HEAT EXCHANGERS

Heat Exchangers

The overall coefficient of heat transfer in heat exchangers borosilicate glass supports favorably comparing with the conventional heat exchangers made in other materials and normally used in industry.
This is mainly due to the state of perfectly smooth glass walls which improves the film coefficient and reduces fouling.

Soffieria Sestese offers two types of heat exchangers:

- **Coil heat exchangers**
- **Shell and tube heat exchangers**

The coil heat exchangers type, fully designed in borosilicate glass 3.3 correspond to very many applications in heat exchange, especially in the field of pilot units, small production units, and educational equipment. This design removes the problem of internal seals, since the coil pack is welded into the jacket making a one piece unit.

The shell and tube heat exchangers are an additional range for the installation of large exchange surfaces in a small volume. Their efficiency is generally better than coil type and they can perform on-site maintenance.

Soffieria Sestese present two types of shell and tube heat exchangers:

- Shell and tube heat exchangers type SROBS in borosilicate glass 3.3, and tube plates in PTFE.
- Shell tube heat exchangers type SROB in borosilicate glass 3.3, tube plates in PTFE and covers in stainless steel.

For both coil type and shell and tube type heat exchangers, the permissible operating conditions for glass shells and headers can be determined from chapter 1 (Technical Information).

Installation recommendations for coil heat exchanger

When connecting coil exchangers type to the coolant supply, adequate flexible hoses or bellows should be used to ensure that stresses are not transmitted to the glass.
The maximum differential pressure in the coil is 3 bar.

The coil heat exchanger should never be operated with steam in the coils. They should always be used with a sufficient flow of coolant through the coils and care should be taken to ensure that the coolant does not become heated to boiling point.

Coolant control valves should always be turned on and off slowly, particularly when air is present in the cold water supply line. Coolant should be allowed to drain freely to a point as close as practicable to the heat exchanger .

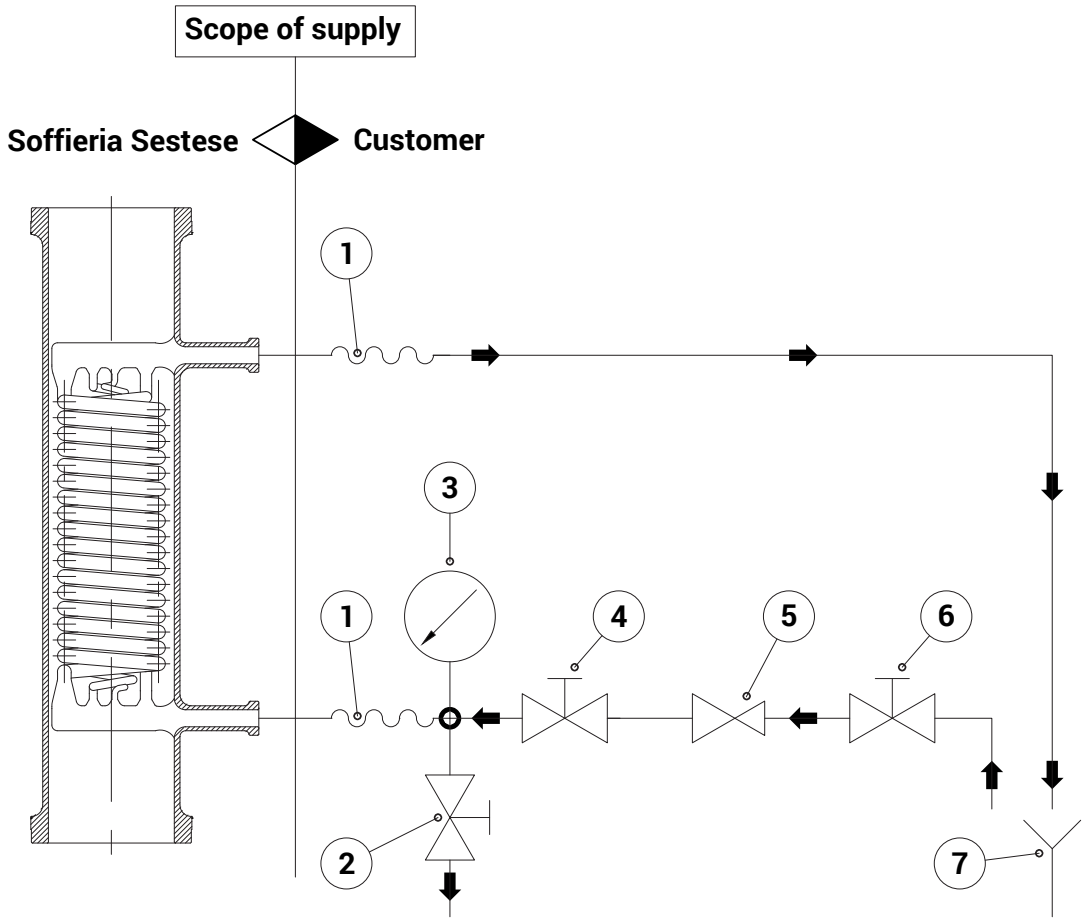
Care should be taken in arranging the coolant supply in order that water hammer is avoided. A regular continuous supply of coolant should be ensured. Using large heat exchangers the fitting of anti-water hammer device is strongly recommended.

If a coil heat exchanger is out of service for any lenght of time, it's advisable to drain the coil, especially during the winter season when proper precautions should be taken to prevent freezing of any water remaining after draining.

Coil heat exchangers can be installed in series to provide larger surface areas.

When connecting direct to the mains water supply, the local water regulations should be considered.

Coil heat exchangers



Graph 1
Typical coil heat exchanger arrangement

Legend:

1 – Flexible hose
2 – Drain valve
3 – Pressure gauge
4 – Control valve
5 – Pressure reducing valve
6 – Shut-off valve
7 – Drain

Coil heat exchangers

Performance data for coil heat exchangers

The heat transferred in coil type heat exchangers can be considered on average as 310 W/m²·K although the figure may vary from 50 to 410 W/m²·K according to conditions of use. The following are examples of this variation in some common applications.

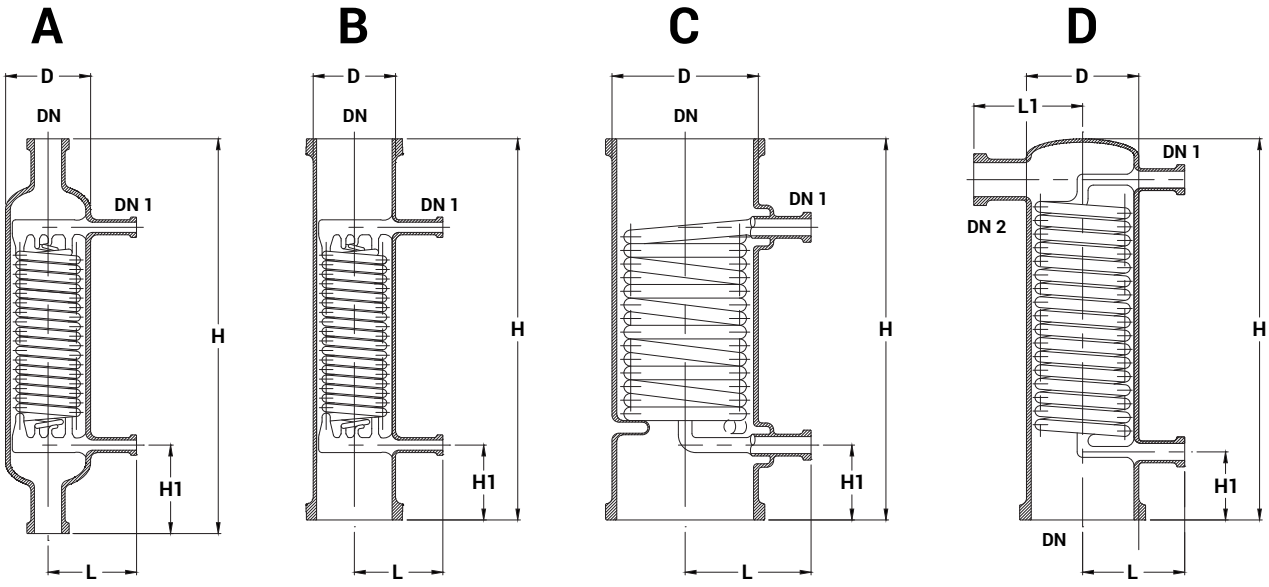
SHELL SIDE	VAPOUR TO BE CONDENSED	LIQUID	GAS
Coil side	Cooling water	Cooling water	Cooling water
Heat transfer coefficient "K" (W/m²·K)	290	175	60

The heat transfer coefficient also varies from one size of heat exchanger to another,
But, as a guide, the table below gives an indication of the performance of coil exchanger at atmospheric pressure, using water (inlet temperature 20 °C) as a coolant in the coils side and steam condensing in the shell side. The figures do not show the maximum performance of the units but are general indication of typical working conditions.

CATALOG REFERENCE	SURFACE AREA (m²)	COOLANT THROUGHPUT (kg/h)	STEAM CONDENSED (kg/h)
SNAK080/25	0.2	-	-
SSCMB040/02	0.2	700	7
SSCMB050/03	0.3	1000	12
SNAK100/50	0.3	-	-
SSCMB080/03	0.3	1000	12
SSCMB100/05	0.5	1500	18
SSCMB150/07	0.7	3000	45
SSCMB150/10	1.0	2300	60
SSCMB200/10	1.0	2100	45
SSCMB200/15	1.5	1600	50
SSCMB300/25	2.5	2700	80
SSCMB300/40	4.0	4750	125
SSCMB400/40	4.0	-	-
SSCMB400/50	5.0	-	-
SSCMB450/60	6.0	6100	230
SSCMB450/80	8.0	5800	280
SSCMBC150/10	1.0	-	-
SSCMBC200/15	1.5	-	-

Coil heat exchangers

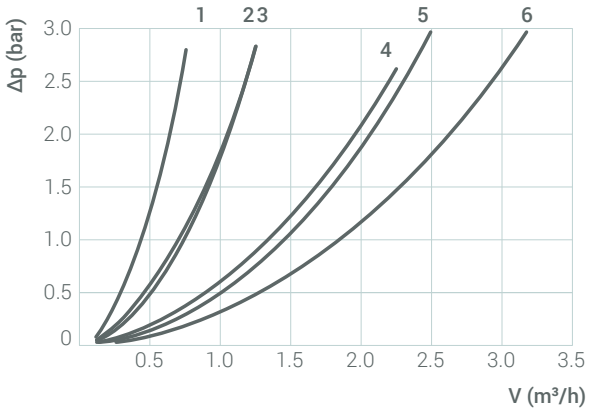
These types of heat exchangers designed and made of borosilicate glass 3.3, are widely used in the field of heat exchanges as of pilot units, small production units and educational units.
A set of heat exchangers standard coils are available, covering a range of exchange surfaces: from 0.2 to 8.0 m².
In every case, the differential pressure in the coils should not exceed 3.0 bar



AREA (m²)	DN	DN1	DN2	D	H	H1	L	L1	TYPE	CODE
0.2	25	15	-	90	500	80	100	-	A	SNAK080/25
0.2	40	15	-	90	610	95	75	-	A	SSCMB040/02
0.3	50	15	-	90	610	95	100	-	A	SSCMB050/03
0.3	50	15	-	115	500	80	125	-	A	SNAK100/50
0.3	80	15	-	90	610	95	100	-	B	SSCMB080/03
0.5	100	15	-	115	610	80	125	-	B	SSCMB100/05
0.7	150	25	-	165	610	100	150	-	C	SSCMB150/07
1.0	150	25	-	165	840	100	150	-	C	SSCMB150/10
1.0	200	25	-	215	500	95	175	-	C	SSCMB200/10
1.5	200	25	-	215	725	95	175	-	C	SSCMB200/15
2.5	300	25	-	315	600	100	275	-	C	SSCMB300/25
4.0	300	25	-	315	825	100	275	-	C	SSCMB300/40
4.0	400	25	-	415	600	110	350	-	C	SSCMB400/40
5.0	400	25	-	415	700	110	350	-	C	SSCMB400/50
6.0	450	25	-	465	850	125	350	-	C	SSCMB450/60
8.0	450	25	-	465	900	125	350	-	C	SSCMB450/80
1.0	150	25	50	165	800	100	150	150	D	SSCMBC150/10
1.5	200	25	50	215	725	95	175	200	D	SSCMBC200/15

Coil heat exchangers

Pressure drop diagram



1 SSCMB040/02
SNAK080/25

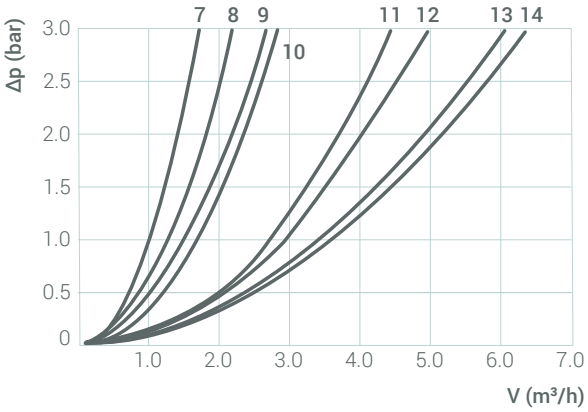
2 SSCMB050/03
SNAK100/50

3 SSCMB080/03

4 SSCMB100/05

5 SSCMB150/10

6 SSCMB150/07



7 SSCMB200/15
SSCMBC200/15

8 SSCMB200/10
SSCMBC150/10

9 SSCMB300/40

10 SSCMB300/25

11 SSCMB400/40

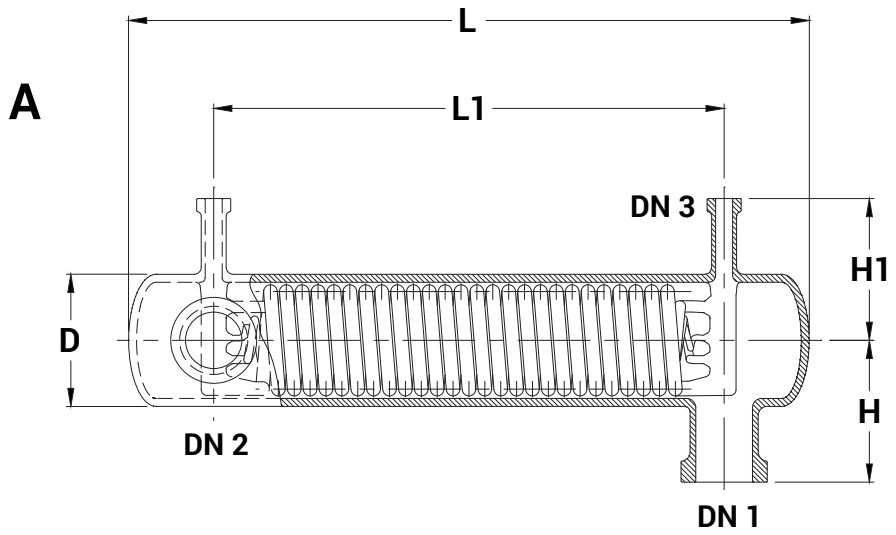
12 SSCMB400/50

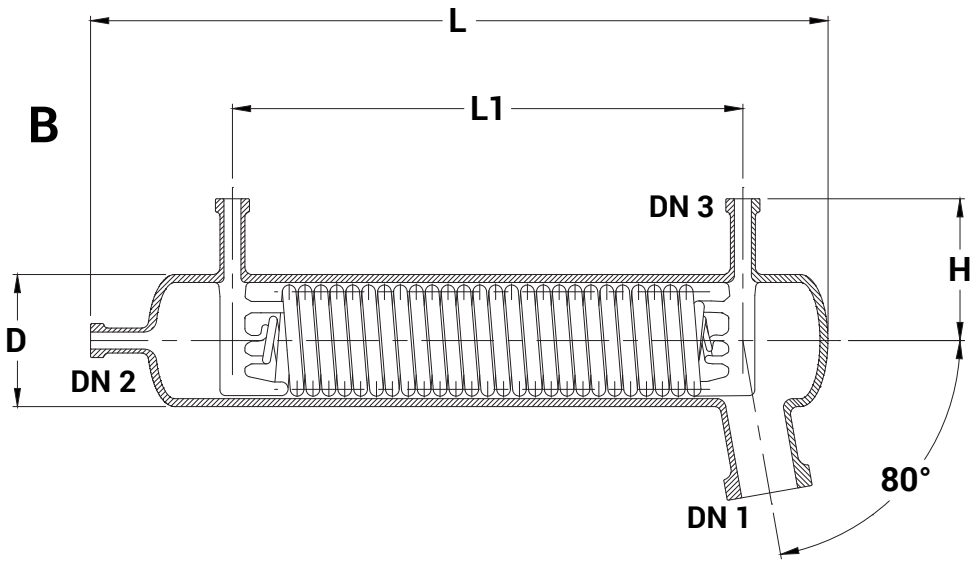
13 SSCMB450/80

14 SSCMB450/60

Graph 2
Pressure drop in the coil as function of throughput for water at 20 °C

Horizontal coil heat exchangers





AREA (m²)	DN1	DN2	DN3	D	L	L1	H	H1	TYPE	CODE
0.3	40	40	15	85	550	420	100	100	A	SSCMBOR080/03
0.5	50	50	15	115	600	450	125	125	A	SSCMBOR100/05
0.7	50	50	25	115	700	575	125	125	A	SSCMBOR100/07
1.0	50	50	25	165	650	520	150	150	A	SSCMBOR150/10
0.3	50	15	15	85	600	420	100	-	B	SSCMBOR080/03/80°
0.5	50	25	15	115	650	450	125	-	B	SSCMBOR100/05/80°
0.7	80	25	25	115	700	575	125	-	B	SSCMBOR100/07/80°
1.0	80	25	25	165	650	520	150	-	B	SSCMBOR150/10/80°

Shell and tube heat exchangers

Shell and tube heat exchangers are one of the most common types of exchangers used in heat transfer.
Typically used in applications where large heat transfer area is required in relatively confined space.
Shell and tube heat exchangers are available in two basic versions:

Type SROBS: single pass units with glass shell, tubes and headers for heat transfer between two aggressive media.

Type SROB: triple pass units with glass shell, glass tubes and stainless steel headers for heat transfer between aggressive media in the shell and non aggressive media in the tubes.

- The glass tubes* are sealed individually into PTFE tube plate with special PTFE bushes and packing. This unique sealing arrangement, permits easy replacement and cleaning of the tubes.
- Baffles, made in PTFE, placed on the shell side ensure improved heat transfer by increased turbulence.
- Shell and tube heat exchangers are designed to operate horizontally but can be supplied for vertical operation if required.
- The position of the connection nozzles must be determined when ordering.
- For shell and tubes type heat exchangers, the permissible operating conditions for glass shells and headers can be determined from chapter 1 (Technical Information).

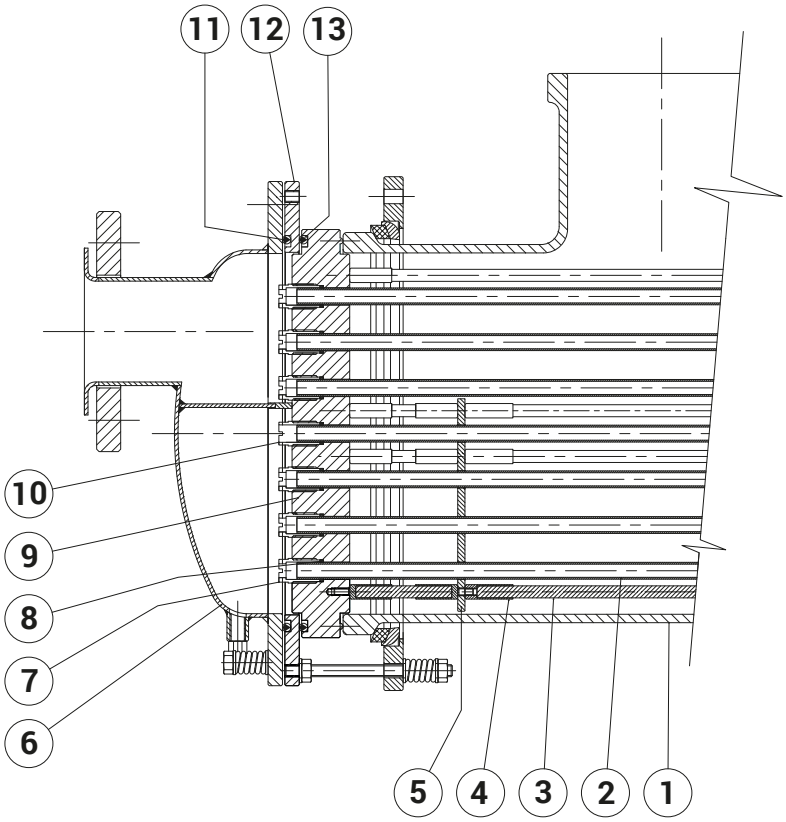
*Available on request with SIC tubes “silicon carbide”

Performance data for heat transfer in shell and tube heat exchangers

The table below gives an indication of the performance of glass shell and tube heat exchangers in several typical applications. For advice on more specific applications, please contact our Technical Department.

TYPE OF HEAT TRANSFER	BASIS	W/m²·K
Liquid	Water – water	580 ÷ 700
	Water – organic solvents	290 ÷ 700
	Water – oil	90 ÷ 400
Liquid – gas	Water – air	30 ÷ 90
Condensation	Water – water	450 ÷ 950
	Water – organic solvents	470 ÷ 700
Evaporation	Steam – water	580 ÷ 950

Shell and tube heat exchangers

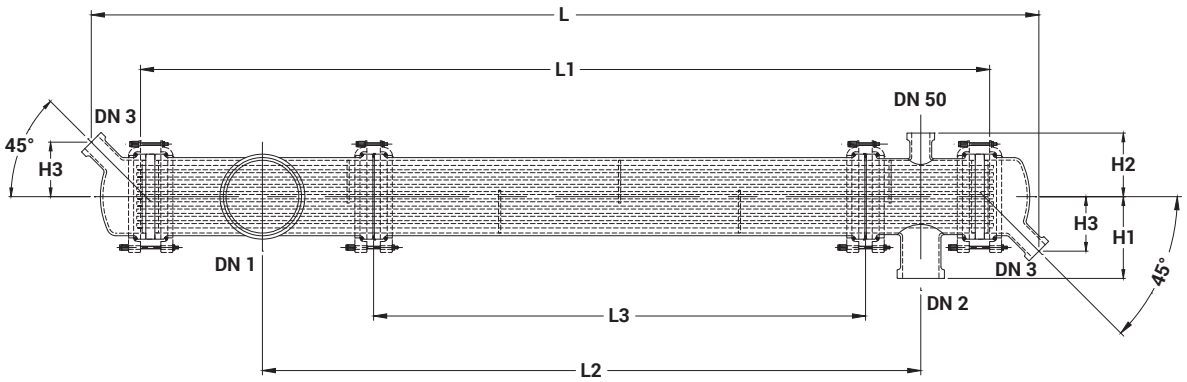


Graph 3
Partial section view shell and tube heat exchanger (glass/steel)

Legend:

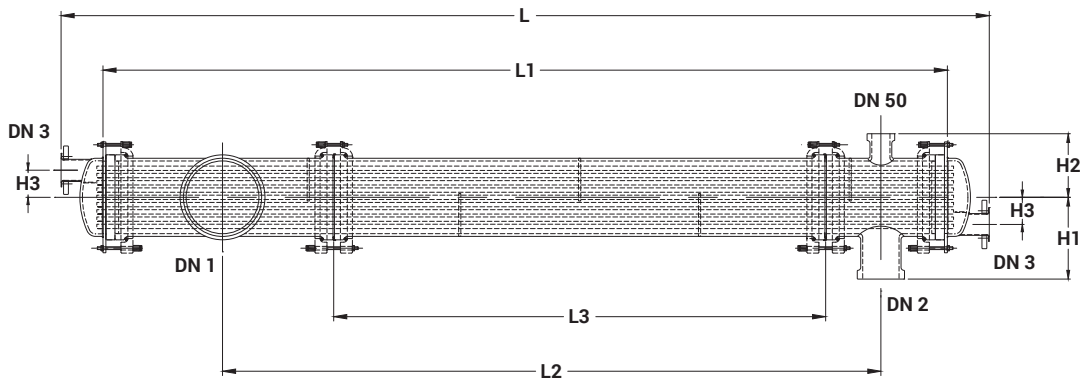
1 – Glass shell tube
2 – Glass inner tube
3 – Glass spacer rod
4 – PTFE threaded bushes for guiding spacer rod
5 – PTFE baffle
6 – Stainless steel cover
7 – PTFE closed bushes
8 – PTFE/viton envelope gasket
9 – PTFE tube plate
10 – PTFE open bushes
11 – PTFE/envelope gasket (tubes side)
12 – Stainless steel intermediate flange
13 – PTFE/envelope gasket (shell side)

Shell and tube heat exchangers single pass (glass/glass)



AREA (m²)	DN	DN1	DN2	DN3	L	L1	L2	L3	H1	H2	H3	CODE
2.5	150	100	50	40	1710	1480	1100	800	150	150	105	SROBS025/150/R/1
3.2	150	100	50	40	2210	1980	1600	1300	150	150	105	SROBS032/150/R/1
4.0	150	100	50	40	2710	2480	2100	1800	150	150	105	SROBS040/150/R/1
5.0	150	100	50	40	3210	2980	2600	2300	150	150	105	SROBS050/150/R/1
5.0	200	150	80	50	2270	1980	1500	1100	225	175	135	SROBS050/200/R/1
6.3	200	150	80	50	2770	2480	2000	1600	225	175	135	SROBS063/200/R/1
8.0	200	150	80	50	3270	2980	2500	2100	225	175	135	SROBS080/200/R/1
10.0	200	150	80	50	3770	3480	3000	2600	225	175	135	SROBS100/200/R/1
12.5	300	200	100	80	2305	1980	1300	700	275	225	185	SROBS125/300/R/1
16.0	300	200	100	80	2805	2480	1800	1200	275	225	185	SROBS160/300/R/1
20.0	300	200	100	80	3305	2980	2300	1700	275	225	185	SROBS200/300/R/1
25.0	300	200	100	100	3805	3480	2800	2200	275	225	185	SROBS250/300/R/1

Shell and tube heat exchangers triple pass (glass/steel)



AREA (m²)	DN	DN1	DN2	DN3	L	L1	L2	L3	H1	H2	H3	CODE
2.5	150	100	50	40	1750	1480	1100	800	150	150	55	SROB025/150/SH/3
3.2	150	100	50	40	2250	1980	1600	1300	150	150	55	SROB032/150/SH/3
4.0	150	100	50	40	2750	2480	2100	1800	150	150	55	SROB040/150/SH/3
5.0	150	100	50	40	3250	2980	2600	2300	150	150	55	SROB050/150/SH/3
5.0	200	150	80	50	2300	1980	1500	1100	225	175	77	SROB050/200/SH/3
6.3	200	150	80	50	2800	2480	2000	1600	225	175	77	SROB063/200/SH/3
8.0	200	150	80	50	3300	2980	2500	2100	225	175	77	SROB080/200/SH/3
10.0	200	150	80	50	3800	3480	3000	2600	225	175	77	SROB100/200/SH/3
12.5	300	200	100	80	2350	1980	1300	700	275	225	112	SROB125/300/SH/3
16.0	300	200	100	80	2850	2480	1800	1200	275	225	112	SROB160/200/SH/3
20.0	300	200	100	80	3350	2980	2300	1700	275	225	112	SROB200/300/SH/3
25.0	300	200	100	80	3850	3480	2800	2200	275	225	112	SROB250/300/SH/3

Available with SIC tubes (silicon carbide) custom made