

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

COIL TYPE HEAT EXCHANGERS

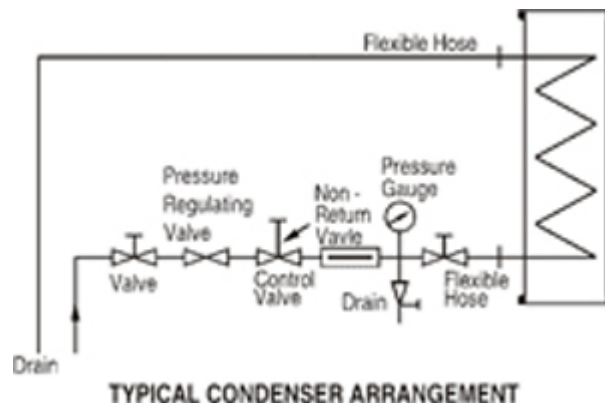
Coil type heat exchangers are of all-glass design. There are no internal sealing problems as the coil battery is welded into the jacket making a one piece unit. Coil type heat exchanger are used for condensation of vapours and cooling of liquid.

PERFORMANCE DATA

The heat transfer coefficients also varies from one size of condenser to another but as a guide, the table below gives an 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 sideMedium	Vapour to be condensed	Liquid	Gas
Coil side medium	Cooling water	Cooling water	Cooling water
Heat transf. coeff.	-	-	-

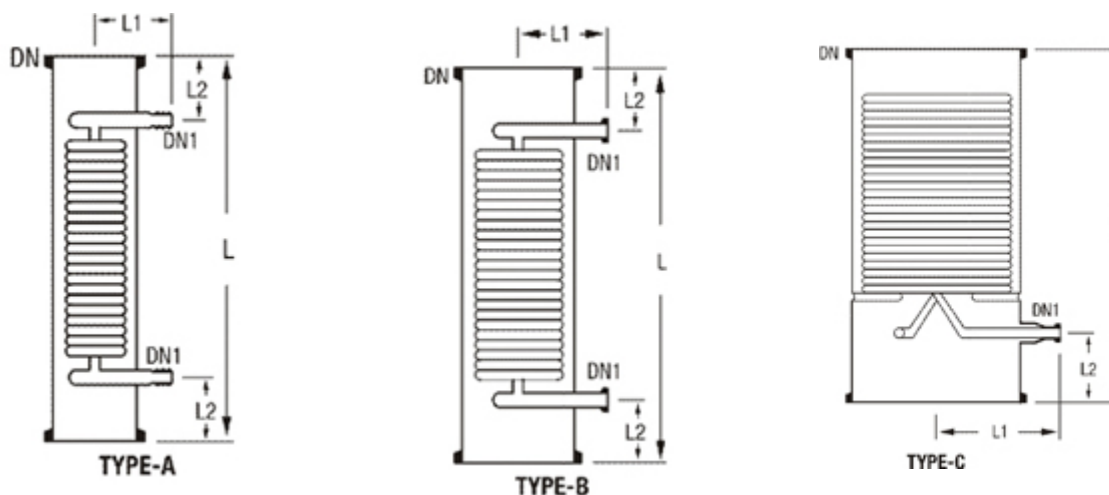
PRECAUTIONS TO USE CONDENSER ARE AS FOLLOW



- 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.
- 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.
- 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 close as practicable to the heat exchangers.
- 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.
- 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.
- Brine or other coolants in closed circuit can be used as a coolant provided the suitable precautions against water hammer are taken.
- Condensers can be mounted in series to provide larger surface area. Generally condensers should be mounted vertically only.

The maximum pressure in the coil is 2.7 Bar g the maximum differential pressure

GLASS CONDENSER



AREAz (m ²)	DN	DN1	L	L1	L2	TYPE	COOLANT JACKETTHROUGH FCSA*			CAT. REF.
							CAP .LTR.	PUT Kg/h	DHELL (cm ²)	
0.2	40	16	610	85	100	A	1.0	700	4.5	DHE 1.5/2
0.3	50	16	610	90	100	A	1.25	1200	5	DHE 2/3
0.3	80	80	610	90	100	A	2	1200	5	DHE 3/3
0.5	100	20	610	120	100	A	4	2200	18	DHE 4/5
0.6	100	20	760	120	100	A	6	2200	30	DHE 4/6
1.0	150	25	610	150	100	B	9	2300	52	DHE 6/10
1.5	150	25	840	150	125	B	11	2300	52	DHE 6/15
2.5	225	25	790	180	125	B	18	3000	142	DHE 9/25
2.5	300	25	610	250	125	B	25	2750	210	DHE 12/25
4.0	300	25	900	250	125	B	35	4200	258	DHE 12/40
4.0	400	25	600	350	125	B	55	4800	450	DHE 16/40
5.0	400	25	700	350	125	B	65	5800	450	DHE 16/50
6.0	450	25	760	325	150	B & C	100	5800	820	DHE18/60
8.0	450	25	900	325	150	B & C	110	6100	820	DHE 18/80

GLASS BOILER

Type DHEB 4, DHEB 6 and DHEB 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.

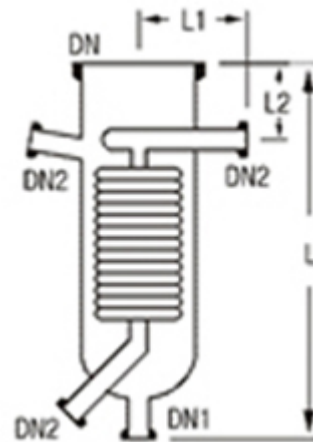
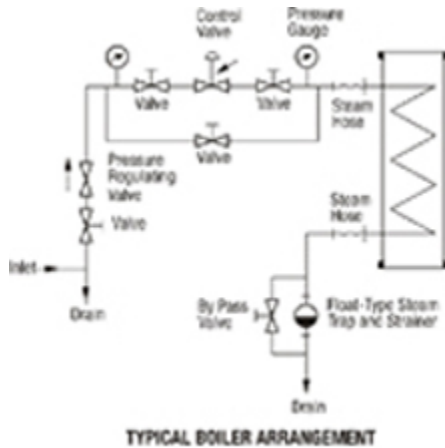
The maximum pressure in the coils is 3.0 barg. The maximum differential pressure across the coils is 3.0 bars. Please

refer to the performance data for glass coil-type.

		DN 150		DN 225		DN 300	
Details of Construction		Max	Min	Max	Min	Max	Min
DHEISide	GlassDHEII	2.0 bar.g	Vacuum	1.0bar.g	Vacuum	0.7bar.g	Vacuum
	Steel DHEII	3.5bar.g	Vacuum	3.5bar.g	Vacuum	3.5bar.g	Vacuum
Tube Side	Glass Bonnet Single Pass	2.0 bar.g	Vacuum	1.0 bar.g	Vacuum	0.7 bar.g	Vacuum
	Metal Bonnet Triple Pass	2.5 bar.g	Vacuum	2.5 bar.g	Vacuum	2.5 bar.g	Vacuum

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TOP

PERFORMANCE DATA



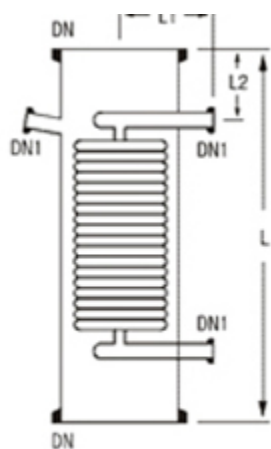
The maximum permissible steam pressure at the coil inlets of boilers is 3.0 barg which is equivalent to temperature of about 143°C with saturated steam. Higher temperature can be achieved by using heat.

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 :

- Flexible hoses must be used on the coil inlet and outlet and must have sufficient fall to avoid the collection of condensate.
- To avoid the possibility of steam hammer, the steam main should be adequately trapped.
- 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.
- Control valves and pressure gauges should be positioned near to the heat exchanger.
- 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.
- 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 DHEB 12/12 and DHEB 450, a minimum pressure of 2 bar.g will probably be required.

- 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.



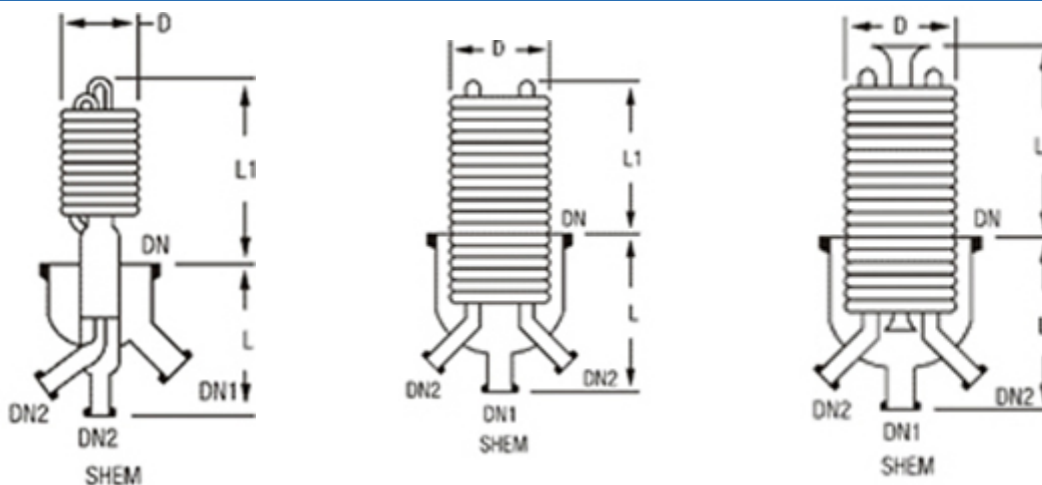
TYPE-B

Area (m)	DN	DN1	DN2	L	L1	AreaL2	FCSA			Type	Cat.Ref.
							Cap. (cm ²)	Jacket Ltr.			
0.15	100	25	25	380	125	100	40	2	A	DHEB 4	
0.15	100	25	-	405	125	100	41	3	B	DHEB 4/4	
0.50	150	40	25	455	150	90	51	5	A	DHEB 6	
0.50	150	25	-	510	150	100	51	7	B	DHEB 6/6	
1.50	225	40	25	710	180	140	147	16	A	DHEB 9	
1.20	225	25	-	710	180	115	193	20	B	DHEB 9/9	
2.00	300	25	25	700	215	135	330	40	B	DHEB 12/12	

* FCSA - Free Cross Section Area



IMMERSION HEAT EXCHANGERS



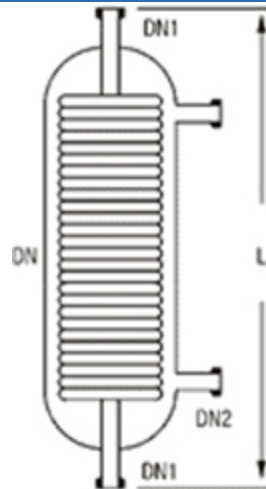
Immersion heat exchangers are used to control exothermic reactions in glass vessels.

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

Area (m ²)	DN	DN1	DN2	L	L1	D	Cat Ref
0.50	150	40	25	230	330	145	DHEM 6
0.70	225	25	25	275	205	210	DHEM 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	DHEF 1/1
0.2	50	25	16	610	A	DHEF 1/2
0.3	80	25	16	610	A	DHEF 1/3
0.35	100	25	19	610	A	DHEF 1/3.5
0.50	150	25	25	610	B	DHEF 1/5

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TOP

HOSE CONNECTOR



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

DHELL AND TUBE HEAT EXCHANGERS

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

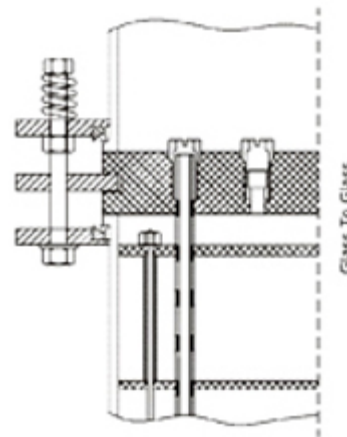
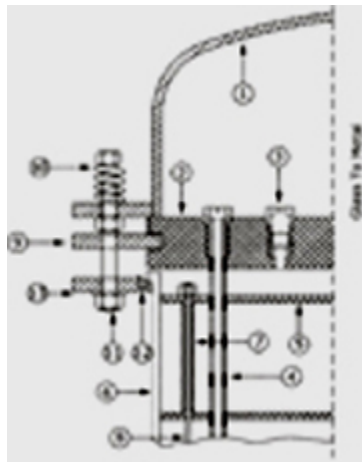
DHEll & tube heat exchangers are available in single-pass as well as multi - pass on tube side. Material of Construction of tube is Borosilicate Glass (3.3)

Range of the models

Cat.Ref.	DHElls	End Fittings	Tubes	Number of passes
DRGG	Glass	Glass	Glass	1
DRGM	Glass	Steel	Glass	1/2/3
DRMG	Steel	Glass	Glass	1

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TOP

CONSTRUCTION FEATURES

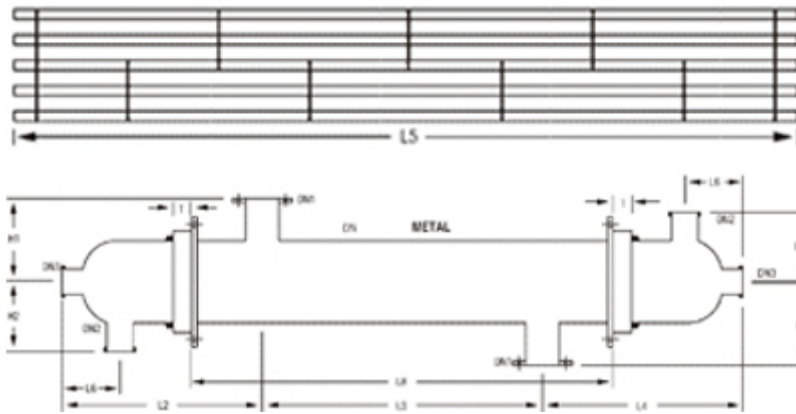


The glass tube are sealed individually into PTFE tube DHEET with special PTFE sockets and packing. This unique ferrule type sealing arrangement permits easy replacements and cleaning of tubes. Baffles on DHEll side ensure improved heat transfer by increased turbulence. Further details of construction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

Sealing principle similar on all models

- 1 METAL / GLASS BONNET
- 2 PTFE TUBE DHEET
- 3 THREADED BUSH
- 4 GLASS TUBE
- 5 BAFFLE
- 6 METAL / GLASS DHELL
- 7 PTFE TUBE
- 8 TIE ROD IN PTFE
- 9 CAST IRON FLANGE
- 10 SPRING
- 11 SCREWED ROD OR NUT

12 INSERT



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	-	-
DN 1	-	-	80	-	-	-	-	100	-	-	-	-	150	-	-
DN2	-	-	50	-	-	-	-	50	-	-	-	-	80	-	-
DN 3	-	-	25	-	-	-	-	40	-	-	-	-	40	-	-
DN 4	-	-	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	11	14	-	19	24	7	9	-	13	17	17	5	7	73 151	13

Tubes															
No. of Baffles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
All glass tubes have an external diameter of 13mm or 14mm and a wall thickness of 1 mm															



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
DRGG	DHEII	0.2	1.0	0.75
-	Tube	0.2	2.0	1.0 0.75
DRGM	DHEII	2.0	1.0	0.75
-	Tube	3.0	3.5	3.5
DRMG	DHEII	3.5	3.5	3.5

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

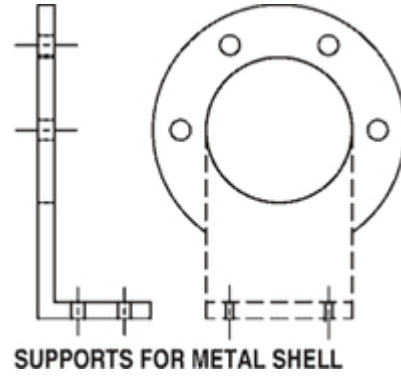
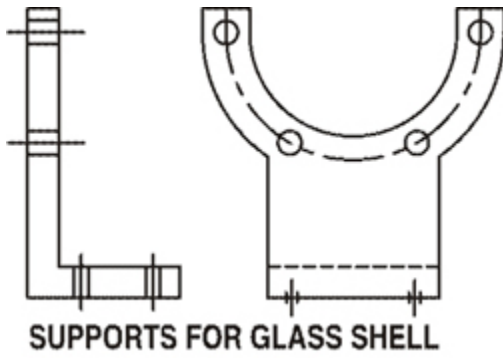
Maximum temperature difference between the DHEII side and tube side process fluids : 120° C.

PERFORMANCE & DESIGN DATA

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

Type of Heat transfer	Basis	Kcal/m ² 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

SUPPORTS



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

MOC of these supports is MS.