installations the outer surface of BW Finned Tube Heating Coils are electroplated with tin.

Pressure testing

BW Finned Tube Heating Coils are pressure tested under water with gas at a pressure of 20 bar to ensure tightness.



Nomenclatur

A	m^2	external surface
C_p	kJ/kgK	specific thermal capacity
f	–	correction factor
k	W/m^2K	heat transfer coefficient
q	cm^2	cross section
$\dot{Q}$	kW	heat output
t	min	heating time
V	m^3	content
$\dot{V}$	m^3/h	flow rate
v	m/s	velocity
Δp	bar	pressure losst
ρ	kg/m^3	density
ϑ	°C	temperature
$\Delta\vartheta$	K	temperature difference

Indices

a	start; outlet
d	continuous output
e	end; inlet
eff	effective
i	interior
m	medium
s	tank
w	heating water; domestic water

Installation instructions

BW Finned Tube Heating Coils can be installed in the hot water tank either horizontally or vertically.

To prevent damage during transport and when the hot water tank is in service it is recommended that the BW Finned Tube Heating Coil is supported in the hot water tank.

All plastic parts on the connection fitting are suitable for continuous temperatures of 110°C.

It should be noted that changes in connection line length due to temperature fluctuations must be compensated for with expansion elements or suitable line guides.

Please request any brochures that are of interest:

- → SBW Finned Tube Instantaneous Heater for Boilers and Storage Tanks: No. 864 e
- → RW tube bundle heat exchangers for the heating industry: No. 868
- → Calcification of heat exchangers in domestic water storage tanks: No. 863
- → Finned Tubes (overview brochure): No. 820 e
- → Heat Exchangers (overview brochure): No. 850 e

This project description is based on our own studies and relevant literature.
The description was complied with due diligence.
Regardless of the information given herein the suitability of the product should be tested under the actual operating conditions.
This particularly applies to the suitability of the chosen material for the intended application.
The standards and regulations pertinent to the operation of heat exchangers must be taken into account.
We reserve the right to make modifications, particularly if they improve the quality of the product, increase the efficiency and performance or streamline manufacture.

We will gladly provide you with any advice and consultation you may require.

Schmöle GmbH

Diagram 1

Output of Finned Tube Heating Coils

Heating coil type	BW-10-1
Tank content	Vs = 0.3 m³
Heating medium	water
Velocity	v = 1.8m/s

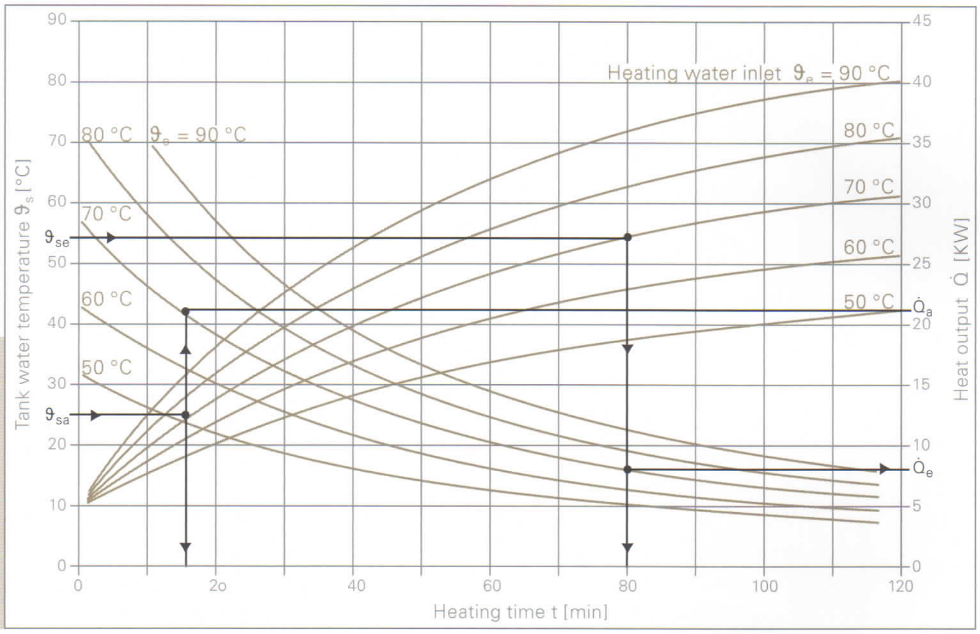


Diagram 2

Output of Finned Tube Heating Coils

Heating coil type	BW-13-1
Tank content	Vs = 0.3 m³
Heating medium	water
Velocity	v = 1.8m/s

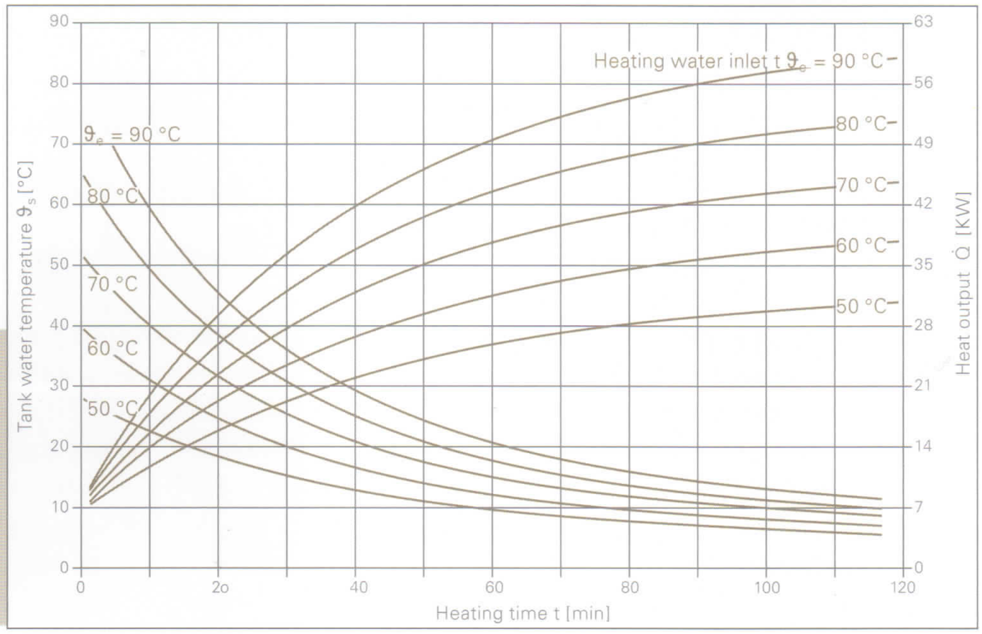
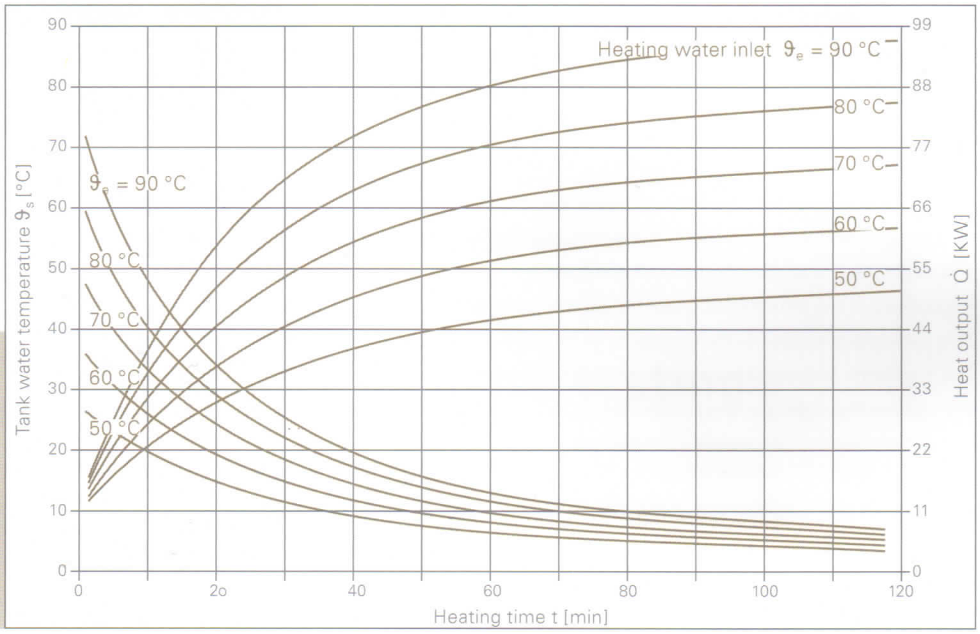


Diagram 3

Output of Finned Tube Heating Coils

Heating coil type	BW-18-1
Tank content	Vs = 0.3 m³
Heating medium	water
Velocity	v = 1.8m/s



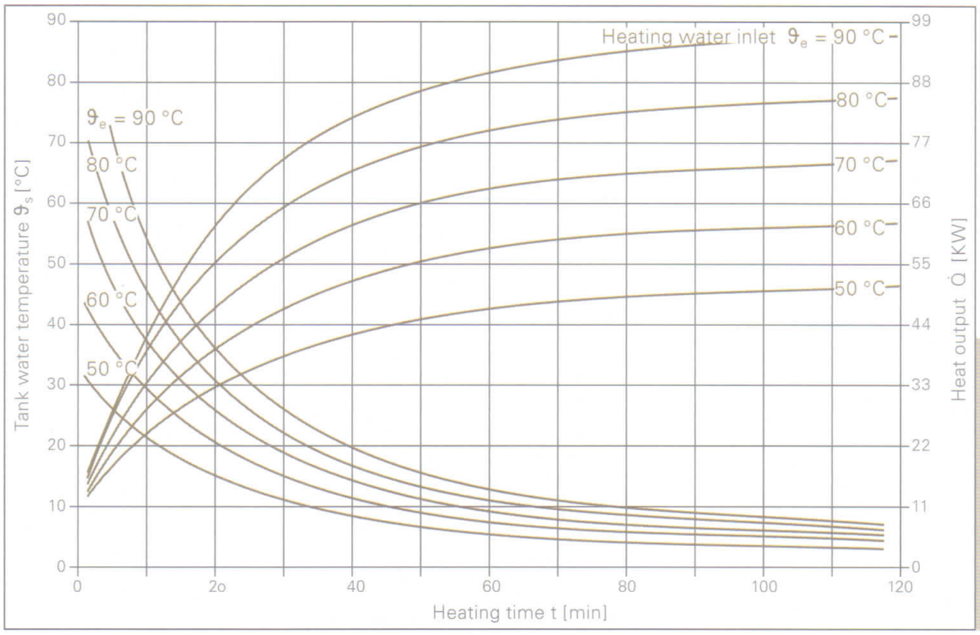


Diagram 4

Output of Finned Tube Heating Coils

Heating coil type	BW-23-1
Tank content	Vs = 0.3 m^3
Heating medium	water
Velocity	v = 1.8m/s

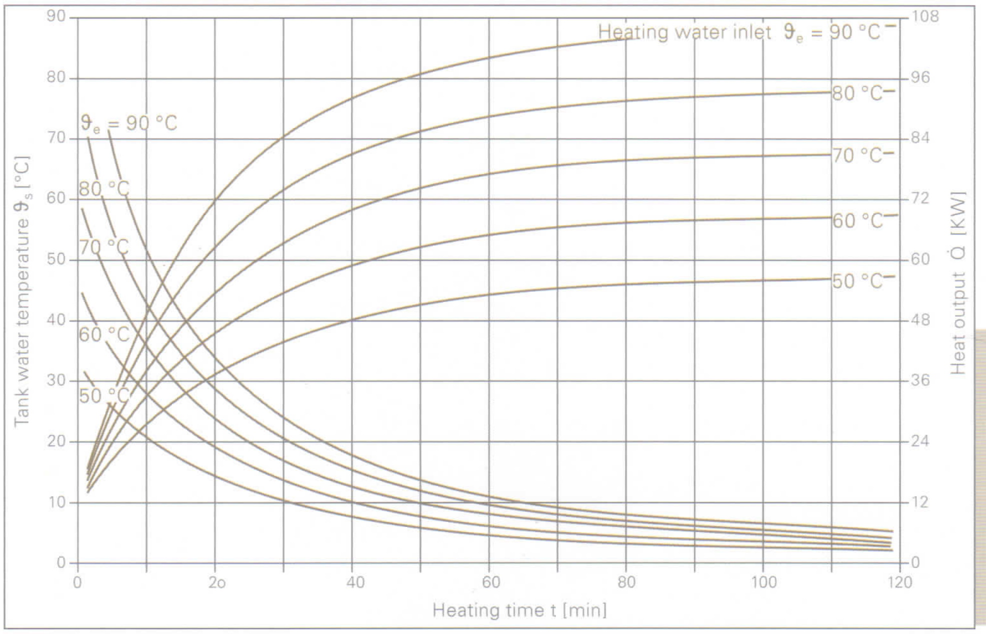


Diagram 5

Output of Finned Tube Heating Coils

Heating coil type	BW-26-1
Tank content	Vs = 0.3 m^3
Heating medium	water
Velocity	v = 1.8m/s

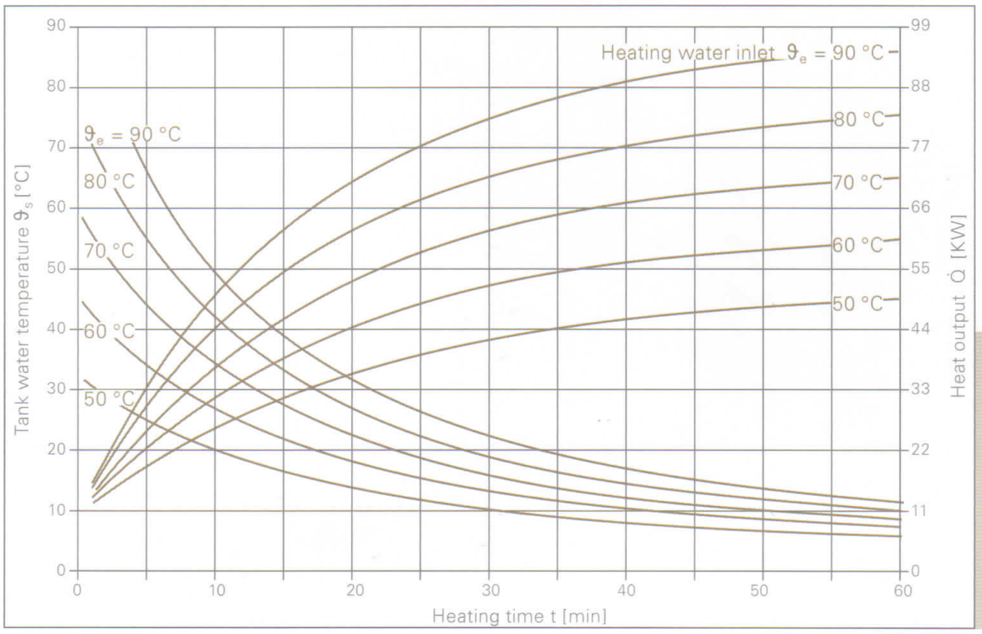


Diagram 6

Output of Finned Tube Heating Coils

Heating coil type	BW-26-2
Tank content	Vs = 0.3 m^3
Heating medium	water
Velocity	v = 1.8m/s

Diagram 7

Output of Finned Tube Heating Coils

Heating coil type	BW-31-2
Tank content	Vs = 0.3 m³
Heating medium	water
Velocity	v = 1.8m/s

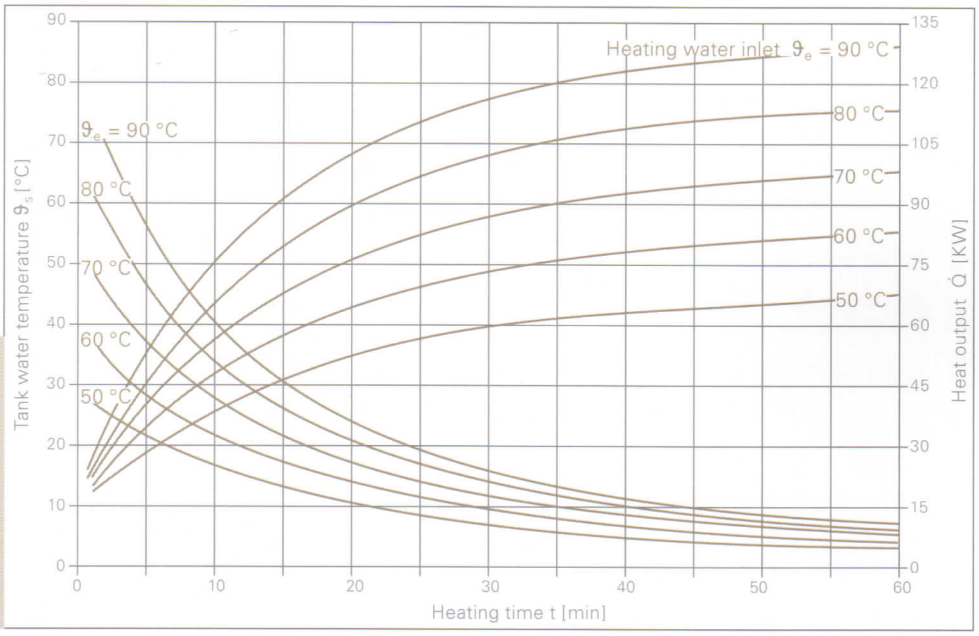


Diagram 8

Output of Finned Tube Heating Coils

Heating coil type	BW-36-2
	BW-36-5
Tank content	Vs = 0.3 m³
Heating medium	water
Velocity	v = 1.8m/s

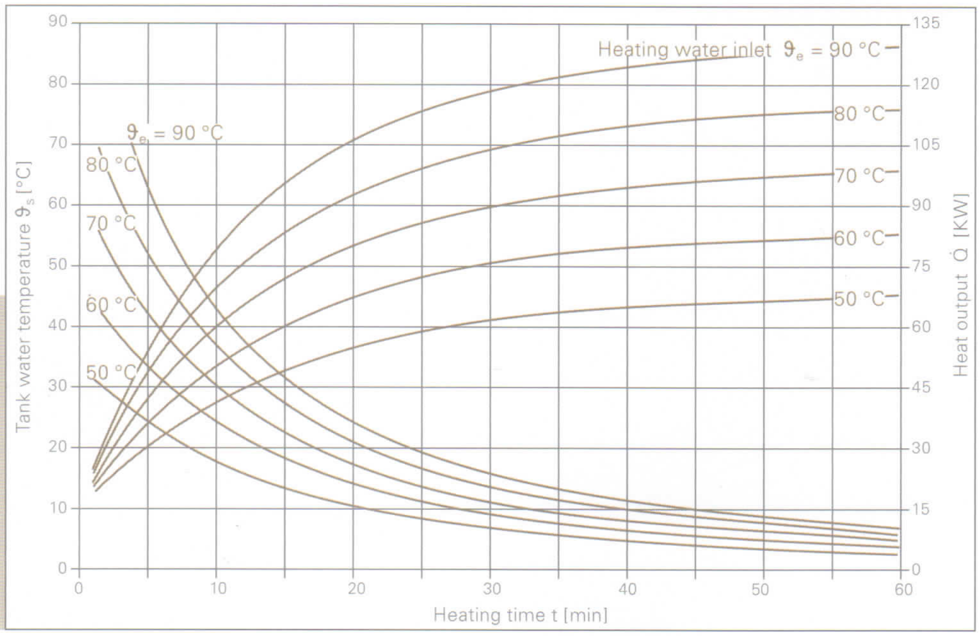
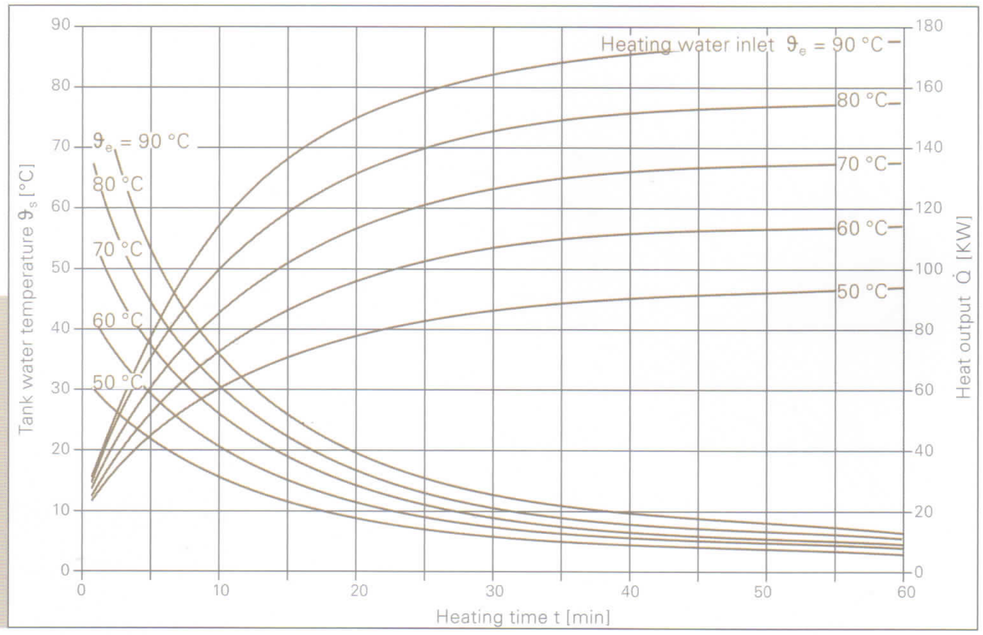


Diagram 9

Output of Finned Tube Heating Coils

Heating coil type	BW-45-2
	BW-45-5
Tank content	Vs = 0.3 m³
Heating medium	water
Vemocity	v = 1.8m/s



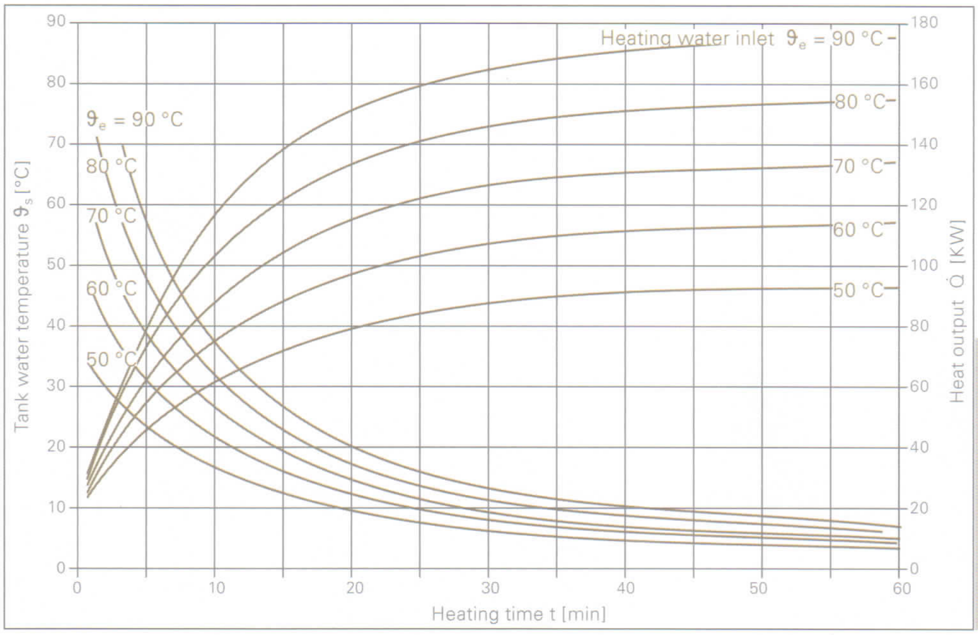


Diagram 10

Output of Finned Tube Heating Coils

Heating coil type	BW-50-5
Tank content	Vs = 0.3 m^3
Heating medium	water
Velocity	v = 1.8m/s

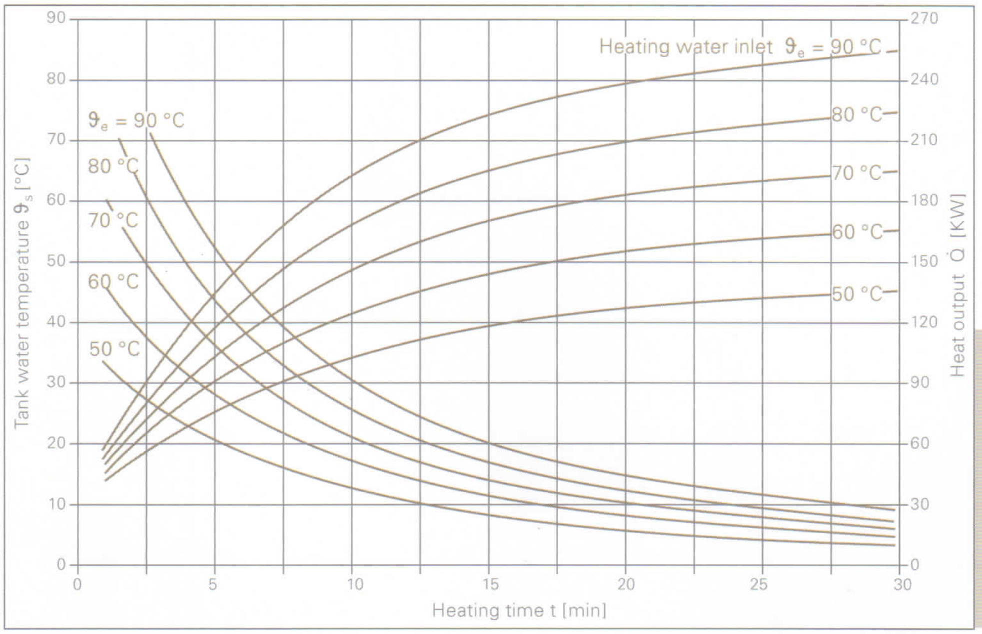


Diagram 11

Output of Finned Tube Heating Coils

Heating coil type	BW-70-5
Tank content	Vs = 0.3 m^3
Heating medium	water
Velocity	v = 1.8m/s

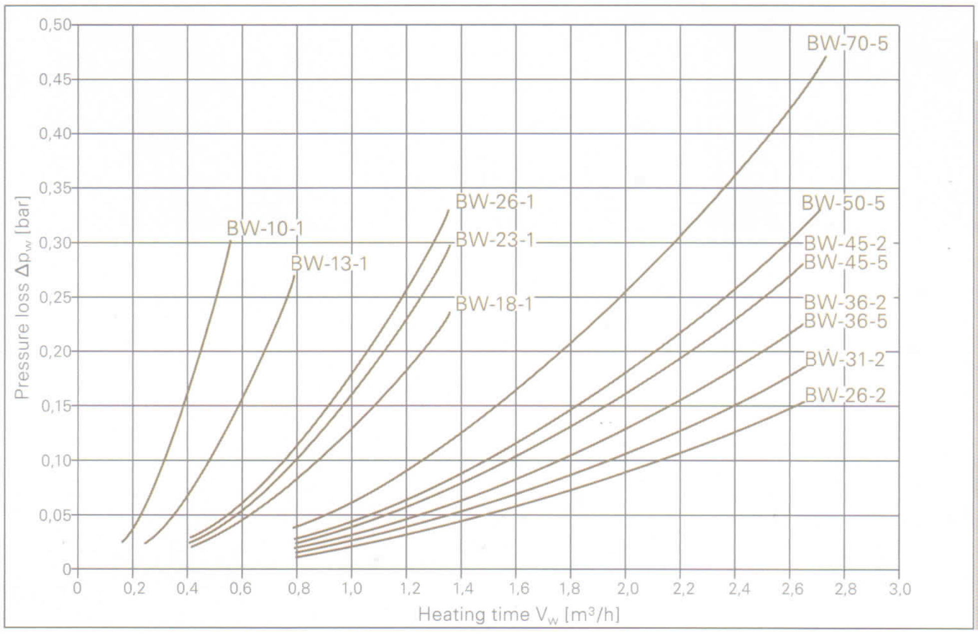


Diagram 12

Pressure loss of BW Finned Tube Heating Coils

Heating coil type	BW-10-1
	BW-13-1
	BW-26-1
	BW-23-1
	BW-18-1
	BW-70-5
	BW-50-5
	BW-45-2
	BW-45-5
	BW-36-2
	BW-36-5
	BW-31-2
	BW-26-2

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