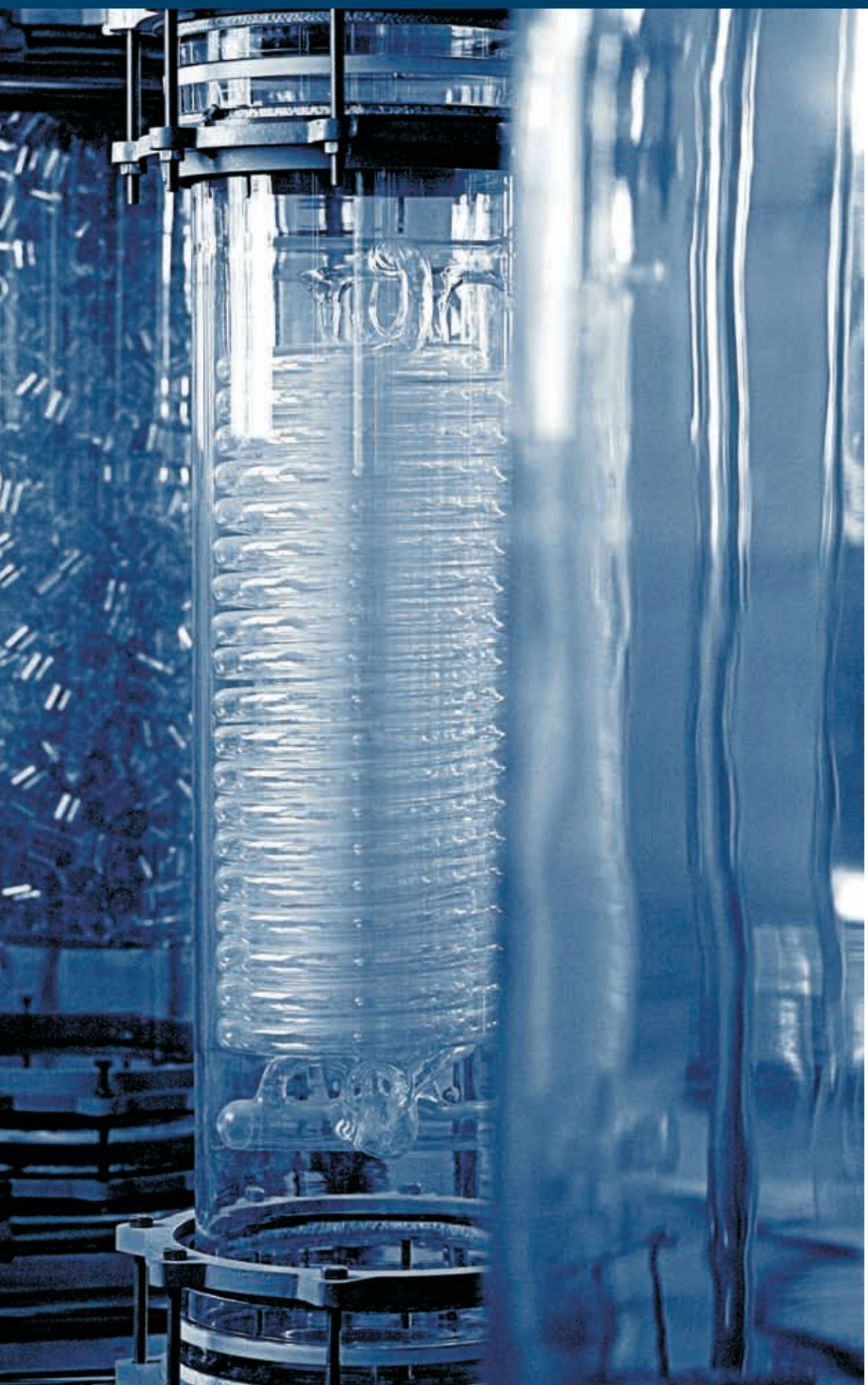
4. HEAT EXCHANGERS



HEAT EXCHANGERS

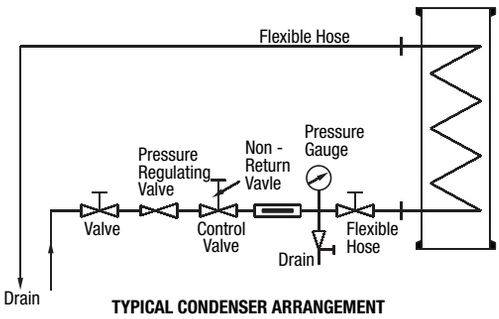
ablaze®

HEAT EXCHANGERS

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

COIL TYPE HEAT EXCHANGER

Coil type heat exchanger is mainly used as condenser or cooler. It can, however, be used for heat transfer between liquids & gases in general. It has the coil battery welded to the jacket making a one piece unit. The maximum allowable pressure in the coils is 2.7 bar gauge.



TYPICAL CONDENSER ARRANGEMENT

PERFORMANCE DATA

An approximate calculation of heat transfer surface areas can be based on the following guide figure for heat transfer coefficients.

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 – 0c	200-250	100-150	40-60

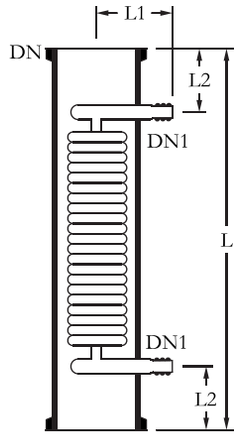
PRECAUTIONS TO USE CONDENSER ARE AS FOLLOWS:

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 close as practicable to the heat exchanger.
4. Care should be taken in arranging the coolant supply in order to avoid water hammer 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 coolant provided the suitable precautions against water hammer are taken.
7. Condensers can be mounted in series to provide larger surface area. Condensers should be mounted vertically only.
8. The maximum pressure in the coil is 2.7 bar. The maximum differential pressure across the coil is2.7 bar.

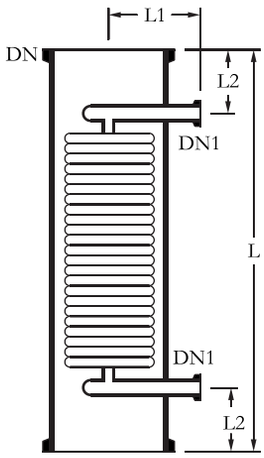
GLASS CONDENSER

HTA (m2)	DN	D/ DN1	L	L1	L2	Type	Jacket Cap. Ltr.	Coolant Rate Kg/h	*FCSA SHELL (cm2)	CAT. REF.
0.20	40	16	600	85	100	A	1	750	4.5	AHE1.5/2
0.35	50	16	600	90	100	A	1.25	1300	5	AHE2/3.5
0.35	80	16	600	90	100	A	2	1300	5	AHE3/3.5
0.50	100	19	600	120	100	A	4	2400	30	AHE4/5
0.60	100	19	750	120	100	A	6	2400	30	AHE4/6
1.00	150	25	600	150	100	B	9	2600	52	AHE6/10
1.50	150	25	850	150	125	B	11	2600	52	AHE6/15
2.50	225	25	800	180	125	B	18	3300	142	AHE9/25
2.50	300	25	600	250	125	B	25	5700	175	AHE12/25
4.00	300	25	900	250	125	B	35	5700	175	AHE12/40
4.00	400	25	600	265	125	B	60	6200	450	AHE16/40
5.00	400	25	700	265	125	B	70	6200	450	AHE16/50
6.00	450	40	750	325	150	B / C	100	4800	820	AHE18/60
8.00	450	40	900	325	150	B / C	110	6200	820	AHE18/80

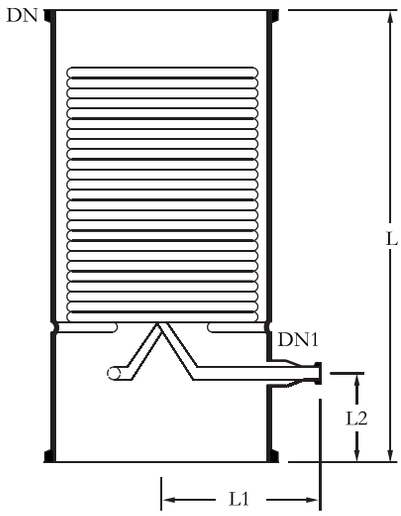
Note : L / L1 / L2 may be + 10mm.
* FCSA- Free Cross Section Area .



TYPE-A



TYPE - B



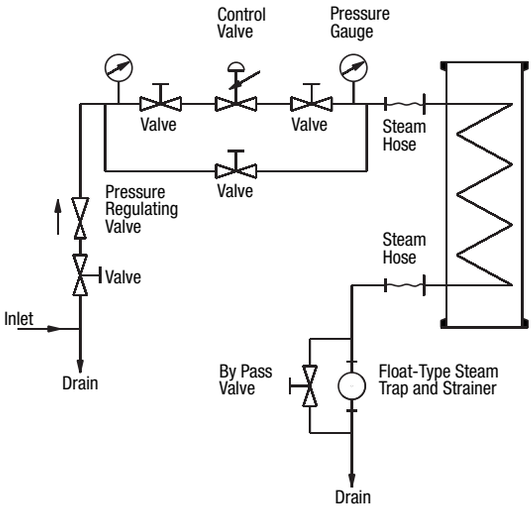
TYPE -C

GLASS BOILER

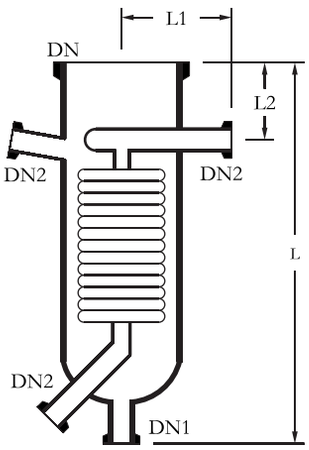
Type AHEB4, AHEB6 and AHEB9 glass coil-type boiler is normally mounted in external circulatory loops using a spherical vessel as the main still. It should not be installed in the bottom of a flask or column.

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

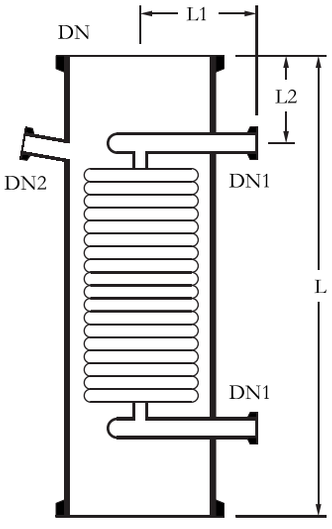
The maximum pressure in the coils is 3.0 barg. The maximum differential pressure across the coils is 3.0 bars. Please refer to the performance data for glass coil-type.



TYPICAL BOILER ARRANGEMENT



TYPE- A



TYPE B

PERFORMANCE DATA

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

The heat transferred in most sizes can be considered on average as 250 Kcal/hr – m^2 °c with a steam pressure in the coils of 3.0 barg, although this figure declines marginally at lower pressure.

PRECAUTIONS TO USE GLASS BOILER ARE AS FOLLOWS:

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 unidirectional flow 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 the conditions of use and size of heat exchanger. For example, with the AHEB 12/12 , 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.

HTA (m2)	DN	DN1	DN2	L	L1	L2	*FCSA SHELL (cm2)	Jacket Cap. Ltr.	Type	CAT. REF.
0.15	100	25	25	375	125	100	40	2	A	AHEB 4
0.15	100	25	-	400	125	100	40	3	B	AHEB 4/4
0.35	150	40	25	450	150	100	50	5	A	AHEB 6
0.35	150	25	-	500	150	100	50	7	B	AHEB 6/6
1.00	225	40	25	700	180	100	150	16	A	AHEB 9
1.00	225	25	-	700	180	100	180	20	B	AHEB 9/9
1.30	300	25	25	700	215	125	330	40	B	AHEB 12/12

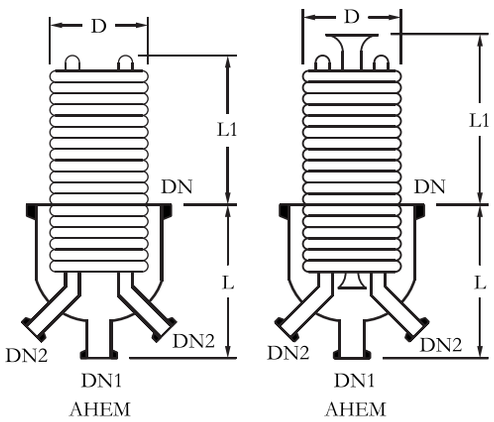
* FCSA- Free Cross Section Area .

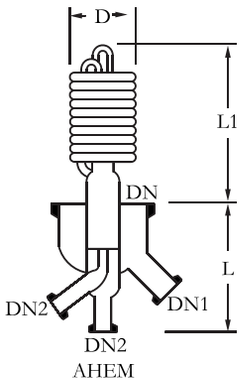
GLASS IMMERSION HEAT EXCHANGER

Immersion heat exchanger is 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 bars.

Area (m2)	DN	DN1	DN2	L	L1	D	CAT. REF.
0.4	150	40	25	200	200	145	AHEM 6
0.6	225	40	25	300	200	200	AHEM 9



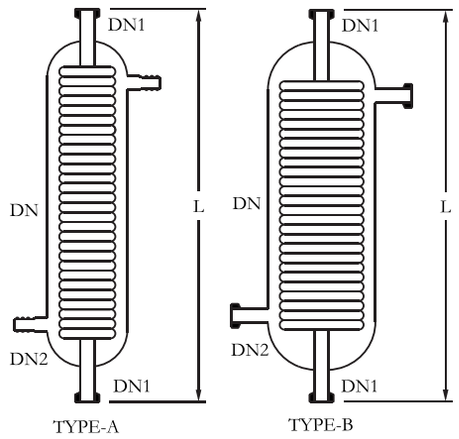


PRODUCT COOLER

AHEF product cooler is general purpose cooler, used typically for the cooling of products from distillation columns. The cooler is 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.

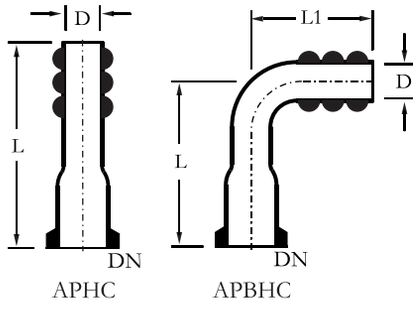
For connection of the cooling water inlet and outlet, we recommend the use of angled hose connections.

Area (m2)	DN	DN1	DN2	L	TYPE	CAT. REF.
0.1	50	25	16	450	A	AHEF 1/1
0.2	50	25	16	600	A	AHEF 1/2
0.3	80	25	16	600	A	AHEF 1/3
0.35	100	25	19	600	A	AHEF 1/3.5
0.50	150	25	25	600	B	AHEF 1/5
1.00	150	25	25	850	B	AHEF 1/10



HOSE CONNECTOR

This glass connector is used to connect flexible hose to the inlets and outlets of coil type condensers.



SHELL AND TUBE HEAT EXCHANGER

Shell and tube heat exchanger provides a versatile alternative to the coil-type heat exchnger described in previous pages. Shell and tube heat exchanger is particularly suitable for applications where large heat transfer area is required in relatively confined spaces. It is equally suitable for heat transfer between two liquids or gases.

Shell & tube heat exchanger is available in single-pass as well as multi - pass.

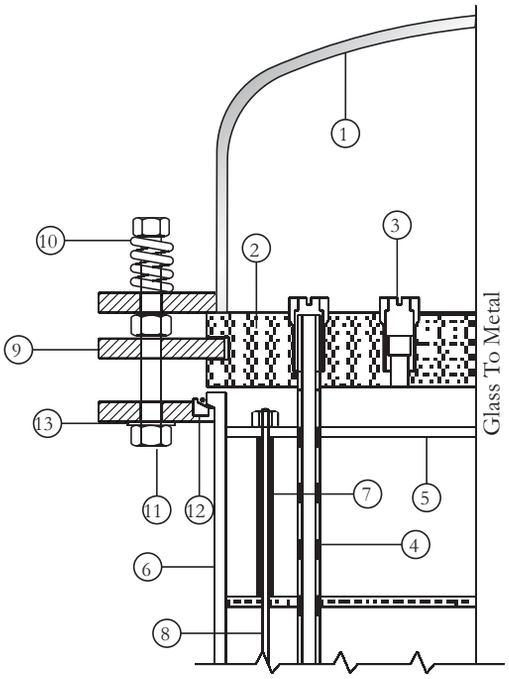
Both versions are available with glass or mild steel shells in combination with glass tubes as standard. Consequently, there are three basic models.

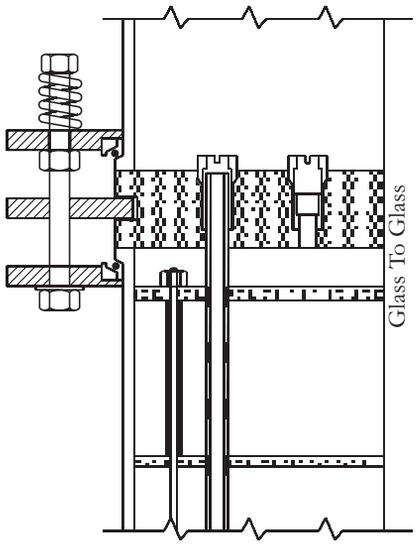
RANGE OF THE MODELS

CAT.REF.	SHELLS	END FITTINGS	TUBES	NUMBER OF PASSES
ARGG	Glass	Glass	Glass	1
ARGM	Glass	Steel	Glass	1/2/3
ARMG	Steel	Glass	Glass	1

SALIENT FEATURES

- Universal corrosion resistance
- Outstanding heat transfer
- Space-saving arrangement by installing in horizontal or vertical position
- Simple replacement of inner tubes for repair and cleaning
- Low maintenance cost
- Available in wide range of HTAs.





CONSTRUCTION FEATURES

The glass tubes are individually sealed in the PTFE tube plates using threaded bushes. The special construction ensures permanent tightness and easy replacement and cleaning of tubes. Baffles on shell side ensure improved heat transfer by increased turbulence.

Sealing principle similar on all models :

1 Metal Cover (Bonnet)

2 PTFE Tube Plate (Tube Sheet)

3 Threaded Bush

4 Glass Tube

5 Baffle

6 Glass Shell

7 PTFE Tube

8 Tai Rod in PTFE

9 Cast Iron / SS Flange

10 Springs

11 Screwed Rod or Nut

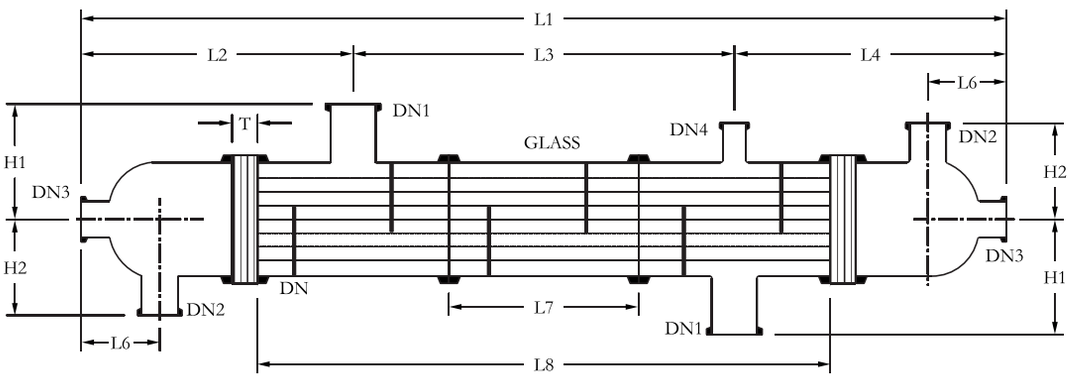
12 Insert

13 Flat Washer

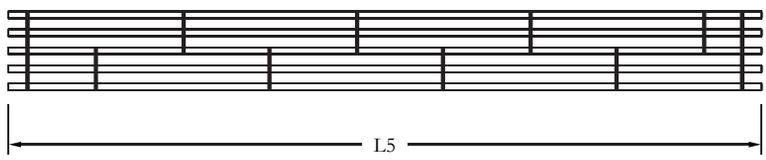
CAT . REF. ARGG/ARGM.	6/3	6/4	6/5	6/6	9/6	9/8	9/10	9/12	12/12	12/16	12/21	12/26
Area (m2)	**3**	**4**	**5**	**6**	**6**	**8**	**10**	**12**	**12**	**16**	**21**	**26**
DN	150				225				300			
DN1	80				100				150			
DN2	50				50				80			
DN3	25				40				40			
DN4	50				50				50			
H1	175				250				300			
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 1mm.

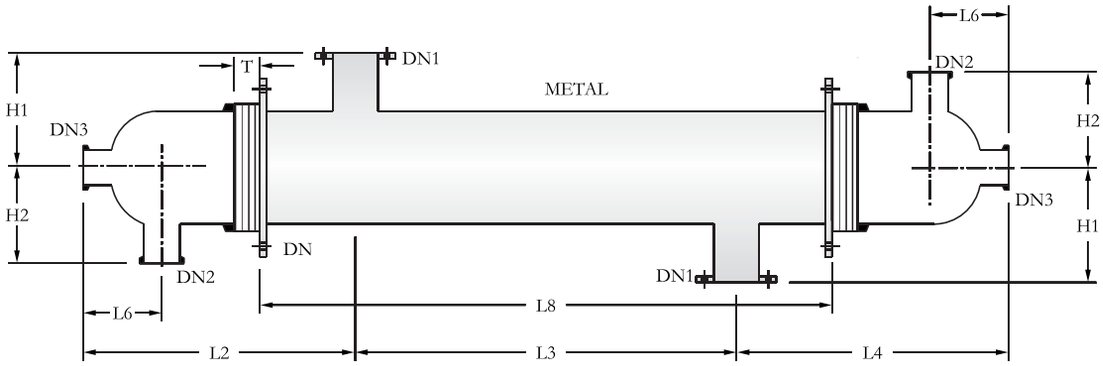
ARGG / ARGM



T. BUNDLE



ARMG



OPERATING RANGE

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

Permissible Operating Pressure Ranges (bar g)

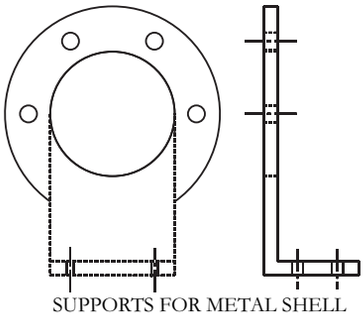
Models	Side	DN150	DN225	DN300
ARGG [Glass Shell/Glass Header]	Shell	2.0	1.0	0.75
	Tube	2.0	1.0	0.75
ARGM [Glass Shell/Metal Header]	Shell	2.0	1.0	0.75
	Tube	3.0	3.0	3.0
ARMG [Metal Shell/Glass Header]	Shell	3.5	3.5	3.5
	Tube	2.0	1.0	0.75

- *Maximum operating temperature at shell and tube sides: - 40 deg C to 150 deg C.*
- *Maximum temperature difference between the shell side and tube sides process fluids : 120 deg C.*

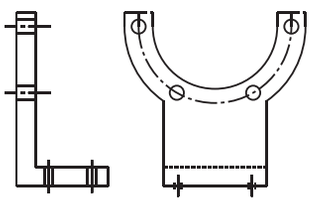
PERFORMANCE & DESIGN DATA :

The table given below is an indication of the performance of glass shell and tube heat exchanger in several typical applications. More specific advice can be given on receipt of details.

TYPE OF HEAT TRANSFER	BASIS	Kcal/m^2h^0C
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 FOR METAL SHELL



SUPPORTS FOR GLASS SHELL

SUPPORT :

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

MOC of these supports is M.S.