

TM

ProChill

100 NTR - 1400 NTR



HOT WATER DRIVEN ABSORPTION CHILLERS

*The Latest Advanced Technology
High Efficiency Series*



The eco-friendly solution

FOR AIRCONDITIONING AND INDUSTRIAL COOLING





Conserving Energy and Preserving the Environment.

At Thermax, not only are the products eco-friendly, but also the manufacturing processes. They even conform to the Kyoto Protocol and are in absolute tandem with Clean Development Mechanisms Code (CDM) which is becoming the order of times worldwide.



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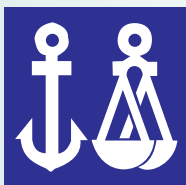
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some of our prestigious installations

Name	Application	Country
Diamler Chrysler	Automobile	Germany
Hospital San Rafael	Hospital	Spain
Panasonic	Electronics	UK
St. David's Hall	Auditorium	UK
Bosch	Electronics	Germany
Kelanco Ltd.	CHP	UK
Pleitz	Shopping Mall	Germany



ISO 14001



REGISTERED FIRM



THERMAX

a company with engineering excellence ...

Thermax, a technology driven company has been in the core sectors of **Energy, Environment and Exports** for more than 25 years and has defined its business as - **Conserving Energy and Preserving the Environment**. Electricity is scarce and expensive. It should be used only where it is irreplaceable. Keeping this in mind, Thermax took up the challenge of finding an alternative for traditional electrically operated compression chillers. About a decade ago, Thermax introduced the revolutionary concept of **Vapour Absorption Chillers** for air-conditioning and process cooling requirements, in India.

Considering the growing demand for Vapour Absorption Chillers, Thermax set up its state-of-the-art manufacturing plant in 1988, in India at Pune which has been awarded the ISO 9001 and the ISO 14001 certificates. Needless to mention, these chillers conform to international standards. To maintain these high standards, a team of workers and engineers is specially trained and exposed to global work and quality culture. With this positive and innovative attitude, Thermax has carved a niche in the global market where competition is stiff and performance is the only criteria.

Thermax sales and after-sales service is efficient, responsive and responsible. Our Engineers understand customer requirements, design the most optimal solutions and ensure quality at every stage, to achieve customer delight.





Thermax manufactures the environment friendly and energy efficient Vapour Absorption Chillers at its plant in Pune, India. Its state-of-the-art manufacturing facility is awarded with ISO 9001 and ISO 14001 certificates. Stringent quality control procedures alongwith a skilled workforce ensure that a highly reliable product leaves the factory. The equipment and manufacturing processes conform to most of the International standards.

Thermax's manufacturing capabilities are confirmed by the fact that over the years Thermax has installed many chillers in countries like USA, Germany, UK, Spain, Italy, Middle East, South East Asia with the product conforming to the respective country standards like ETL, CE, TUV, DNV, ISPE, ASME, etc.

The chillers can be performance tested under the simulated site conditions before it leaves the factory. The factory assembled and tested unit considerably reduces the time needed for installation and commissioning of the units at site.



CNC drilling machine with high speed and direct feed technology ensures fine tube hole finish and accuracy, which is important for leak tight expansion and effective heat transfer.



CNC Gas cutting machine for plate cutting ensures precision cutting of shell plates and profile cut tube plates.



A Helium leak detection test ensures there is no leakage at the welding joints.

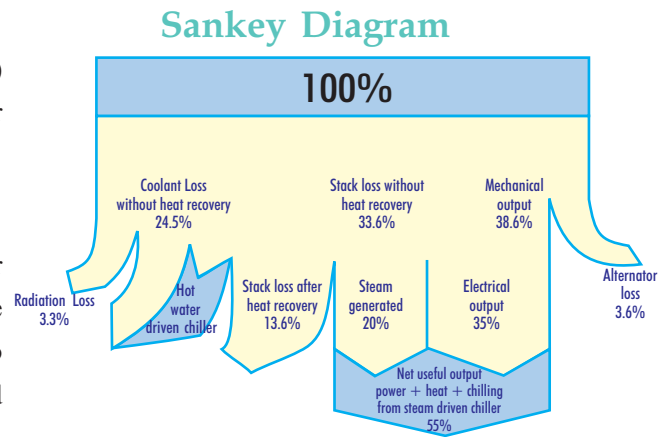
CHPC

Combined Heat, Power and Cooling System :

The concept of co-generation by means of Genset (Engine) based CHP's is becoming increasingly popular worldwide for reducing overall energy costs.

Sankey Diagram :

The Sankey diagram shows the heat energy distribution per unit quantity of fuel to a Genset. The portion indicated in blue represents the net useful output which is raised from 35% to 65% by recovering the waste heat from exhaust gases and jacket water, to enhance the utilization of fuel.



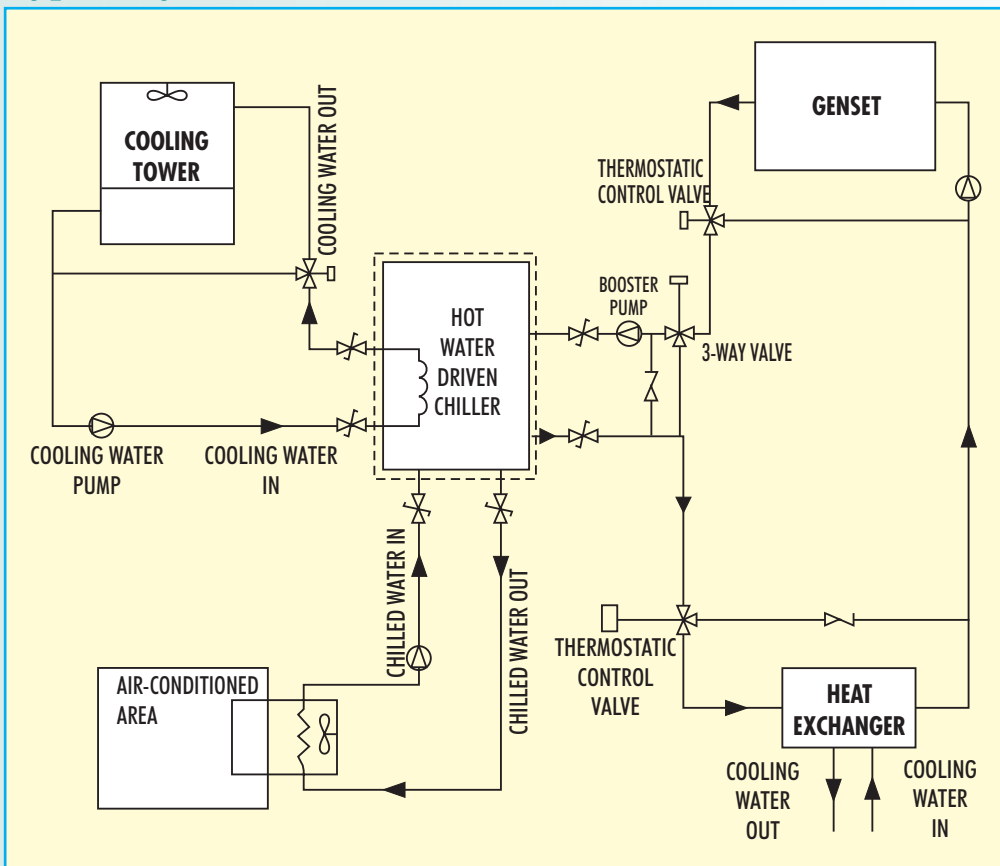
Around 25% of the input energy of the Genset is wasted in a cooling tower to cool the jacket water coming out of the engine, which is at a high temperature. The same heat can be used as an energy heat source for the Hot water driven chiller to produce chilling at a negligible cost. The typical system schematic given below explains the connectivity between the Genset and the Hot water driven vapour absorption chiller.

Indicative Table

Genset Capacity	Indicative Chilling Capacity (TR)
6 MW	225
4 MW	150
2.5 MW	100
1.5 MW	70

Jacket water Inlet / Outlet Temperature : 90.6 / 85°C

Typical System Schematic for Genset / Hot Water Driven Chiller





features

ProChill™

hot water driven absorption chillers

- **Capacity :**

Thermax chillers, achieving chilled water temperature upto 4.5°C, are available in the following range:

Low Temperature (LT): 100 NTR - 650 NTR *

Medium Temperature (MT): 100 NTR- 1400 NTR

High Temperature (HT): 100 NTR- 1400 NTR

- **Operating Hot Water Temperatures:**

Low Temperature (LT): 70°C - 110°C

Medium Temperature (MT): 110°C - 150°C

High Temperature (HT): 150°C - 200°C

- **10-100% Stepless Modulation:**

For cooling loads ranging from 10% to 100% of the designed capacity of the chiller, the 3-way diverting valve automatically varies hot water flow in order to maintain the temperature of chilled water leaving the chiller. This ensures better part load performance.

- **Split Evaporator Design:**

The chillers come with split design and other innovations for higher efficiency.

- **Auto De-crystallization:**

Thermax chillers are installed with a unique auto de-crystallization circuit to virtually eliminate any chances of crystallization.

- **On-line Purging:**

The factory mounted and tested purging unit consists of an electrical motor driven purge pump, storage tank, necessary piping and valves. Any non-condensable gas generated in the chiller during operation, is purged continuously into the storage tank, thereby maintaining low vacuum in the shell. The non-condensable gases collected in the storage tank can be purged periodically.

- **Side Exit Nozzles:**

The absorber, evaporator and condenser headers are provided with side exit nozzles for ease of maintenance and lower down-time. The absorber and condenser headers are hinged type, for easy access to the tube bundle and eliminate need for heavy lifting arrangements.

* Low temperature (LT): 10 NTR to 80 NTR available as cogenie series.

- **Gravity Feed System :**

Thermax chillers use gravity feed, non-pressurised super-spraying system, for spraying refrigerant and absorbent. This avoids the use of nozzles, which have the problems of clogging, wear & tear.

- **PLC Based Control Panel :**

Thermax chillers are provided with state-of-the-art PLC based control panel with unique display, user friendly interface and data-logging system.

- **Cross-over Piping :**

The cross-over piping from absorber to condenser is a standard feature in Thermax vapour absorption chillers. It reduces the piping work, welding, at site.

- **Isolation Valves for Pumps :**

Isolation valves provided on the pumps, facilitate on-line pump maintenance, without breaking the vacuum in the Thermax chillers. This ensures minimum downtime.

- **High Temperature Generator Tubes :**

Thermax hot water driven chillers use the following tube materials:

Low fin copper tubes in the generator for LT series

SS 430 Ti ferritic stainless steel tubes in the generator for MT series

SS 430 Ti ferritic stainless steel tubes in the high temperature generator for HT series

- **Corrosion Inhibitors :**

Thermax uses the new generation corrosion inhibitor, Lithium Molybdate, which is more effective than Lithium Nitrate and Lithium Chromate, which are conventionally used. Lithium Nitrate can generate Ammonium Nitrate (NH_4NO_3) which is harmful to copper.

optional features

- **Chiller Mounted Canned Motor Pumps :**

When specified, Thermax can offer chiller mounted standby absorbent and refrigerant pumps.

- **Chiller Mounted Bearing Monitoring for Canned Motor Pumps :**

As a special option Thermax can provide a TRG meter for chiller mounted bearing monitoring of the pumps. By continuously measuring the bearing clearance, through eddy currents, the TRG reading pro-actively lets the user know the health of the bearing at any given instant.

- **Auto-purging :**

When specified, Thermax chillers can come with automatic purging system that expels non-condensable gases continuously out of the system, thereby enhancing greater convenience in operation. This drastically reduces / eliminates frequent human intervention during operation.

- **Special Tube Material for Evaporator / Absorber / Condenser :**

The selection of tube material is done purely on the basis of the water quality available at the jobsite. Accordingly Thermax can offer the following special tube materials :

- Cupro-nickel
- SS-316L
- Titanium

- **Multi-sectional Shipment Arrangements :**

For convenience of shipping and rigging, the vapour absorption chillers can be shipped in two or more sections depending upon the site requirements. This is particularly beneficial for retrofit jobs.

- **Factory Performance Test :**

After assembly, Thermax absorption chillers can be individually tested for performance at the conditions specified by the customer.

During Performance Test, readings are taken for various parameters like :

- Chilled water inlet / outlet temperatures
- Capacity
- Cooling water inlet / outlet temperatures
- Hot water inlet / outlet temperatures



● Improved Reliability :

Thermax vapour absorption chillers incorporate a state-of-the-art programmable logic controller, which incredibly enhances the flexibility and reliability of the chiller. It brings along all the advantages of a Solid State Control System. Elimination of rigid electro-mechanical control components promises enhanced reliability and fail safe operation, which reduces maintenance and ensures minimum downtime of the chiller.

● Elaborate Diagnostics :

Thermax Control system provides a host of diagnostic information such as Hardware related faults, Chiller trip causes, Sensor errors, Pump errors and Data history regarding previously occurred faults and alarms. This equips the operator with an overview of the chiller and adequate data for faster and easier troubleshooting and routine maintenance.

● Easier Operation & Maintenance :

Unique 4 line display, keypad and the software constitute a user-friendly operator interface. The operator can easily control the chiller functions, with the aid of self-explanatory messages appropriately displayed on the screen. The status screens provide audio-visual alarms and display warnings about the abnormal conditions in the chiller function. This alerts the operator, specifying the abnormality, to initiate the necessary action.

● Data Acquisition and Logging :

Control system allows the user to log parameters noted in the last one week, at a sampling time of one hour. During a chiller trip condition, the data is logged at a faster, adjustable sampling time. Also a log of last six alarms with date and time stamp is maintained.

● Holiday Schedule :

Client can programme chiller operating schedule as per his convenience so that the chiller is switched on or switched off as per the programmed schedule. It can be set by the customer anytime.

● Modem Connectivity (Optional) :

Through modem the control panel can also be connected to the nearest Thermax service center as well as to the head office, from where the Thermax engineer can monitor the chiller performance. This results in an immediate response to customer service call.

● PC Connectivity (Optional) :

Man Machine Interface (MMI) - Supervisory Control and Data Acquisition (SCADA) software makes it possible to display real time trends and set points to the host computer. This allows remote control of the Thermax chillers and does away with a logbook and a dedicated operator.

● DCS/BAS/BMS Connectivity (Optional) :

With the help of RS485 port on the PLC, the panel can achieve connectivity to the client's BAS / BMS / DCS. This connectivity can be done through proper protocol compatibility. This provides flexibility in the operation of the absorption chiller without manual intervention through client's BAS / BMS / DCS.

safeties

hot water driven absorption chillers

● Antifreeze Protection :

- L-cut - refrigerant pump
- Antifreeze thermostat
- Chilled water pump interlock
- Chilled water flow switch
- Chilled water DP switch

● Crystallization Protection :

- HT Generator / Generator temperature high cutout*
- Cooling water temperature low cutout

● Alarm Cycle :

- Chiller routine fault alarm
- Total shutdown alarm

● Motor Protection :

- Absorbent pump overload relay
- Refrigerant pump overload relay
- Absorbent pump thermal cutout
- Purge pump overload relay

● Pump Cavitation Safety :

- Absorbent pump level relay (HT series)
- Refrigerant pump level relay

* HT - High Temperature

As the Vapour Absorption Chillers work under vacuum conditions, the manufacturing of these chillers is very critical with respect to leak tightness. Hence it is necessary to follow stringent quality control procedures and also perform leak detection tests. Understanding the importance, Thermax carries out the leak detection test in the following sequence :

1. Nitrogen or Soap Test :

Nitrogen is charged into the shell side of the chiller upto 1.3 to 1.4 kg/cm²g pressure and soap solution is sprayed on all the joints and expanded tube ends. In case of leakage, Nitrogen leaks out, forming soap bubbles, indicating the leak points.

2. Decay Test :

The chiller is kept under pressurized condition for 24 hours, by charging it with Nitrogen upto 1.3 kg/cm²g pressure on the shell side. In case of leakage, Nitrogen escapes out, resulting in drop in Nitrogen pressure inside the chiller, indicating leakage.

3. Helium Spray Test :

Helium, the next smallest molecule after Hydrogen, can leak through very minute holes. In this test Helium is sprayed on all the joints of the chiller. As the chiller is under vacuum conditions, leakages, if any, will result in Helium entering into the chiller and thus will be displayed on the screen of Helium leak detector. The joints are marked for repairs.

4. Helium Shroud Test :

In this test, the chiller is fully covered by a polythene sheet and Helium is passed from below, to observe the cumulative leak rate of the entire chiller.

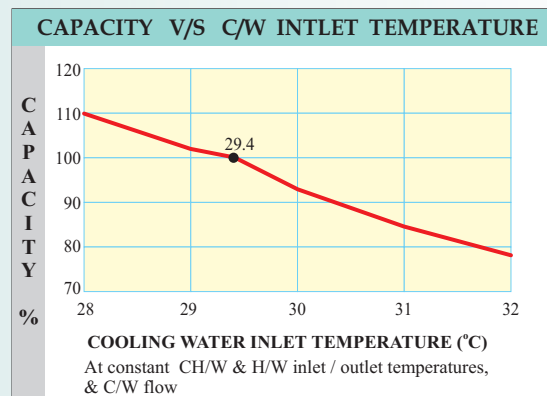
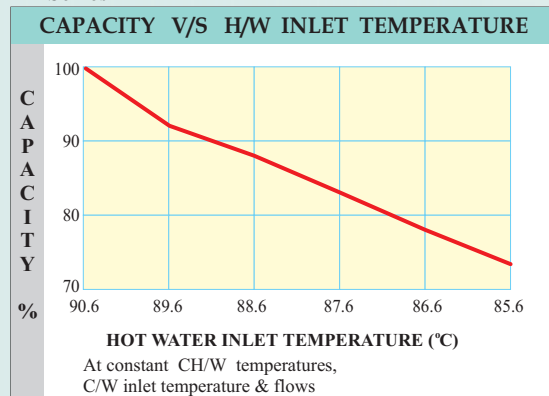
5. Hydraulic Test :

After the chiller passes all the above tests, it is tested for hydraulic test, at 1.5 times the design pressure on the tube side.

PERFORMANCE CURVES

hot water driven absorption chillers

LT Series



CH/W : Chilled Water
 C/W : Cooling Water
 H/W : Hot Water

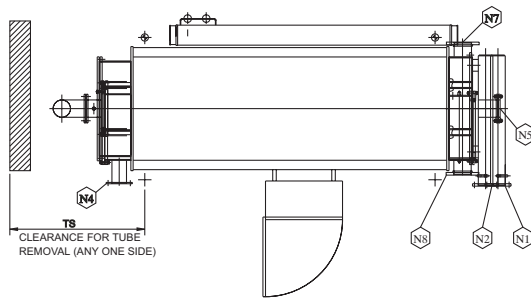
* The above graphs are for indicative purpose only.

LT SERIES - TECHNICAL SPECIFICATIONS

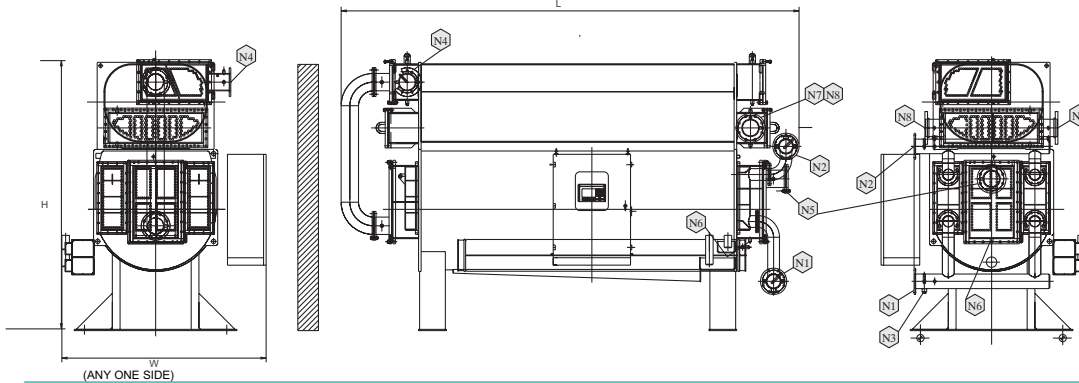
MODEL NUMBERS		UNIT	LT 10 S	LT 14 S	LT 16 S	LT 21 S	LT 27 S	LT 31 S	
NOMINAL REFRIGERATION CAPACITY		NTR	100	140	160	210	270	310	
		kW	352	493	563	739	950	1091	
CHILLED WATER CIRCUIT	Flow Rate	m ³ /hr	55	77	88	115.5	148.5	170.4	
	Inlet / Outlet Temperature	°C	12.2 / 6.7						
	Friction Loss	m.w.c.	7.8	7.2	7.9	7.0	7.8	7.6	
	Connection Diameter	mm NB	100	125		150		200	
	No of passes (Evaporator)	nos.	6				5		
COOLING WATER CIRCUIT	Flow Rate	m ³ /hr	100	140	160	210	270	310	
	Inlet / Outlet Temperature	°C	29.4 / 36.8						
	Friction Loss	m.w.c.	5.5	5.0	5.3	7.0	7.9	7.7	
	Connection Diameter	mmNB	125	150		200		250	
	No of passes (Absorber)	nos.	3						
No of passes (Condenser)	nos.	2							
HOT WATER CIRCUIT	Flow Rate	m ³ /hr	81	112	128	168	216	246	
	Inlet / Outlet Temperature	°C	90.6 / 85						
	Friction Loss	m.w.c.	4.0	1.6	1.9	2.8	3.2	2.3	
	Connection Diameter	mmNB	150				200		
	No of passes (Generator)	nos.	3	2					
ELECTRICAL DATA	Absorbent Pump	kW (A)	1.5 (5.0)			3.0 (9.5)			
	Refrigerant Pump	kW (A)	0.3 (1.4)						
	Purge Pump	kW (A)	0.55 (0.8)						
	Total power consumption	kVA	5.5			8.7			
	Power Supply		415 V (± 10%), 50 Hz (± 5%), 3 Ph + N						

Note: Specifications for MT and HT series are available on request

TYPICAL GENERAL ARRANGEMENT



NOZZLE SCHEDULE			
NOZZLE	NOZZLE FL. RATING	DESCRIPTION	QTY
N1	B.S.10 TABLE-E / ANSI # 150	CHILLED WATER INLET	1
N2	B.S.10 TABLE-E / ANSI # 150	CHILLED WATER OUTLET	1
N3	1/2" BSP	CHILLED WATER DRAIN PLUGGED	1
N4	B.S.10 TABLE-E / ANSI # 150	COOLING WATER INLET	1
N5	B.S.10 TABLE-E / ANSI # 150	COOLING WATER OUTLET	1
N6	1/2" BSP	COOLING WATER DRAIN PLUGGED	1
N7	B.S.10 TABLE-H / ANSI # 150	HOT WATER INLET	1
N8	B.S.10 TABLE-H / ANSI # 150	HOT WATER OUTLET	1



- NOTES:-
- (1) INDICATES THE POSITION OF ANCHOR BOLTS.
 - (2) INDICATES THE POSITION OF THE POWER SUPPLY CONNECTION ON CONTROL PANEL.
 - (3) MINIMUM INSTALLATION CLEARANCE :
CONTROL PANEL SIDE : 1200 mm
TOP : 200 mm
OTHERS : 500 mm

FOR REFERENCE ONLY

MODEL NUMBERS		UNIT	LT 10 S	LT 14 S	LT 16 S	LT 21 S	LT 27 S	LT 31 S	LT 34 S	LT 38 S	LT 42 S	LT 47 S	LT 52 S	LT 60 S	LT 65 S
NOMINAL REFRIGERATION CAPACITY		TR	100	140	160	210	270	310	340	380	425	470	525	600	650
DIMENSIONS	Length (L)	mm	4400	4700		5200		5500		7000		8200		8600	
	Width (W)	mm	2100			2500			3000			3300			
	Height (H)	mm	2800	3000		3400		3600		4000		4400			
	Clearance for tube removal (approx.)	mm	3400			4100			6560		8500				
	Operating weight (approx.)	x 10 ³ kg	8.1	9.5	11	14.3	16.5	18.8	19.4	26	29.4	31.2	32.3	36.8	39.2
	Maximum Shipping weight (approx.)	x 10 ³ kg	7.7	8.6	10.1	12.8	15	16.8	17.4	23.9	27.2	28.4	29	32.8	34.8

LT 34 S	LT 38 S	LT 42 S	LT 47 S	LT 52 S	LT 60 S	LT 65 S
340	380	425	470	525	600	650
1197	1338	1496	1654	1848	2112	2288
184.7	208.9	233.7	258.4	288.7	329.9	357.4
12.2 / 6.7						
7.5	4.9	5.2	8.5	8.6	8.1	8.3
200			250			
5	4					
340	380	425	470	525	600	650
29.4 / 36.8			29.4 / 36.7			
7.7	3.6	3.9	5.5	5.9	7.2	7.8
250	300				350	
3	2					
2	1					
272	304	341	376	421	477	516
90.6 / 85						
2.6	4.9	5.3	1.8	2.0	2.3	2.5
200						
2			1			
3.0 (9.5)				4.5 (13)		
0.3 (1.4)			1.5 (5.0)			
0.55 (0.8)						
8.7			11.3		13.8	
415 V (± 10%), 50 Hz (± 5%), 3 Ph+N						

Minimum operating cooling water temperature = 20°C

Minimum chilled water outlet temperature = 4.5°C

Ambient condition should be between 5 to 45°C

Fouling Factor in water circuits is 0.0001 metric

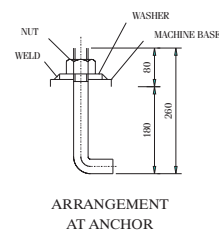
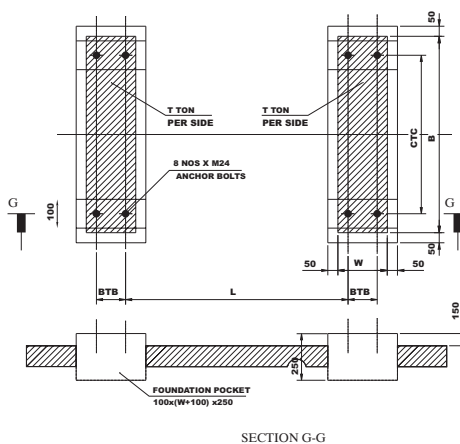
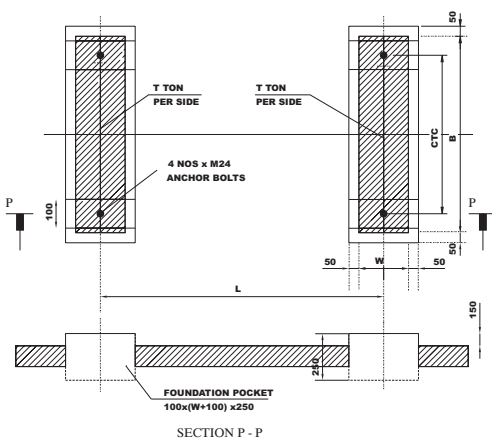
Maximum working pressure in chilled / cooling water lines = 8 kg/cm²g

Maximum working pressure in hot water lines = 5 kg/cm²g

Performance based on JIS B8622.

FOR CONDITIONS OTHER THAN ABOVE
PLEASE CONTACT THE NEAREST
THERMAX OFFICE / DISTRIBUTOR

FOUNDATION DRAWING



INDICATES THE BASE OF MACHINE

MODEL	L	W	B	CTC	T
	mm	mm	mm	mm	TON(10 ³ kgs)
LT 10S	2866	220	1690	1550	4.05
LT 14S	2816	270	1580	1380	4.75
LT 16S	2816	270	1580	1380	5.5
LT 21S	3416	270	1640	1440	7.15
LT 27S	3424	270	1640	1440	8.25
LT 38S	4592	320	1975	1135	13.0
LT 42S	4592	320	1975	1135	14.7
LT 47S	5826	320	1975	1135	15.6
LT 52S	5826	320	1975	1135	16.15

MODEL	L	W	B	CTC	BTB	T
	mm	mm	mm	mm	mm	TON(10 ³ kgs)
LT 31S	3304	270	1840	1500	120	9.4
LT 34S	3304	270	1840	1500	120	9.4
LT 60S	5486	420	2412	2272	240	18.4
LT 65S	5486	420	2412	2272	240	19.6

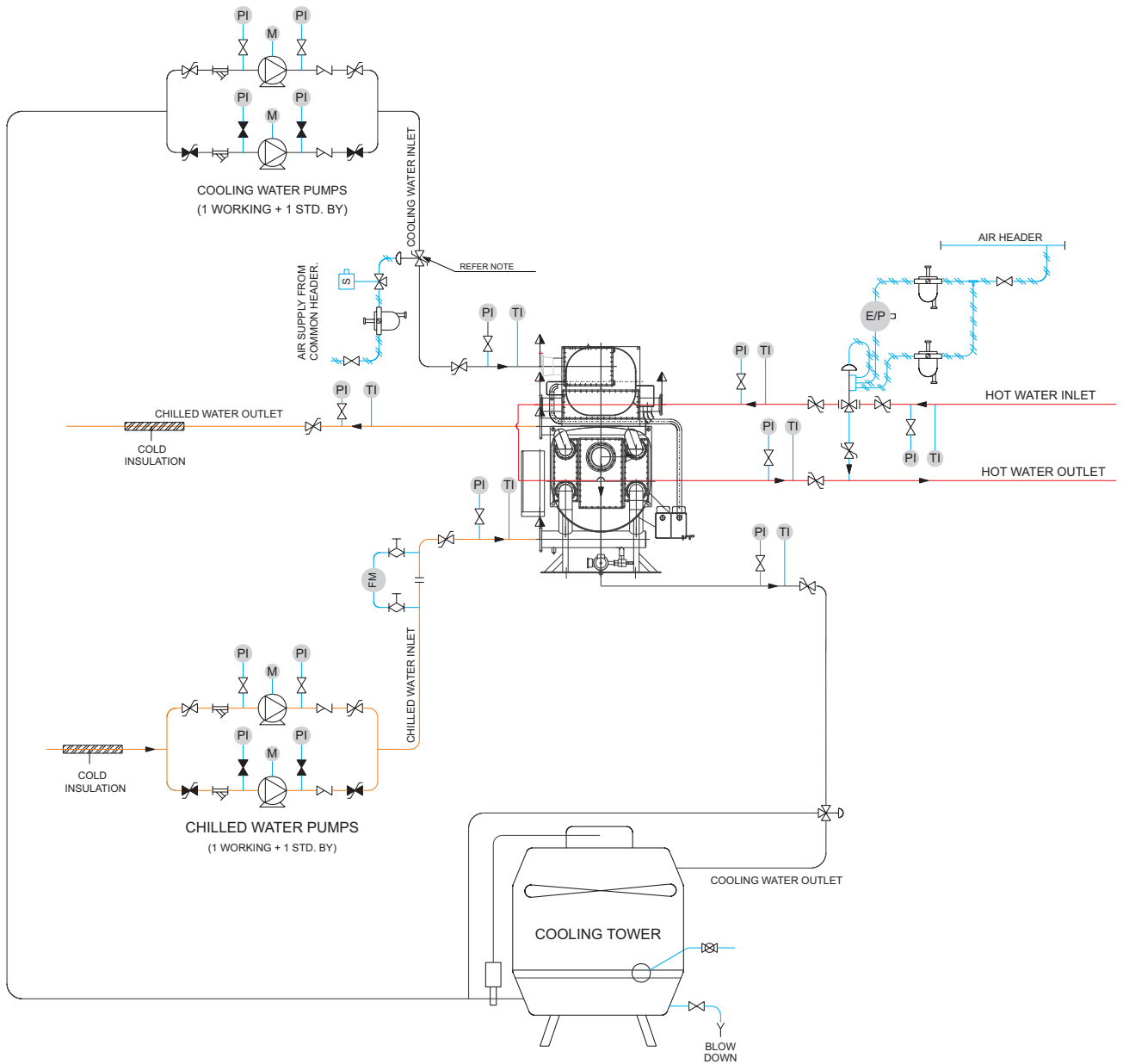
NOTES :

- There should be a drain ditch around the foundation.
- Anchor bolts should be fixed in the foundation prior to the chiller installation.
- Anchor bolts (anchor bolts, nuts & washers) are supplied with the chiller.
- Be sure to weld the washer as shown in above detail.
- The floor surface should be made water proof, for ease of maintenance work.
- All the above indicated dimensions are in millimeters.

TYPICAL SYSTEM P & I DIAGRAM



hot water driven absorption chillers



- ⊗ GATE VALVE (OPEN)
- ⊗ GATE VALVE (CLOSE)
- ⊗ GLOBE VALVE (OPEN)
- ⊗ GLOBE VALVE (CLOSE)
- ∇ NON RETURN VALVE
- ⊗ COCK
- ⊗ CONTROL VALVE
- ⊗ BUTTERFLY VALVE (OPEN)
- ⊗ BUTTERFLY VALVE (CLOSE)
- ⊗ INVERTED BUCKET STEAM TRAP

- ⊗ THERMODYNAMIC STEAM TRAP
- ⊗ AIR FILTER REGULATOR
- ⊗ PNEUMATIC CONVERTER
- ⊗ PUMP
- ⊗ MOTOR
- ⊗ BALANCE VALVE
- ⊗ THERMOSTAT
- ⊗ PNEUMATIC LINE
- ⊗ "Y" STRAINER

NOTE:- AUTOMATIC ARRANGEMENTS SHOULD BE PROVIDED TO STOP COOLING WATER FLOW IF THE CHILLED WATER FLOW STOPS.



- P - PRESSURE
- T - TEMPERATURE
- F - FLOW
- I - INDICATOR
- R - RECORDER
- L - LEVEL
- M - METER
- L - LOW
- S - SWITCH

FOR REFERENCE ONLY

OPERATING PRINCIPLE



hot water driven absorption chillers

Basic Principle :

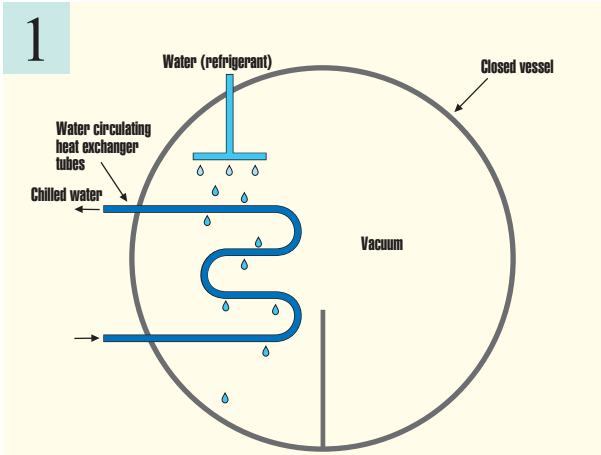
Boiling point of water is a function of pressure. At atmospheric pressure, water boils at 100°C. At lower pressure it boils at lower temperature. The boiling point of water at 6 mm of mercury absolute, is only 3.7 °C.

Lithium Bromide (LiBr) salt has the property to absorb water due to its chemical affinity. It is soluble in water. As the concentration of LiBr increases, its affinity towards water increases. Also as the temperature of LiBr increases the affinity decreases.

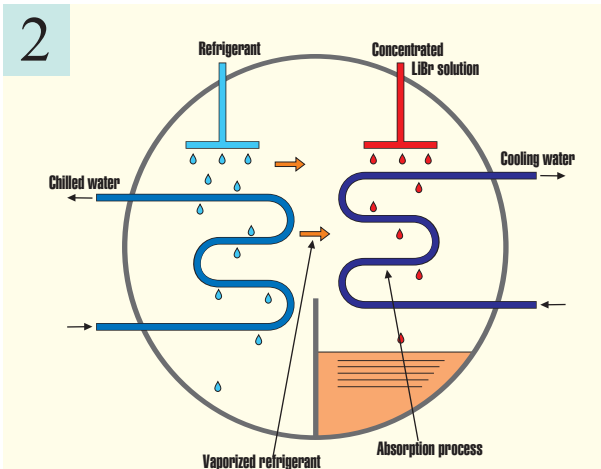
There is a large difference between vapour pressure of LiBr and water.

Operating Principle :

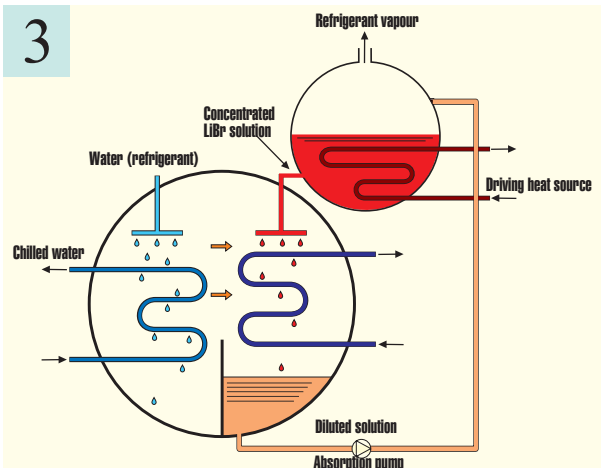
The vapour absorption chiller produces chilled water upto 4.5°C, utilizing hot water as the driving source. The chiller utilizes the latent heat released by the refrigerant (water) as it evaporates (in a closed pressure vessel,) for cooling. Unlike a compression chiller which uses a compressor to pressurize the vapourized refrigerant (Freon) and condenses it by using cooling water, the absorption chiller uses an absorbent (LiBr) to absorb the vapourized refrigerant (water). The refrigerant is then released from the absorbent when heated by an external source.



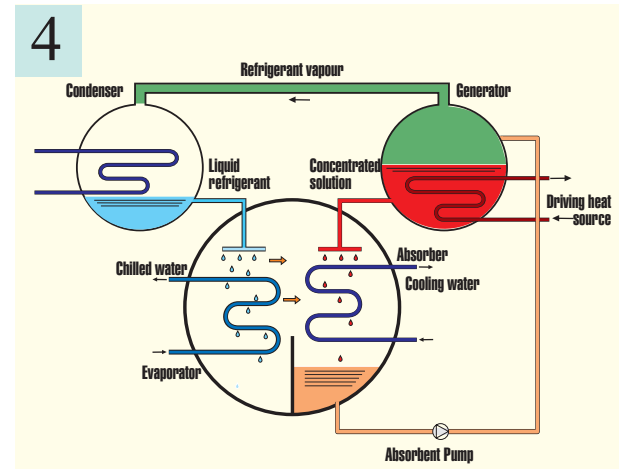
When maintained at high vacuum, water will boil and flash cool itself.



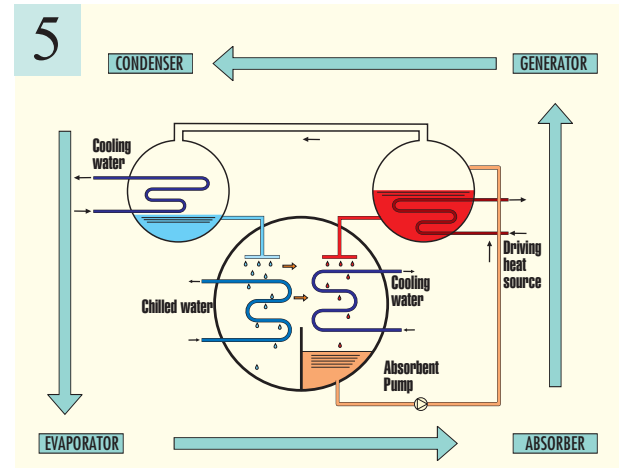
Concentrated Lithium Bromide solution has affinity towards water. The solution absorbs vapourized refrigerant water.



As Lithium Bromide becomes dilute it loses its capacity to absorb water vapour. It thus needs to be re-concentrated using a heat source.



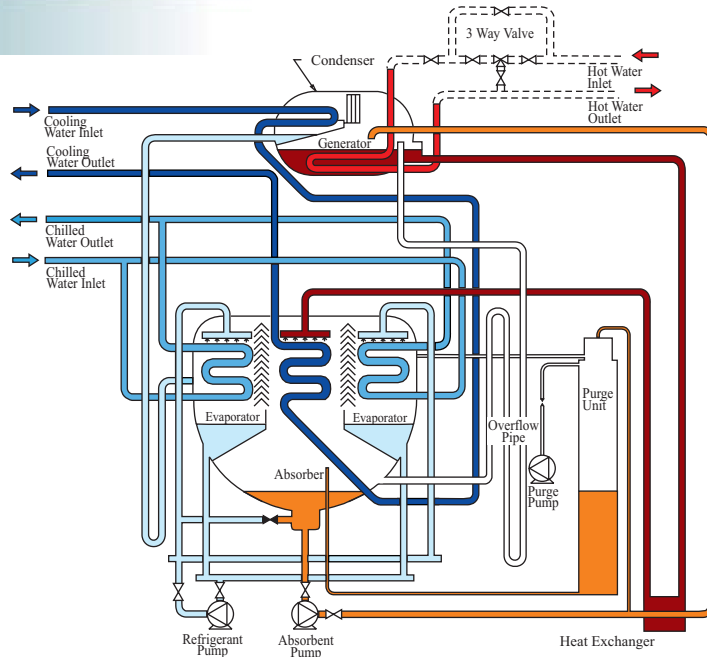
This heat causes the solution to release the absorbed refrigerant in the form of vapour. This vapour is cooled in a separate chamber to become liquid refrigerant.



The basic operation cycle of the single effect vapour absorption chiller.

CYCLE DIAGRAM

- Dilute Solution
- Refrigerant
- Chilled Water
- Cooling Water
- Hot Water
- Concentrated Solution
- Valve open
- Valve close



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