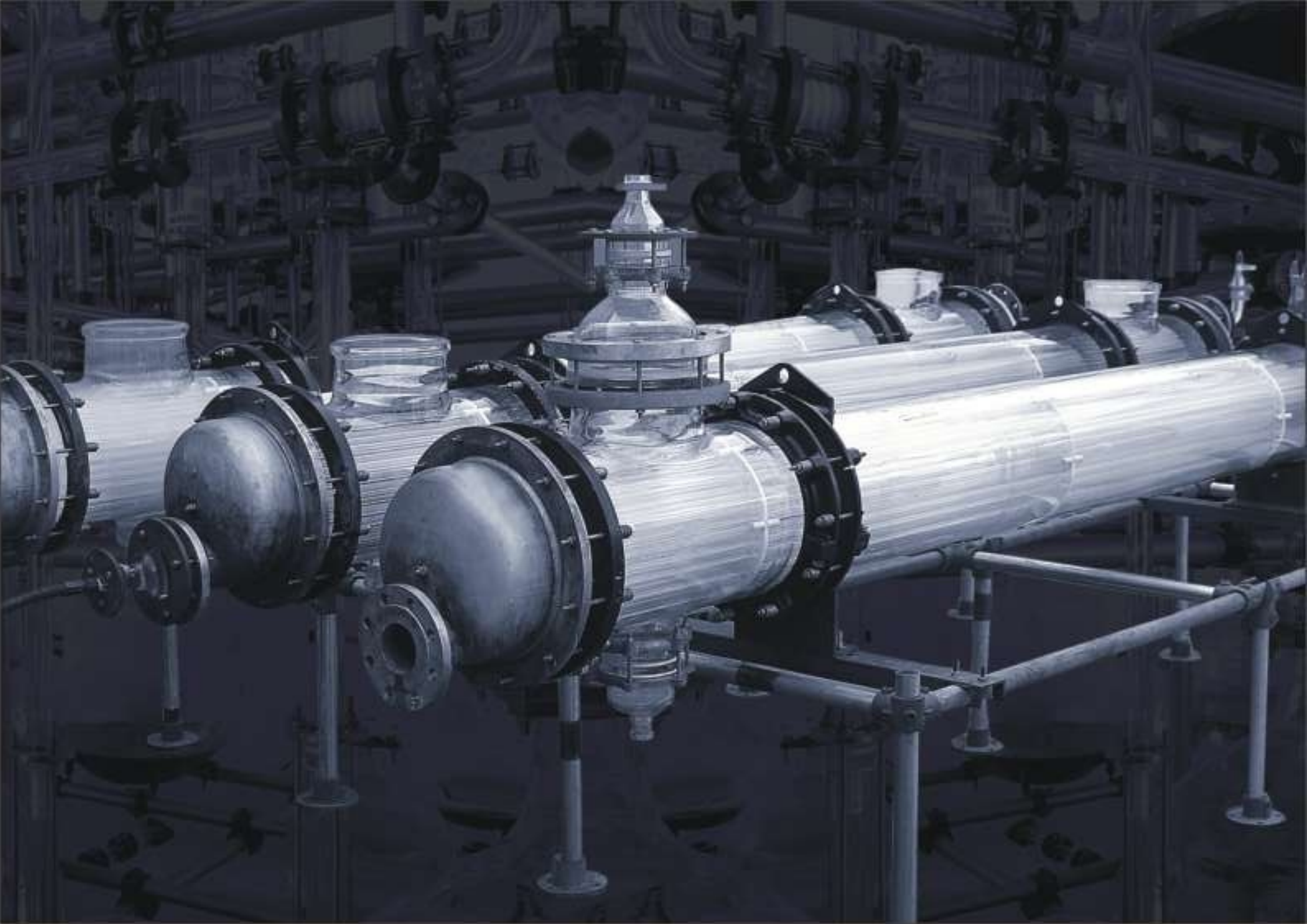


HEAT EXCHANGERS

There are two types of glass heat exchangers, coil type and shell and tube type heat exchangers.

COIL TYPE HEAT EXCHANGERS

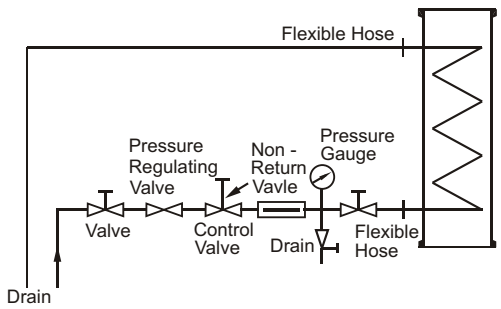
Coil type heat exchangers are of all-glass design. There are no internal sealing problems as the coil battery is welded into the jacket making a one piece unit. Coil type heat exchanger are used for condensation of vapours and cooling of liquid . The maximum allowable pressure in the coils is 2.7 bar gauge.

PERFORMANCE DATA

The heat transfer coefficients also varies from one size of condenser to another but as a guide, the table below gives as indication of the performance of condenser at atmospheric pressure, using water (inlet temperature 30° C) as a coolant in the coils and steam condensing in the jackets.

The figures do not show the maximum performance of the units but are a general indication of typical working conditions.

Jacket side Medium	Vapour to be condensed	Liquid	Gas
Coil side medium	Cooling water	Cooling water	Cooling water
Heat transf. coeff. Kcal/hr – m² °c	200-250	100-150	40-60



TYPICAL CONDENSER ARRANGEMENT

PRECAUTIONS TO USE CONDENSER ARE AS FOLLOW :

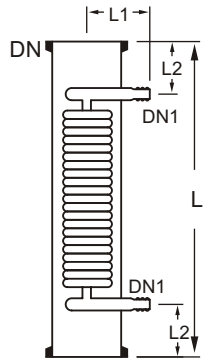
1. When connecting coil-type condensers to the coolant supply, adequate flexible hose should be used to ensure that stresses are not transmitted to the glass.
2. Condenser should never be operated with steam in the coils. They should always be used with an adequate flow of coolant through the coils and care should be taken to ensure that the coolant does not become heated to boiling point.
3. Coolant control valves should always be turned ON and OFF slowly, particularly when air is present in the line. Coolant should be allowed to drain freely to a point as closed as practicable to the heat exchangers.
4. Care should be taken in arranging the coolant supply in order to that water hammer is avoided. A uniform, continuous supply of coolant should be ensured.
5. If a condenser is out of service for any length of time, it is advisable to drain the coils, especially in winter when suitable precautions should be taken to prevent freezing of any water remaining after draining.
6. Brine or other coolants in closed circuit can be used as a coolant provided the suitable precautions against water hammer are taken.
7. Condensers can be mounted in series to provide lager surface area. Generally condensers should be mounted vertically only.
8. The maximum pressure in the coil is 2.7 Bar g the maximum differential pressure across the coil are 2.7 Bar g.

GLASS CONDENSER

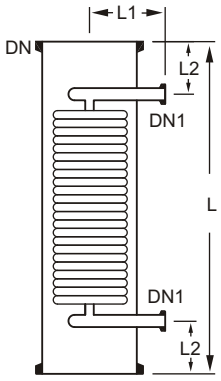
AREA (m²)	DN	DN1	L	L1	L2	TYPE	COOLANT JACKET CAP LTR.	THROUGH PUT Kg/h	FCSA* SHELL (cm²)	CAT. REF
0.2	40	16	610	85	100	A	1.0	700	4.5	SHE1.5/2
0.3	50	16	610	90	100	A	1.25	1200	5	SHE2/3
0.3	80	16	610	90	100	A	2	1200	5	SHE3/3
0.5	100	20	610	120	100	A	4	2200	18	SHE4/5
0.6	100	20	760	120	100	A	6	2200	30	SHE4/6
1.0	150	25	610	150	100	B	9	2300	52	SHE6/10
1.5	150	25	840	150	125	B	11	2300	52	SHE6/15
2.5	225	25	790	180	125	B	18	3000	142	SHE9/25
2.5	300	25	610	250	125	B	25	2750	210	SHE12/25
4.0	300	25	900	250	125	B	35	4200	258	SHE12/40
4.0	400	25	600	350	125	B	55	4800	450	SHE16/40
5.0	400	25	700	350	125	B	65	5800	450	SHE16/50
6.0	450	25	760	325	150	B & C	100	5800	820	SHE18/60
8.0	450	25	900	325	150	B & C	110	6100	820	SHE18/80

Note : *L1 / L2 may be ± 10mm.*

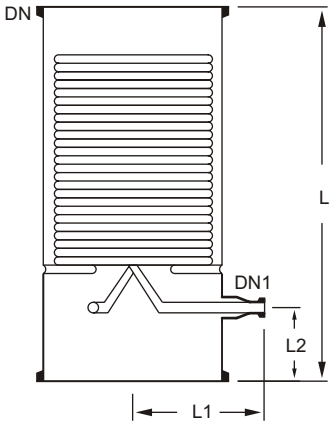
** FCSA - Free Cross Section Area.*



TYPE-A



TYPE-B



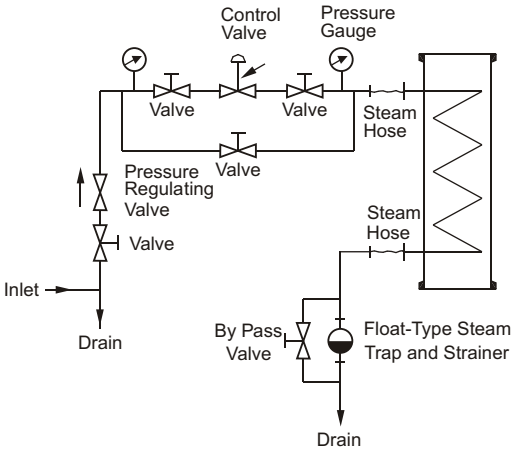
TYPE-C

GLASS BOILER

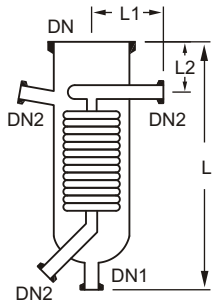
Type SHEB 4, SHEB 6 and SHEB 9 glass coil-type boiler are normally mounted in external circulatory loops using a spherical vessel as the main still. They should not be installed in the bottom of a flask or column.

The other types of glass coil-type boilers detailed on this page are again mounted in circulatory loops but as their nominal bore is same at the top and bottom, these units can, under certain circumstances, be installed one above the other to achieve multiples of the basic heat transfer area.

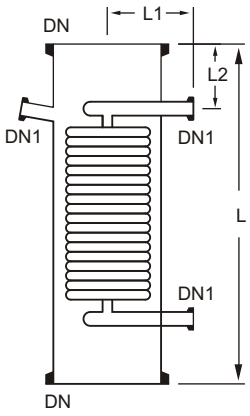
The maximum pressure in the coils is 3.0 barg. The maximum differential pressure across the coils is 3.0 bars. Please refer to the performance data for glass coil-type.



TYPICAL BOILER ARRANGEMENT



TYPE-A



TYPE-B

PERFORMANCE DATA

The maximum permissible steam pressure at the coil inlets of boilers is 3.0 barg which is equivalent to temperature of about 143°C with saturated steam. Higher temperature can be achieved by using heat.

The heat transferred in most sizes can be considered on average as 250 Kcal/hr – m² °c a steam pressure in the coils of 3.0 Bar g, although this figure declines marginally at lower pressure.

PRECAUTIONS TO USE GLASS BOILER ARE AS FOLLOW :

1. Flexible hoses must be used on the coil inlet and outlet and must have sufficient fall to avoid the collection of condensate.
2. To avoid the possibility of steam hammer, the steam main should be adequately trapped.
3. To clear the line of the very heavy condensate flow produced on start-up by-pass valves must be installed around the trap on the coil outlet.
4. Control valves and pressure gauges should be positioned near to the heat exchanger.
5. Coil type boilers should not be fitted at the bottom of flasks or columns. They are designed to be mounted on an external circulatory loop, this ensures a rapid uni - directional flows across the heating surfaces, which improves the heat transfer performance and promotes smooth operation.
6. The steam pressure should always be adequate enough to ensure effective and smooth condensate removal. This pressure will vary according to conditions of use and size of heat exchanger. For example, with the SHEB 12/12 and SHEB 450, a minimum pressure of 2 bar.g will probably be required.
7. On start-up, the steam should be admitted positively and progressively to the coil battery to remove the condensate as it is formed and with the by-pass valve left open until a uniform flow of condensate is being vented.
8. Depending upon the overall operating conditions, the use of boilers under high vacuum is not always recommended.

Area (m²)	DN	DN1	DN2	L	L1	Area L2	FCSA Cap. (cm²)	Jacket Ltr.	Type	Cat. Ref.
0.15	100	25	25	380	125	100	40	2	A	SHEB4
0.15	100	25	-	405	125	100	41	3	B	SHEB4/4
0.50	150	40	25	455	150	90	51	5	A	SHEB6
0.50	150	25	-	510	150	100	51	7	B	SHEB6/6
1.50	225	40	25	710	180	140	147	16	A	SHEB9
1.20	225	25	-	710	180	115	193	20	B	SHEB9/9
2.00	300	25	25	700	215	135	330	40	B	SHEB12/12

** FCSA - Free Cross Section Area.*

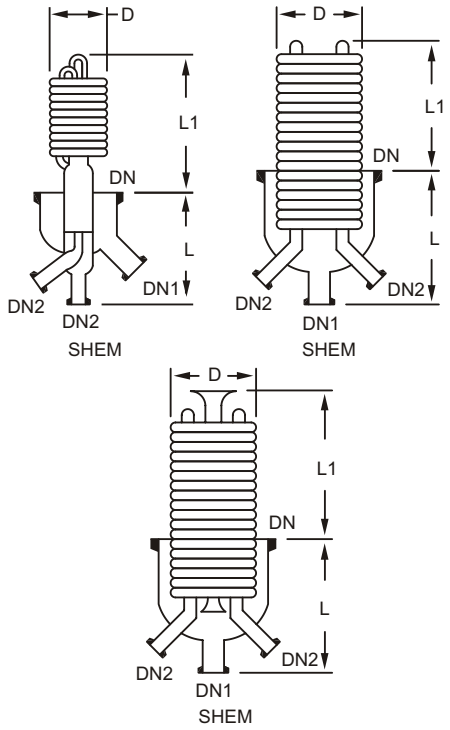
IMMERSION HEAT EXCHANGERS

Immersion heat exchangers are used to control exothermic reactions in glass vessels.

In most applications, cooling water is used in the coils, but they can also be used with steam.

In the latter case the coils must always be completely immersed in the liquid. The maximum pressure in the coils is 3.0 bar g. the maximum differential pressure across the coils is 3.0 Bar g.

Area (m^2)	DN	DN1	DN2	L	L1	D	Cat Ref
0.50	150	40	25	230	330	145	SHEM 6
0.70	225	25	25	275	205	210	SHEM 9

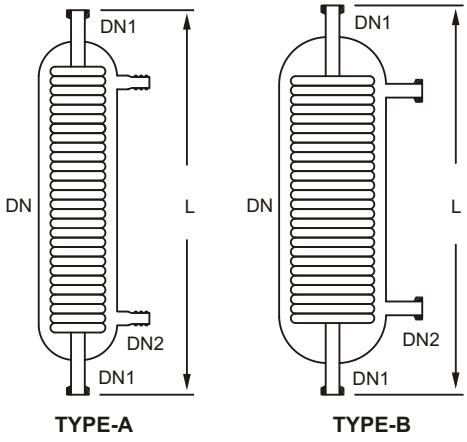


PRODUCT COOLERS

Product coolers are general-purpose coolers used for cooling of products from distillation columns. Coolers are connected directly to the product outlet of the column by means of DN1. The product then flows from the top to the bottom of the unit through the coil battery across which the cooling water flows counter currently from bottom to top

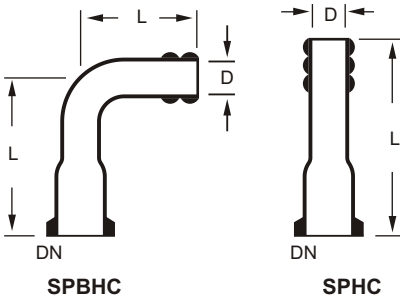
Angled hose connections are recommend for connections of cooling water Inlets and Outlets.

Area (m^2)	DN	DN1	DN2	L	Type	Cat Ref
0.1	**40**	25	16	610	A	SHEF 1/1
0.2	50	25	16	610	A	SHEF 1/2
0.3	80	25	16	610	A	SHEF 1/3
0.35	100	25	19	610	A	SHEF 1/3.5
0.50	150	25	25	610	B	SHEF 1/5
1.00	150	25	25	840	B	SHEF 1/10



HOSE CONNECTOR

These glass connectors are used to connect flexible hoses to inlet and outlet of coil type condensers.



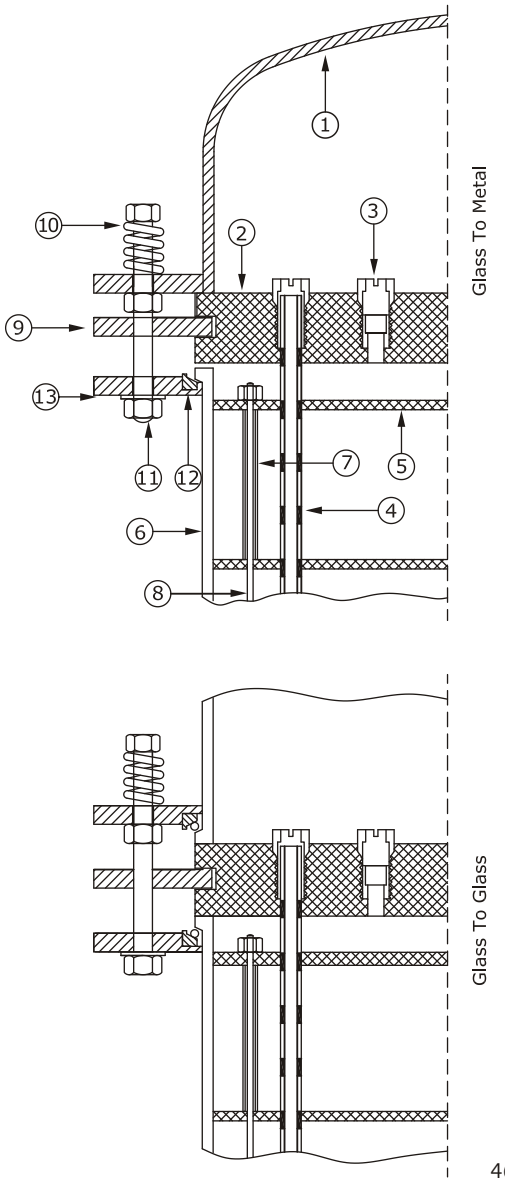
SHELL AND TUBE HEAT EXCHANGERS

Shell and tube heat exchangers are available in various option depends upon required application, which are mentioned as under. Shell and tube heat exchangers are particularly suitable for application where large heat transfer area is required in relatively confined space.

Shell & tube heat exchangers are available in single-pass as well as multi - pass on tube side. Material of Construction of tube is Borosilicate Glass (3.3)

Range of the models

Cat.Ref.	Shells	End Fittings	Tubes	Number of passes
SRGG	Glass	Glass	Glass	1
SRGM	Glass	Steel	Glass	1/2/3
SRMG	Steel	Glass	Glass	1



CONSTRUCTION FEATURES

The glass tube are sealed individually into PTFE tube sheet with special PTFE sockets and pakcing. This unique ferrule type selling arrangement permits easy replacements and cleaning of tubes. Baffles on shell side ensure improved heat transfer by increased turbulence. Further details of construction can be seen in the diagram

Sealing principle similar on all models

1 METAL / GLASS BONNET

2 PTFE TUBE SHEET

3 THREADED BUSH

4 GLASS TUBE

5 BAFFLE

6 METAL / GLASS SHELL

7 PTFE TUBE

8 TIE ROD IN PTFE

9 CAST IRON FLANGE

10 SPRING

11 SCREWED ROD OR NUT

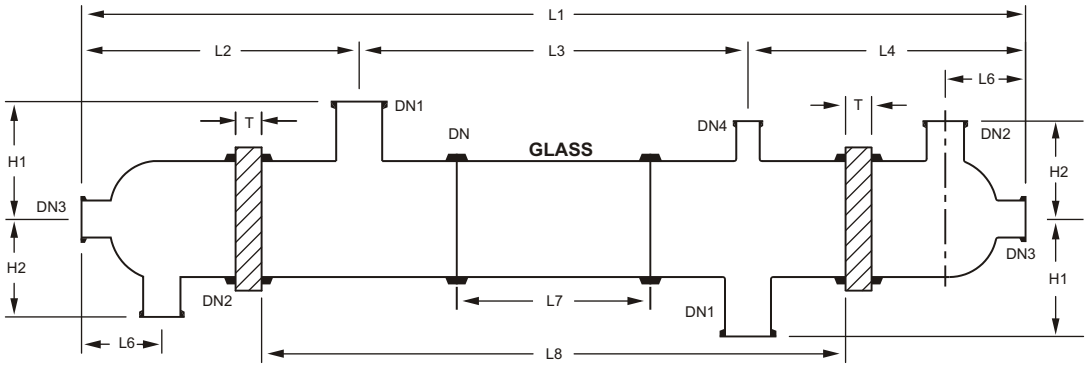
12 INSERT

13 FLAT WASHER

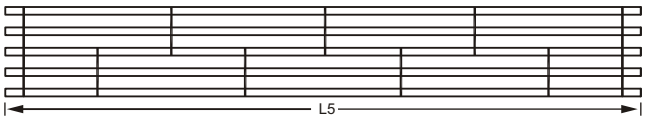
Cat Ref. RGG/RMG	6/3	6/4	6/5	6/6	9/6	9/8	9/10	9/12	12/12	12/16	12/21	12/26
Area (m²)	3	4	5	6	6	8	10	12.5	12	16	21	26
DN	150				225				300			
DN1	80				100				150			
DN2	50				50				80			
DN3	25				40				40			
DN4	50				50				50			
H1	175				250				300			
H2	150				205				240			
L1	2534	3034	3834	4534	2864	3364	4164	4864	2916	3416	4216	4916
L2	440	440	440	440	690	690	690	690	730	730	730	730
L3	1650	2150	2950	3650	1480	1980	2780	3480	1450	1950	2750	3450
L4	440	440	440	440	690	690	690	690	730	730	730	730
L5	2030	2530	3330	4030	2030	2530	3330	4030	2030	2530	3330	4030
L6	155	155	155	155	175	175	175	175	200	200	200	200
L7	1350	1850	2650	3350	1030	1530	2330	3030	1000	1500	2300	3000
L8	1960	2460	3260	3960	1940	2440	3240	3940	1910	2410	3210	3910
No. of Tubes	37				73				151			
No. of Baffles	11	14	19	24	7	9	13	17	5	7	10	13
T	50				60				75			

All glass tubes have an external diameter of 13mm or 14mm and a wall thickness of 1 mm.

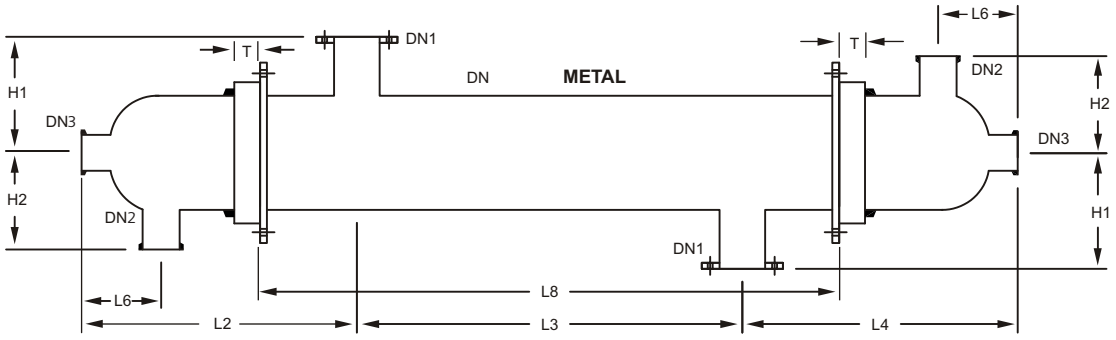
SRGG



TUBE BUNDLE



SRMG



OPERATING RANGE

The maximum permissible operating conditions in borosilicate glass 3.3 heat exchangers are detailed in the table below.

Permissible operating pressure range (Bar g)

Models	Side	DN 150	DN 225	DN 300
SRGG	Shell Tube	2.0 2.0	1.0 1.0	0.75 0.75
SRGM	Shell Tube	2.0 3.0	1.0 3.5	0.75 3.5
SRMG	Shell Tube	3.5 2.0	3.5 1.0	3.5 0.75

Maximum operating temperature
shell and tube sides: - 40° C to 150° C.

Maximum temperature difference between the
shell side and tube side process fluids : 120° C.

PERFORMANCE & DESIGN DATA:

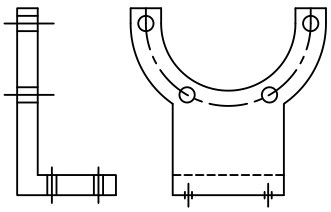
Table given below indicates performance of glass shell and tube heat exchanger in several typical application. More specific advice can be given on receipt of details.

Type of Heat transfer	Basis	Kcal/m² hr °C
Liquid - Liquid Cooling -	Water-water	500-600
	Water- organic solvents	250-600
	Water-oil	75-350
	Water - air	25-250
Liquid - -Gas Condensation -	Water-water	600-900
	Water- organic solvents	400-600
Evaporation -	Steam - organic solvents	400-600
	Steam-water	500-900

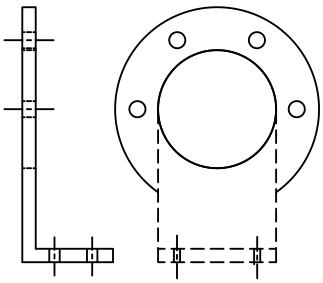
SUPPORTS :

Generally two types of supports are used in shell and tube heat exchangers depends upon MOC of shell & tube heat exchangers.

MOC of these supports is MS.



SUPPORTS FOR GLASS SHELL



SUPPORTS FOR METAL SHELL