

# Steam Driven Vapour Absorption Chiller

Single Effect - 120 TR to 2180 TR (420 kW to 7650 kW)





## ■ Cooling & Heating Division - Cooling SBU

The Cooling SBU of THERMAX promotes Vapor Absorption Chillers as a cost effective and environment friendly alternative to electricity driven compression chillers.

It offers expert solutions in Process Chilling & Air Conditioning for industrial as well as commercial applications. Cooling SBU's strength lies in customized solutions as per the requirements of its customers.

Unlike electrical chillers, Absorption Chillers are powered by heat. These machines can run on a variety of heat sources, e.g. steam, hot water, liquid/gaseous fuels, exhaust gases and/or a combination of above.

## ■ Thermax - Conserving Energy, Preserving the Environment

Vapor Absorption Technology from Thermax is at work for clients in more than 50 industries including Pharmaceuticals, Chemicals, Fertilizers, Steel, Textiles, Petrochemicals, Food & Beverages and Automobile industries as well as in Hotels, Commercial Complexes, Shopping Complexes, Office Buildings, Educational Institutes, Airports, Cinema halls and Medical Centers.

Manufacturing capabilities of Thermax's Cooling SBU are confirmed by the fact that, over the years, Thermax has installed thousands of machines in more than 70 countries including USA, Brazil, Germany, Spain, UK, Italy, UAE, Saudi Arabia, India, China, Australia, Thailand, Philippines, Malaysia, Russia and Nigeria with the products conforming to the respective country standards like ETL, CE, TUV, DNV, ASME etc. Thermax has its fully owned subsidiaries namely Thermax Inc. in USA, Thermax Europe Limited in UK and Thermax (Zhejiang) Cooling and Heating Engg. Company Limited in China.

Thermax believes in efficient and responsive services to its clients and exhibits in its way of business, by giving optimal and quality solutions and achieving customer delight. Thermax has a worldwide sales, service and distribution network to fulfill the needs of its valuable customers.

## ■ Vision

To be a globally respected high performance organization offering sustainable solutions in energy and environment.

## ■ Sustainable Solutions

From Cooling to Heating, from Power Generation to Air Purification, from Water and Sewage Treatment to Speciality Chemicals, THERMAX Solutions are improving life at work in many ways.

Every year THERMAX helps generate 6,000 MW of Power, produce 100,000 tons of steam, provide 4 billion tons of Cooling and treat 1,000 million litres/day of Water and Waste.

THERMAX today is a major Engineering and Environment company with revenues of USD 800 million and with market capitalization of over USD 1 billion.

THERMAX was one of 20 Indian companies in Forbes list of "Asia's Best Under a Billion Companies" in 2005 and 2006 and was ranked "No. 1 among the top 21 wealth creators" in India over the last 5 years by a leading investment journal.

THERMAX brings to customers enriched experience of industrial applications, and expertise through technological partnerships and strategic alliances.

Operating from its Headquarters in Pune (Western India), Thermax has built an international sales & service network spread over South East Asia, Middle East, Africa, Russia, UK, US and China. It has full fledged ISO 9001:2000 and ISO 14000 accredited manufacturing setups.





## ■ Manufacturing & Testing World-Class Facilities

### Quality assured manufacturing to international codes

Thermax manufactures environment friendly and energy efficient vapor absorption chillers at its plants in Pune, India, and China. Its state-of-the-art manufacturing facility has been awarded with ISO 9001 and ISO 14001 certifications.

Stringent quality control procedures, along with a skilled workforce, ensure that a highly reliable product leaves the factory. The equipment and manufacturing processes conform to international standards.

Thermax's pressure part manufacturing has been approved by ASME and bears the 'S', 'U', 'H' and 'R' stamps. The vapor absorption chillers are CE certified for the European Union and ETL listed for the US and Canadian markets. They conform to the Kyoto Protocol and are in absolute tandem with the Clean Development Mechanism code (CDM).

Thermax also conforms to Environmental Management System standard 14001 and OHSAS 18001.



CNC twin spindle 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.

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



Welding robot for high precision automatic welding.



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



Press Brake Machine



Rolling Machine



# ■ Salient Features for Matchless Reliability, Efficiency and Durability

## Split Evaporator Design

Split evaporator design helps to improve absorption rate of LiBr, thereby improving efficiency. This also reduces surface area under cold insulation.

## Gravity Feed LiBr and Refrigerant Distribution Mechanism

Nozzle-less, non-clogging gravity feed distribution mechanism for stable and reliable operation throughout the life of the machine. Drop in performance due to nozzle wear, clogging eliminated. Need for separate pump for spray eliminated, resulting in lower power consumption.

## Zero Crystallization

Unique State-of-the-Art concentration monitoring and control that virtually eliminates crystallization and is distinctly different from the conventional auto de-crystallization. This helps the chiller to operate even at low cooling water inlet temperature without crystallisation.

## Lowest Chilled Water / Brine Outlet Temperature

Thermax innovative absorption chillers can deliver leaving chilled water temperatures down to 3.5°C and leaving chilled brine solution up to 0°C, enabling absorption chillers to be used for applications involving low chilled water / brine temperature.

## Condensate Heat Recovery

Specially designed shell and tube heat exchanger with ferritic SS430 Ti tubes used as heat reclaimer for condensate heat recovery.

## Isolation Valves for Canned Motor Pumps

Double seal isolation valves and bolted pumps facilitate easy maintenance of the machine mounted canned motor pumps without any loss of vacuum in the system. This significantly reduces the down time of the chiller.

## Ferritic Stainless Steel Tubes In Generator

Titanium stabilized ferritic stainless steel tubes (SS430 Ti) used in generator for lowest differential thermal expansion, thereby protecting the tubes from stress corrosion cracking. Suitable for steam with dissolved ammonia compounds, where copper alloys are not recommended.

## De-Oxidised Low Phosphorus Copper Tubes

Copper tubes conforming to ASTM/JIS standards, with phosphorus content maintained below 0.005 ppm, used in chilled water and cooling water circuits. This protects the tubes from hydrogen embrittlement in LiBr environment.

## Non-Toxic Corrosion Inhibitor

New generation non-precipitating, non-toxic molybdenum based corrosion inhibitor which is more effective than conventional inhibitors based on Chromate (Cancer causing, prohibited in several countries) and Nitrate.

## 10-100% Step less Modulation

For cooling loads ranging from 10% to 100% of the designed capacity, the steam control valve automatically varies steam flow in order to maintain the temperature of chilled water leaving the chiller.

## Multi-Stage Level Control

Multiple stage level control in three locations enables effective operation during part load and prevents cavitation of refrigerant and absorbent pumps.

## BAS/DCS Connectivity

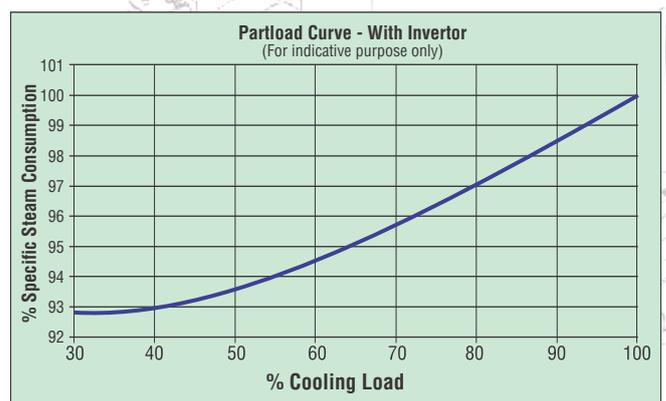
Direct connectivity of machine PLC panel with Third party monitoring systems like BAS (Building Automation System), DCS (Distributed Control System) or PLC (Programmable Logic Controller) can be provided via Modbus RTU protocol on RS485 network.

## PLC Based Control Panel

Thermax chillers are provided with State-of-the-Art PLC based control panel, user friendly operator interface and data logging system.

## Variable Frequency Drive On Absorbent Pump

Variable Frequency Drive on absorbent pump for higher reliability, savings in steam & savings in power, during part load operation.





## ■ Scope of work

Item / Activity	Thermax	Customer	Remarks
<b>Production of Vapour Absorption Chiller</b>			
Design	✓		
Procurement	✓		
Manufacturing	✓		
<b>Testing</b>			
NDT for quality check (Helium leak test, pneumatic tests etc.)	✓		
Control panel and PLC software testing	✓		
Factory Performance Testing			Thermax Optional Feature
<b>Transportation</b>			
Loading at Thermax Factory	✓		
Factory to Port	✓		
Port in India to Port of Destination *		✓	
Port to Job-site		✓	
Unloading at Job-site		✓	
Storage at Job-site		✓	If required
<b>Construction and Installation</b>			
Handling at Job-site		✓	Rigging, Shifting to actual location
Civil Foundation		✓	
Piping outside Battery Limits		✓	Refer Offer Document
Chiller Insulation*		✓	
Piping Insulation outside Battery Limits		✓	Refer Offer Document
Electrical Connections outside Battery Limits		✓	Refer Offer Document
Assembly and On-site Connections		✓	For Multi-Sectional Shipment (If required).
On-site Erection		✓	
Supervision of commissioning	✓	✓	Customer to assist, Thermax Representative will supervise the commissioning
<b>Operation and Maintenance</b>			
Training of Customer's Operators during commissioning	✓		
Operation		✓	

Note: \*Indicates that the scope of supply can also be included by Thermax, as an option.

## ■ Customized Offering

### Tailor Made, High Efficiency Solutions For Low Steam Pressure

Single effect lithium bromide absorption chillers can be offered for steam pressures as low as 0.1 kg/cm<sup>2</sup>(g), which normally calls for heat recovery using secondary hot water circuit. This reduces the total project costs and gives lowest operating costs.

### LiBr Absorption Chillers For Sub-Zero Cooling Applications

Single effect Lithium bromide absorption chillers can be offered for leaving brine temperatures as low as -5.0 oC, offering great savings in operating costs.

### Stand-by Pumps

For critical applications where scheduled maintenance of pumps cannot be carried out, stand-by absorbent, refrigerant and/or vacuum pump can be provided.

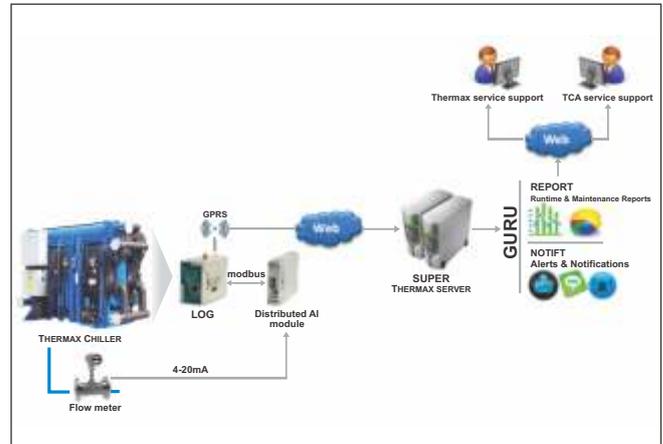
### Fully Automatic Purging

The automatic purging system eliminates the need for periodic monitoring of purge tank pressure and operation of purge system.

### THERMMONITOR - Remote Performance Monitoring System (RPMS)

Advanced feature that monitors the chiller performance & provides data via internet. This feature enables the facility manager or Thermax engineer to monitor the performance remotely. It offers features like e-log book, status, trends, abnormal maintenance schedules, alerts etc.

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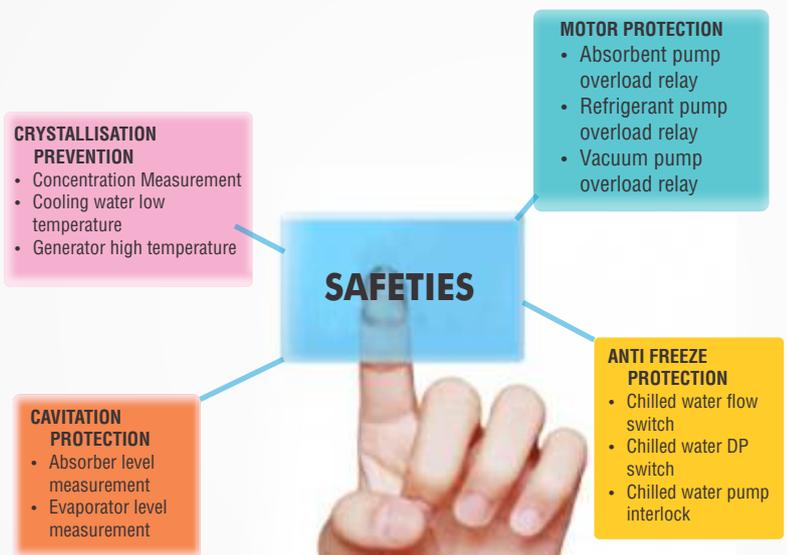
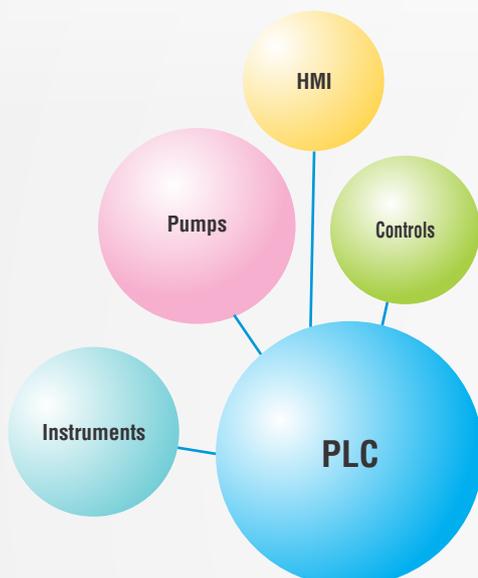
### Multi Sectional Shipment Arrangement

For convenience of shipping, the absorption chillers can be shipped in two or more sections depending upon the site requirement. This is particularly convenient arrangement for retrofit / replacement jobs.

### Special Tube Metallurgy

Special tube materials like Cupro-Nickel, Stainless Steel or Titanium depending on water quality on site. This not only improves the reliability & efficiency but also makes the chiller suitable for special applications involving sea water and brackish water.

## ■ Instrumentation and Safety Features



## ■ Holistic Customer Care

Cooling Unit of C&H division has a wide network of Service Centers throughout the globe to ensure quick response to customers. With a cumulative service experience of over 4000 VACs operating for more than 25 years, Thermax service personnel are equipped to deliver the right solution to the users. Thermax has developed specific modules for different types of users depending on their usage pattern, conforming to our proactive approach.

For the benefit of its customers Thermax offers various value added services like:

- Preventive maintenance contract
- Operations & manning
- Localized customer training programs



## ■ Testing Procedure

As the Vapor 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 test. Understanding the importance, Thermax carries out the leak detection test in the following sequence:

### ▶ 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. It can detect leakage to the tune of  $5.0 \times 10^{-7}$  std cc/ sec.

### ▶ 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. Every machine has to clear this test before it is shipped to the customer.



## ■ Performance Testing Facility

Thermax has a State-of-the-Art test bay capable of testing various types of vapour absorption chillers - steam driven, hot water driven, fuel fired, exhaust driven and a combination of these up to a capacity of 3500 TR (12300 kW). The entire testing facility is centrally operated by sophisticated Distributed Control Systems (ABB make) and can be operated by the touch of a button.

- ▶ Steam : 50 - 3500 TR (175 kW to 12300 kW)
- ▶ Exhaust : 50 - 3500 TR (175 kW to 12300 kW)
- ▶ Hot Water : 10 - 1730 TR (35 kW to 6080 kW)
- ▶ Fuel Fired : 50 - 3000 TR (175 kW to 10540 kW)

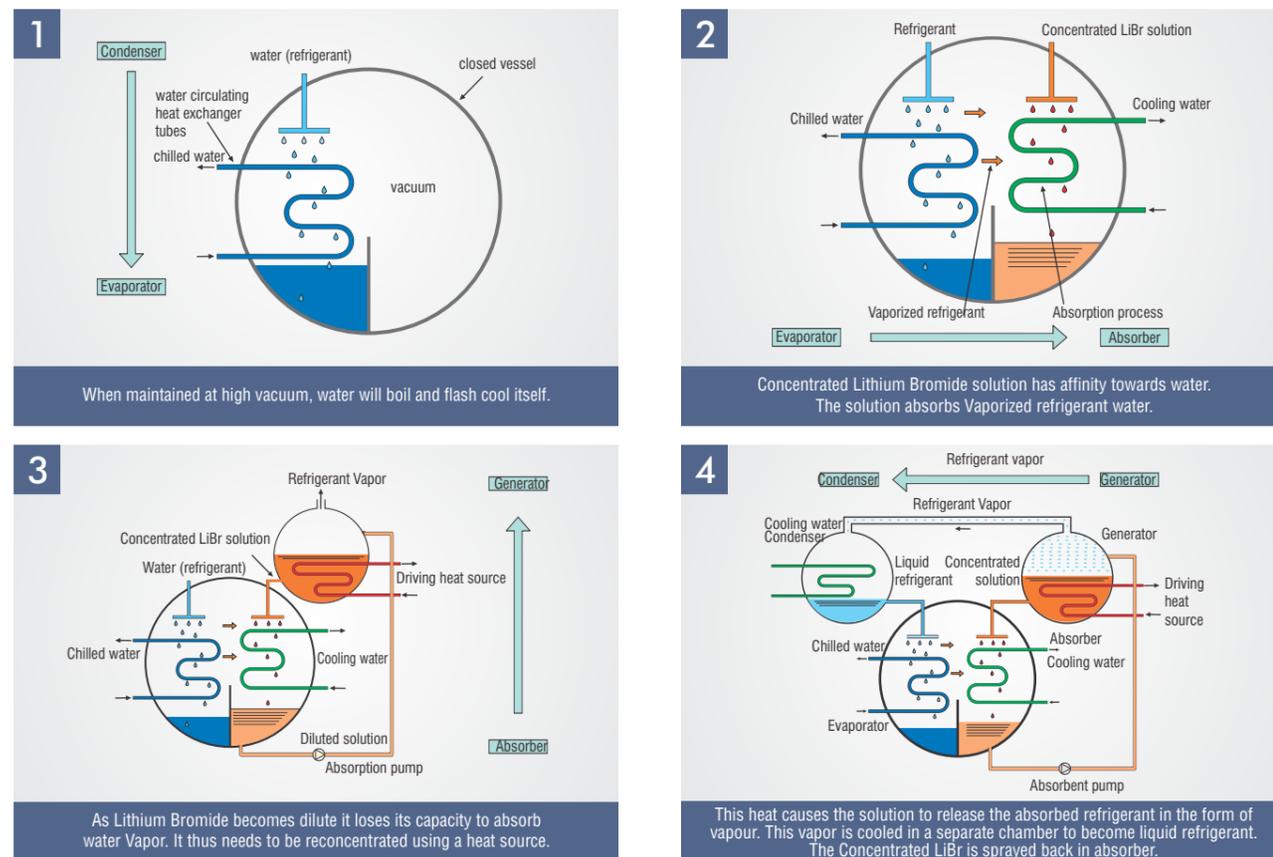
This is one of the largest testing facility for absorption chillers available in the world.

# Specification Sheet

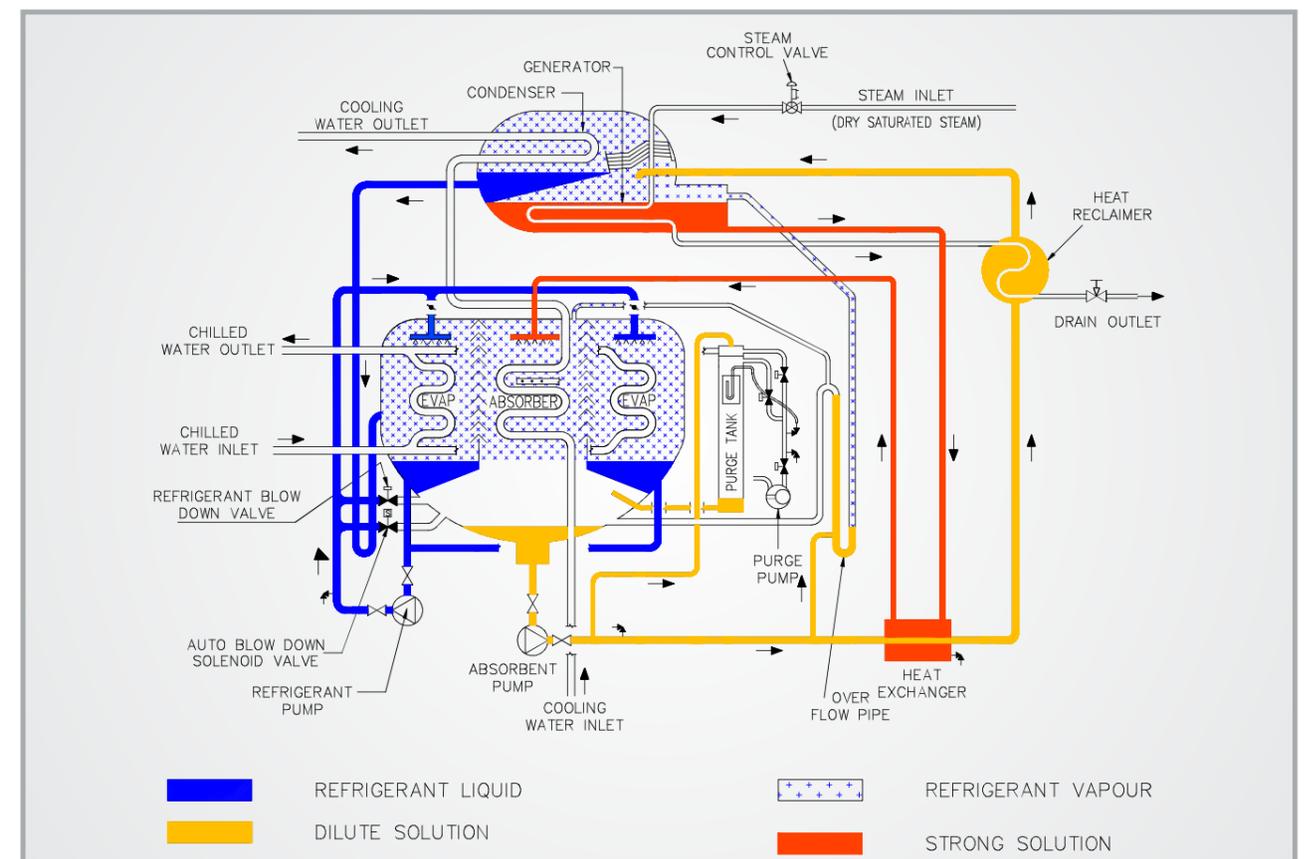
MODEL NUMBER		UNITS	SS 20A CU	SS 20B CU	SS 20C CU	SS 20D CU	SS 30A CU	SS 30B CU	SS 30C CU	SS 40A CU	SS 40B CU	SS 40C CU	SS 50A CU	SS 50B CU	SS 60A CU	SS 60B CU	SS 60C CU	SS 60D CU	SS 70A CU	SS 70B CU	SS 80A CU	SS 80B CU	SS 80C CU	SS 80D CU	SS 90A CU	SS 90B CU																							
Cooling Capacity		TR	120	143	180	215	260	292	346	393	445	480	553	608	685	760	839	929	1055	1180	1335	1450	1685	1820	2020	2180																							
Chilled Water Circuit	Flow Rate	m <sup>3</sup> /hr	72.4	86.3	108.6	129.7	156.8	176.1	208.7	237.1	268.4	289.5	333.6	366.8	413.2	458.4	506.1	560.4	636.4	711.8	805.3	874.7	1016.4	1097.9	1218.5	1315.0																							
	Connection Diameter	mmNB	125				150				200				250				300				350				400				400																		
Cooling Water Circuit	Flow Rate	m <sup>3</sup> /hr	112	134	168	201	242	271	323	364	413	444	513	565	638	710	784	870	980	1100	1240	1336	1570	1700	1885	2025																							
	Connection Diameter	mmNB	150				200				250				300				350				400				450																						
Steam Circuit	Steam Consumption	kg/hr	940	1125	1400	1680	2010	2270	2705	3035	3435	3680	4280	4730	5325	5915	6550	7270	8190	9145	10340	11210	13125	14115	15785	16965																							
	Connection Diameter (Steam)	mmNB	150				200				250				300				350				400				450				500																		
	Connection Diameter (Drain)	mmNB	40				50				50				65				65				80				80				100				100														
Overall Dimensions	Length	mm	2965		3995		4125		4735		4925		5050		6590		7875		7950		8630		9865		11600																								
	Width	mm	1975		2020		2295		2325		2470		2665		2775		2730		2960		3600		3600		3750																								
	Height	mm	2700				2830				3215				3300				3715				4080				4585				4750																		
Operating Weight	x 1000 kg	5.5	5.5	6.6	6.8	8.6	8.9	9.8	12.5	12.9	13.3	15.3	15.7	22.9	23.6	26.4	27.3	34.3	35.3	46.1	46.8	51.8	52.6	62.2	63.1																								
Max. Shipping Weight	x 1000 kg	4.9	4.9	5.9	6.0	7.6	7.8	8.6	10.8	11.1	11.4	13.1	13.3	19.8	20.3	22.8	23.5	29.5	30.2	39.1	39.5	43.9	44.4	52.6	53.3																								
Clearance for Tube Removal	mm	2600				3600				3700				4200				4250				4400				5700				6900				6900				7000				8300				9750			
Electric Supply	Absorbent Pump Motor Rating	kW (A)	1.1 (3.4)		1.5 (5)		3 (8)		3.7 (11)		3.7 (11)		5.5 (14)		6.6 (17)		4.5 (13)		4.5 (13)		5.5 (17)		9.0 (27)																										
	Refrigerant Pump Motor Rating	kW (A)	0.3 (1.4)																																														
	Vacuum Pump Motor Rating	kW (A)	0.75 (1.8)																																														
	Total Electric Input	kVA	5.7	6.9	9.1	11.2	11.2	13.4	18.1	15.2	15.2	18.1	25.3																																				
	Power Supply		415 V(±10%), 50 Hz (±5%), 3 Phase+N																																														

- Notes:** 1) Model Nos. : SS XXX - CU Steam fired Single effect Vapour Absorption Chiller  
 2) Chilled water inlet / outlet temperature = 12 / 7 °C  
 3) Cooling water inlet temperature = 32 / 40 °C  
 4) Minimum Cooling water inlet temperature is 10°C  
 5) Steam at Control Valve Inlet is at 1.5 kg/cm<sup>2</sup>(g) pressure in dry saturated condition.  
 6) Control panel Electric Input = 1 kVA  
 7) Maximum allowable working pressure in Chilled/ Cooling water system=8 kg/cm<sup>2</sup>(g)  
 8) Mechanical Design Pressure for Steam circuit = 5 kg/cm<sup>2</sup>(g)  
 9) Ambient condition shall be between 5 to 45°C  
 10) All Water Nozzle connections to suit ASME B16.5 Class 150  
 11) Technical specification is based on JIS B 8622 : 2002  
 12) Please contact Thermax office for customised or large capacity specifications

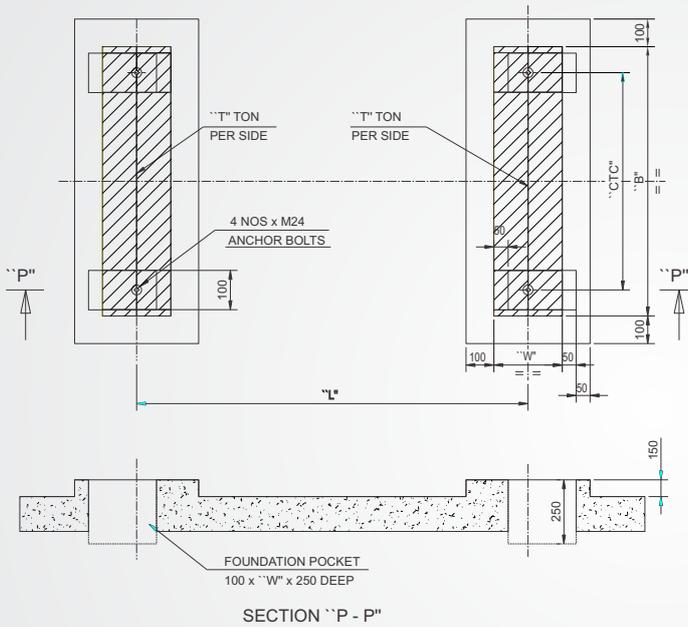
## Operating Principle



## Cycle Diagram

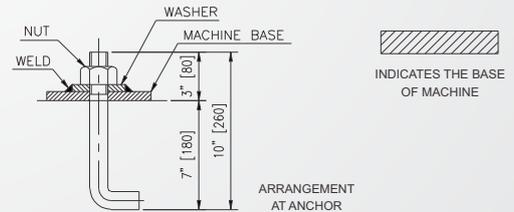


# Foundation Drawing



MODEL	``L``	``W``	``B``	``CTC``	``T``
	mm	mm	mm	mm	TON(1000 kgs)
SS 20A CU	1896	170	1390	1250	2.7
SS 20B CU	1896	170	1390	1250	2.8
SS 20C CU	2866	220	1390	1250	3.3
SS 20D CU	2866	220	1390	1250	3.4
SS 30A CU	2816	270	1580	1380	4.3
SS 30B CU	2816	270	1580	1380	4.5
SS 30C CU	3424	270	1580	1380	4.9
SS 40A CU	3424	270	1640	1440	6.2
SS 40B CU	3424	270	1640	1440	6.5
SS 40C CU	3424	270	1640	1440	6.6
SS 50A CU	3424	270	1840	1500	7.7
SS 50B CU	3424	270	1840	1500	7.8
SS 60A CU	4592	320	1975	1135	11.3
SS 60B CU	4592	320	1975	1135	11.6
SS 60C CU	5826	320	1975	1135	12.9
SS 60D CU	5826	320	1975	1135	13.4
SS 70A CU	5726	420	2412	2272	17
SS 70B CU	5726	420	2412	2272	17.4
SS 80A CU	5726	420	2660	2520	22.8
SS 80B CU	5726	420	2660	2520	23.1
SS 80C CU	7076	320	2660	2520	25.6
SS 80D CU	7076	320	2660	2520	26

Note:-  
The above drawing indicates the dimensions of the equipment base frame and foundation bolt pockets and suggested size of the footings. The foundation shall be designed to suit the soil conditions and other



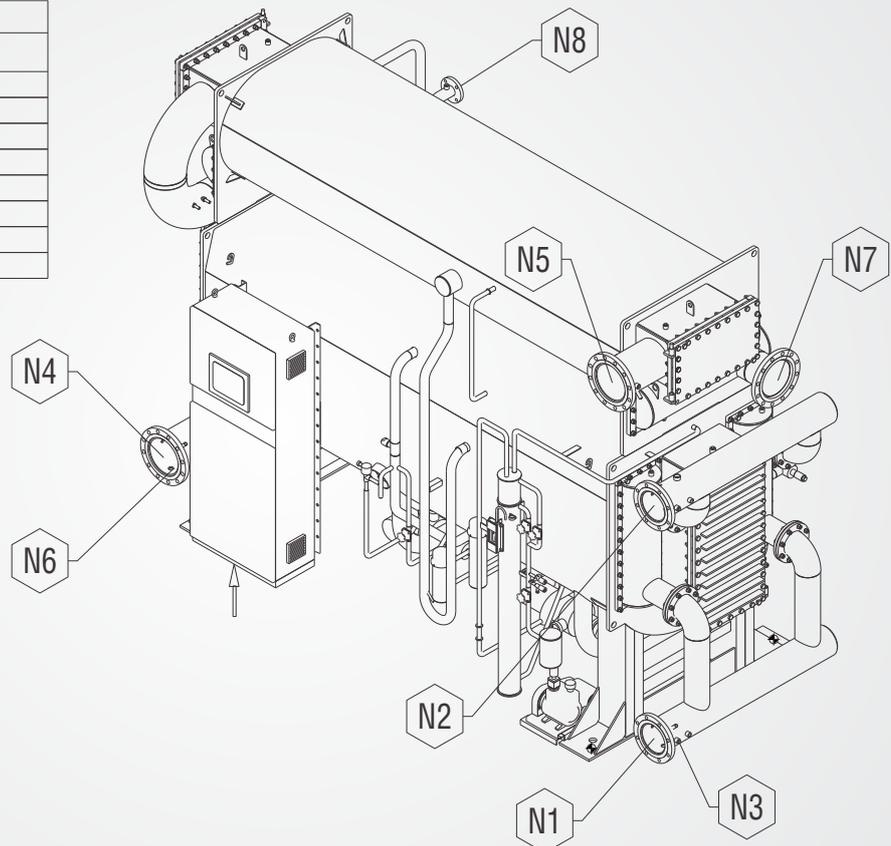
# Typical Machine Illustration

NOZZLE SCHEDULE		
NOZZLE	NOZZLE FL. RATING	DESCRIPTION
N1	ASA 150	CHILLED WATER INLET
N2	ASA 150	CHILLED WATER OUTLET
N3	-	CHILLED WATER DRAIN PLUGGED
N4	ASA 150	COOLING WATER INLET
N5	ASA 150	COOLING WATER OUTLET
N6	-	COOLING WATER DRAIN PLUGGED
N7	ASA 150	STEAM INLET
N8	ASA 150	CONDENSATE OUTLET

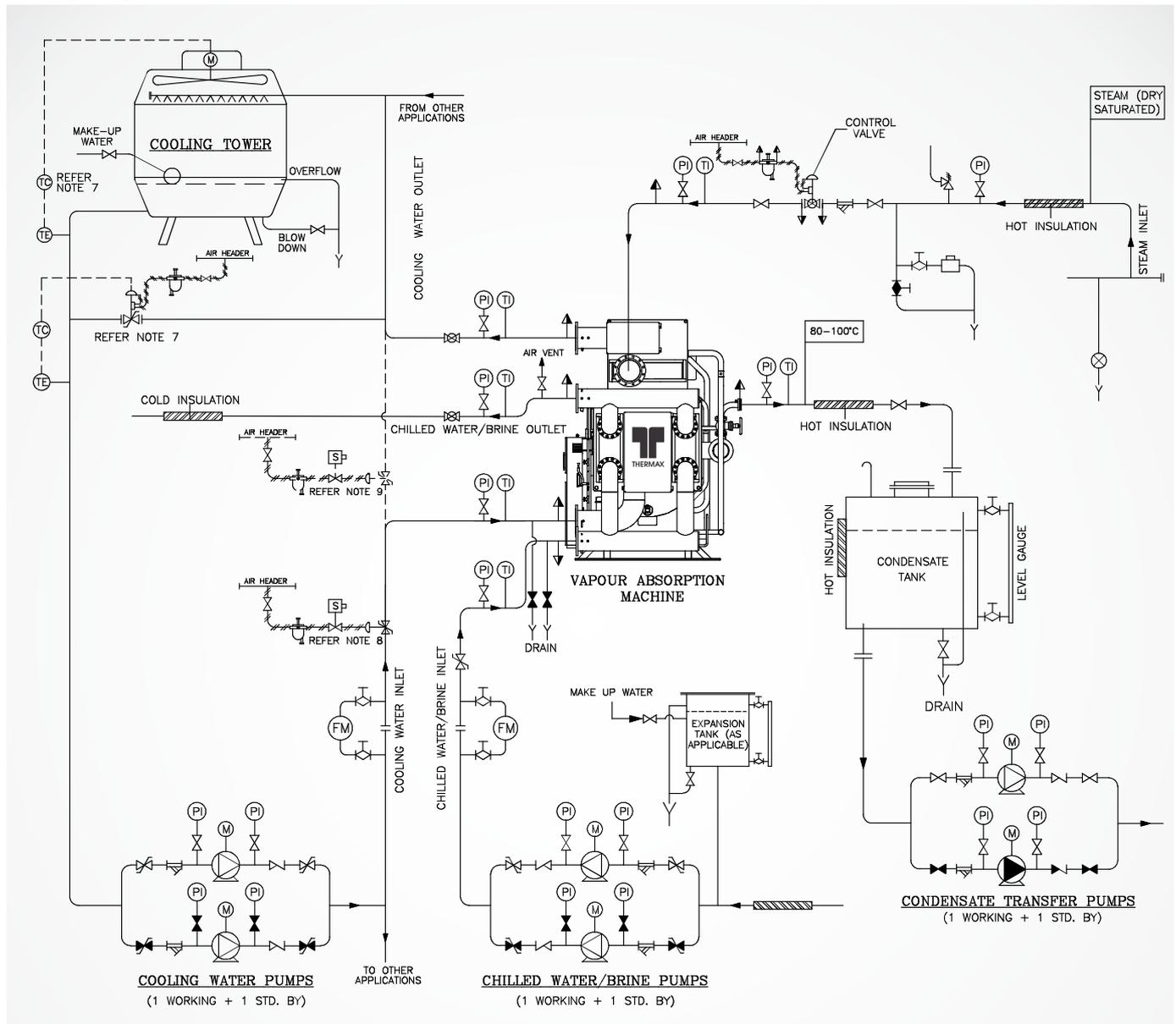
### UNOTES :

- 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 :1250 mm  
TOP : 250 mm  
OTHERS : 500 mm
- 4) MACHINE TOLERANCES :

L (mm)	TOL. (mm)
0- 2500	4.0
2500-5000	6.0
5000-7500	8.0
7500-10000	10
OVER 10000	15



# Piping and Instrumentation Guidelines



	GATE VALVE (OPEN)		SOLENOID VALVE		PRESSURE INDICATOR		LEVEL INDICATOR
	GATE VALVE (CLOSE)		BUTTERFLY VALVE (OPEN)		TEMPERATURE INDICATOR		SAFETY RELIEF VALVE
	GLOBE VALVE (OPEN)		BUTTERFLY VALVE (CLOSE)		FLOW METER		PNEUMATIC ON/OFF BUTTERFLY VALVE
	GLOBE VALVE (CLOSE)		INVERTED BUCKET STEAM TRAP		PNEUMATIC LINE		ELECTRO-PNEUMATIC GLOBE TYPE CONTROL VALVE
	NON RETURN VALVE		THERMODYNAMIC STEAM TRAP		PUMP		CLIENT SCOPE
	COCK		AIR FILTER REGULATOR		MOTOR		THERMAX SCOPE
	CONTROL VALVE (OPEN)				"Y" STRAINER		
	CONTROL VALVE (CLOSE)						

## Notes:

- Pressure reducing station and a safety valve to be provided on steam inlet line, if the design / operating pressure is more than 3.5 kg/cm<sup>2</sup>(g).
- De-superheating to be installed on steam inlet line if the degree of superheat of steam exceeds 15°C.
- The back pressure in the condensate drain line should not be more than 2.0 mWC.
- Automatic arrangements should be provided to stop cooling water flow through the machine, if the chilled water/ brine flow stops.
- Maximum working pressure in water headers is 8.0 kg/cm<sup>2</sup>(g). This should be noted for design of chilled water and cooling water system.
- Clean & dry compressed air supply to the instruments to be 5.0 kg/cm<sup>2</sup>(g).
- Necessary arrangements to be made to maintain constant cooling water inlet temperature to chiller. Minimum allowable cooling water inlet temperature is 10°C.
- Install automatic shut off valve on the cooling water inlet line, if cooling water pumps are not dedicated to the machine.
- If cooling water pumps are dedicated to the machine and chilled water/ brine temperature is < 4.5°C install cooling water automatic shut off valve only on the bypass line between cooling water inlet and outlet.

## References



### Refinery & Petrochemical

- ARAMCO, Saudi Arabia
- Reliance Industries, India
- KNPC, Kuwait
- Exxon Mobil, Saudi Arabia

### Metals

- Tata Steel, India
- Concord Steel, Brazil
- Maklada Prestressed Steel, Tunisia



### Pharmaceuticals

- Astrazeneca, UK
- Pfizer, India
- Johnson & Johnson, USA
- Glaxo Smithkline, India

### Fertilizers

- IFFCO, India
- Chambal Fertilizer, India
- Nagarjuna, India
- Deepak Fertilizers, India



### Food & Beverage

- Nestle, Philippines
- Cadbury, Nigeria
- Ferrero, Italy
- Coca Cola, India

### Textile

- Envoy Textiles, Bangladesh
- Indorama, Thailand
- Raymonds, India
- Garden Silks, India



### Chemical

- Sharq (SABIC), Saudi Arabia
- Eka Chemicals, China
- Tata Chemicals, India
- Malabon Soaps, Malaysia

### Miscellaneous

- NASA, USA
- Pepsico, India
- Fiat, Italy
- Western Michigan University, USA



## Contact Us



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Sustainable Solutions in  
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