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SHELL & TUBE HEAT EXCHANGERS

Heat exchanger play a major role in chemical industry. Major functions of heat exchanger are cooling, heating, condensation, evaporation etc. There are mainly two types of heat exchangers (a) Shell & Tube type (b) Coil type.

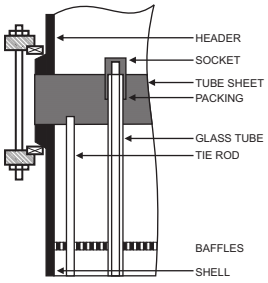
SHELL & TUBE HEAT EXCHANGERS

Model	Shell	Tube	Header	Duty
BRGG	Glass	Glass	Glass	For heat transfer between two aggressive media.
BRGM	Glass	Glass	Steel/FRP	For heat transfer between aggressive media in shell & non-aggressive media in tubes.
BRMG	Steel/FRP	Glass	Glass	For heat transfer between aggressive media in tubes & non-aggressive media in shell.

Shell & Tube Heat Exchangers offer large surface area with high heat transfer efficiency. This type of heat exchangers have wide acceptability in Chemical Industry due to its fine versatility in various areas like cooling, heating, condensation, evaporation, etc. Glass shell & tube heat exchangers have following features :

- Have good corrosion resistance, hence can be used with different types of chemicals & provide a good alternative for expensive MOC's like Graphite, Titanium, Tantalum etc.
- Have high heat transfer area & resist's fouling.
- Are quite user friendly as the installation procedure is hassle free.
- Easy replacement of tubes for cleaning or repair.
- Are available in wide range of heat transfer areas.

Constructional Features :



The shell side is made of baffle which provide large heat transfer area, while the tubes are inserted in the shell through PTFE Plates & proper packing, which makes it easier for cleaning & removing.

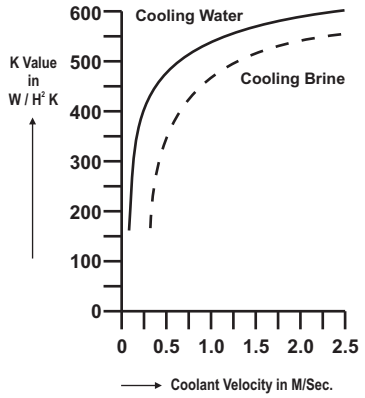
Thus, at the end Borolab's Shell & Tube Heat Exchangers comes with total user friendly mode for easy installation, running & better efficient output.

RANGE OF WORKING

Model	Side	Maximum Permissible Pressure Range, Kg/cm^2(g) 150 DN	225 DN	300 DN
BRGG	Shell	2.0	1.0	1.0
	Tube	2.0	1.0	1.0
BRGM	Shell	2.0	1.0	1.0
	Tube	3.5	3.5	3.5
BGMG	Shell	3.5	3.5	3.5
	Tube	2.0	1.0	1.0

The permissible working temperature for both Shell & Tube sides is 40 °C to 150 °C. The maximum temperature difference between shell side & tube side should be not more than 120 °C. The maximum permissible pressure range is mentioned above in the table.

PERFORMANCE & DESIGN



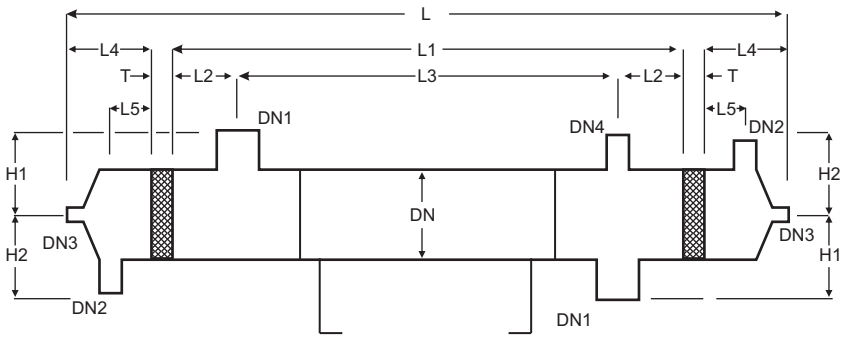
Medium	Use	U - Values Kcal/m^2 hr^{o}K	W/m^2 ^{o}K 300 DN
Steam water	Condensation	350-550	410-640
Water-Water	Cooling	250-350	290-410
Water-air	Cooling	30-60	35-70

The performance of Shell & Tube Heat Exchanger depends upon it proper designing. Shell & Tube Heat Exchanger has high oriented performance output i.e. better heat transfer ratio. The operating data from the client helps in designing procedure after which the most favorable Shell & Tube Heat Exchanger is selected. Some approximate heat transfer coefficient's are given in the above table for ready reference.

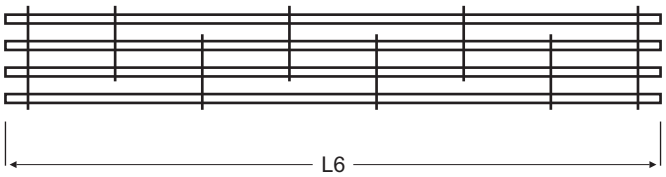
SPECIFICATION OF SHELL & TUBE H.E.

BRGG

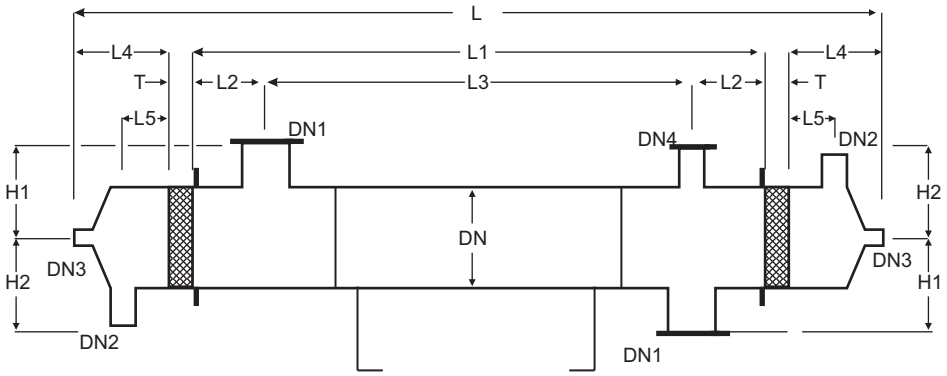
DIMENSIONAL SPECIFICATIONS



TUBE BUNDLES



BRMG



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	12/25
Area (m2)	3	4	5	6	6	8	10	12	12	16	21	25
DN	150				225				300			
DN1	80				100				150			
DN2	50				80				80			
DN3	25				40				40			
DN4	50				50				50			
H1	175				250				300			
H2	150				200				250			
L	2500	3100	3700	4300	2620	3220	3820	4520	2550	3150	3950	4550
L1	1900	2500	3100	3700	1900	2500	3100	3800	1800	2400	3200	3800
L2	150	150	150	150	225	225	225	225	225	225	225	225
L3	1600	2200	2800	3400	1450	2050	2650	3350	1350	1950	2750	3350
L4	250	250	250	250	300	300	300	300	300	300	300	300
L5	125	125	125	125	175	175	175	175	175	175	175	175
L6	1980	2580	3180	3780	2000	2600	3200	3900	1930	2530	3330	3930
T	50				60				75			
No. of Tubes	37				73				151			
No. of Baffles	11	15	19	23	7	9	13	17	5	7	9	11

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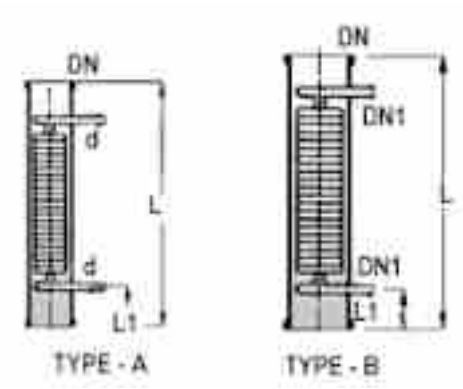
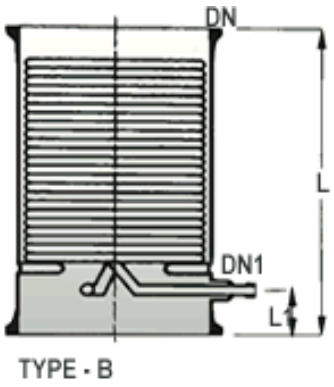
COIL CONDENSORS





Cat. Ref	DN	d/ DN1	L	L1	Type	Actual H.T.A. m2	Cross Area Cm2	Free Coolant Rate Kg/hr.	Max Jacket Cap. Litre
BHE3/3.5	80	16	600	100	A	0.35	5	1300	2
BHE4/5	100	19	600	100	A	0.50	30	2400	4
BHE4/6	100	19	750	100	A	0.60	30	2400	6
BHE6/10	150	25	600	100	B	1.00	52	2600	9
BHE6/15	150	25	850	100	B	1.50	52	2600	11
BHE9/25	225	25	800	100	B	2.50	125	3300	18
BHE12/25	300	25	600	125	B	2.50	175	5700	25
BHE12/40	300	25	900	125	B	4.00	175	5700	35
BHE16/40	400	25	600	125	B	4.00	450	6200	60
BHE16/50	400	25	700	125	B	5.00	450	6200	70
BHE18/60	450	40	750	150	C	6.00	820	4800	100
BHE18/80	450	40	900	150	C	8.00	820	6200	110
BHE24/120	600	50	1250	300	C	12.00	1520	6200	265

Condensors are used for condensation of vapour and cooling of liquids. They are made up of coils covered by glass shell.

The average coefficient of heat transfer in coil condensor is considered as :

Condensation 200-270 Kcal/m2,hroC (approx)

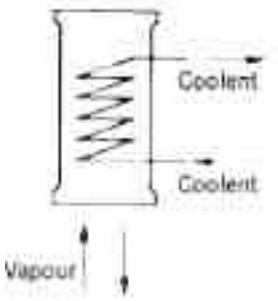
Cooling 100-250 Kcal/m2,hr,oC (approx)

Precautions to be taken in use of condensors

- Vapours should be passed through shell only.
- Maximum pressure of coolant should be 2.7 bars
- Adequate flow of coolant should be used.
- Steam should not be used in coils
- Coolant should not be heated to boiling point.
- Coolant control valve should be turned slowly.
- Coolant should be allowed to drain freely.
- Brine can be used in coils in a closed circuit.
- Water main should be connected with flexible hose.
- Ensure no freezing of water remaining in the coils.
- Condensers should be mounted vertically only.
- Condensers can be mounted in series to provide larger surface area.

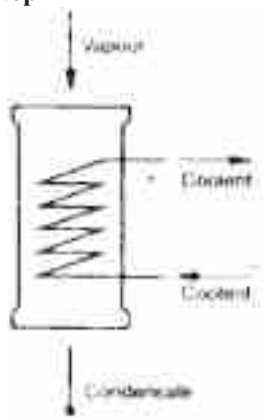
METHODS OF USE

Vapours from bottom



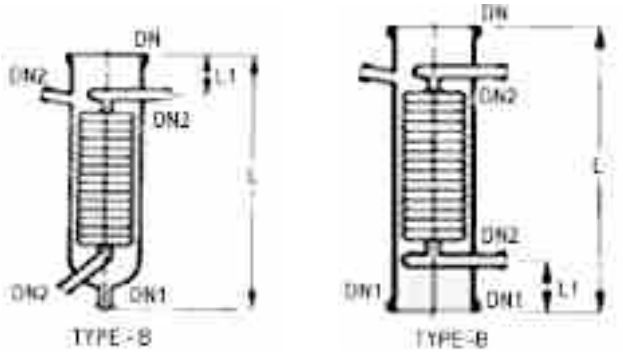
This method is simple to install over a reactor. However this results in condensate returning substantially at its condensing temperature. In this method care must be taken that condensate is not excessive that it can lead to "logging" the coils and create back pressure in the system. Generally a reflux divider is used below the condenser to take out the distillate.

Vapours from top



This method produce a cool condensate using the entire cooling surface area. This method should be used where the condensate can lead to "logging" of coils.

BOILERS



Cat. Ref	Dn	DN1	DN2	L	L1	Type	Actual H.T.A. m2	Free Cross Area Cm2	Jacket Cap. Litre
BHEB4	100	25	25	375	100	A	0.15	40	2
BHEB4/4	100	100	25	400	100	B	0.15	40	3
BHEB6	150	40	25	450	100	A	0.35	50	5
BHEB6/6	150	150	25	500	100	A	0.35	50	7
BHEB9	225	40	25	700	100	A	1.00	150	16
BHEB9/9	225	225	25	700	100	B	1.00	180	20
BHEB12/12	300	300	25	700	125	B	1.30	330	40

Boilers are used for vaporization of liquids by passing the steam in the coils. Boilers are made by fusing number of parallel coils in a glass shell. In Boilers, coils are designed to provide bigger cross section in the shell side as compared to condensers.

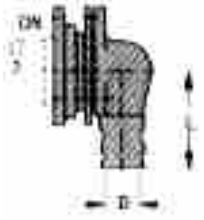
The average heat transfer in Boilers is considered as 350 Kcal/m2,hr,oC at a steam pressure of 3.5 bar.

Notes on use of Boilers :

- Steam should be passed in the coils at a maximum pressure of 3.5 bar which is equivalent to a temperature of 147°C.
- For higher temperature (maximum upto 200°C) heat transfer fluids can be passed in the coils.
- Cold liquids should be preheated for better results.
- Boilers should be mounted in an external circulatory loop (as shown in figure) and not direct at the bottom of flask or column.
- Under certain circumstances, boilers can be mounted in series to provide larger heat transfer area.

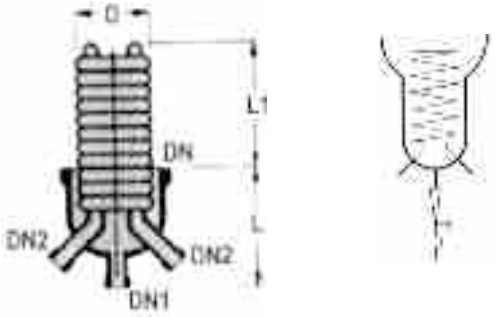
ANGLED HOSE CONNECTOR ASSEMBLIES

Cat Ref.	DN	d	L
BPMC1	25	22	70



Metal/Plastic angled hose connector assemblies are available to connect the flexible hose to the condensers. These are provided with a mating flange, a rubber gasket and nut bolts.

IMMERSIONS

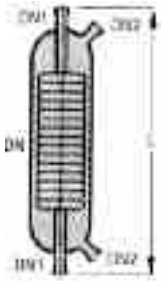


Cat. Ref.	DN	DN1	DN2	L	L1	d	Actual H.T.A. m2
BHEM6	150	40	25	175	200	145	0.4
BHEM9	225	40	25	275	200	200	0.6

Immersion heat exchangers are used to control exothemic reaction in glass vessels. They can be used with vessels having wider bottom outlet (type BVSR and BVSE). These are provided with a central hole through the coil battery so that a special, extended type, stirrer can be fitted which extends to the bottom of heat exchanger and provide through action.

In most applications, cooling water is used in coils (max. pressure 2.7 bar g.), but they can also be used with steam (max. pressure 3.5 bar g.). In latter case the coils must be completely immersed in liquid. Immersions are not recommended for use with products which have a tendency to crystalise.

PRODUCT COOLERS



Cat. Ref.	DN	DN1	DN2	L	Actual H.T.A. m2
BHEF1/1	50	25	16	450	0.10
BHEF1/2	50	25	16	600	0.20
BHEF1/3.5	80	25	16	600	0.35
BHEF1/5	100	25	19	600	0.50
BHEF1/10	150	25	25	600	0.70
BHEF1/15	150	25	25	850	1.25

Product coolers are used for cooling of liquids, typically, for the cooling of distillates from the distillation columns.

Unlike coil condensers, in product coolers, product travels through the coil battery and coolant through shell. This provides more resident time to the product to be cooled. For direct connection with distillate lines, all the product coolers are provided with 25 DN connections.