

Steam Driven Vapour Absorption Chiller

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





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.

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.



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 38.3°F and leaving chilled brine solution up to 32°F, 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

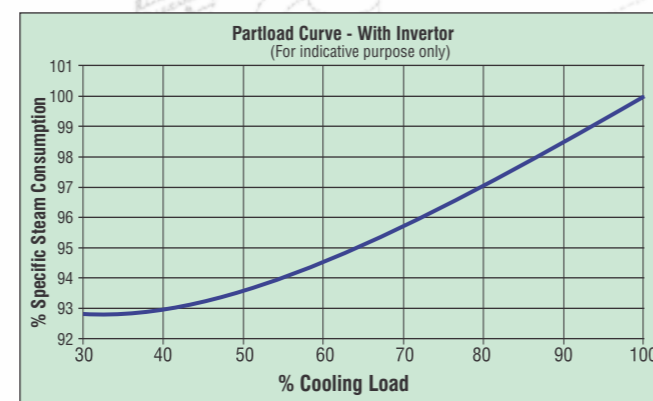
Direct connectivity of machine PLC panel with Third party monitoring systems like BAS (Building Automation System), DCS (Distributed Control System) or PLC (Programmable Logic Controller) can be provided via Modbus RTU protocol on RS485 network.

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
Production of Vapour Absorption Chiller			
Design	✓		
Procurement	✓		
Manufacturing	✓		
Testing			
NDT for quality check (Helium leak test, pneumatic tests etc.)	✓		
Control panel and PLC software testing	✓		
Factory Performance Testing			Thermax Optional Feature
Transportation			
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
Construction and Installation			
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
Operation and Maintenance			
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 1.4 Psig, 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 23°F, 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.

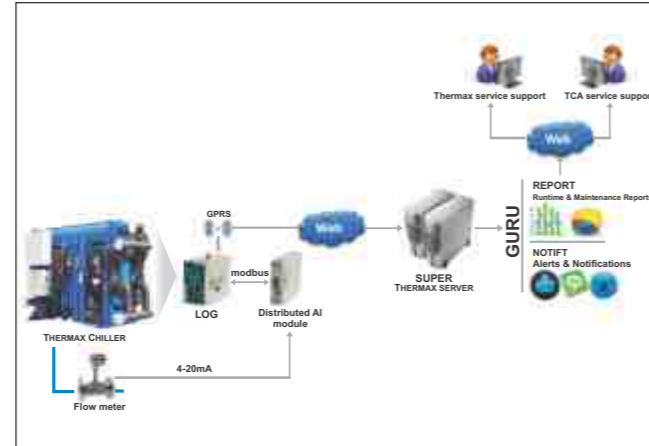
Fully Automatic Purging

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 log book, status, trends, abnormal maintenance schedules, alerts etc.



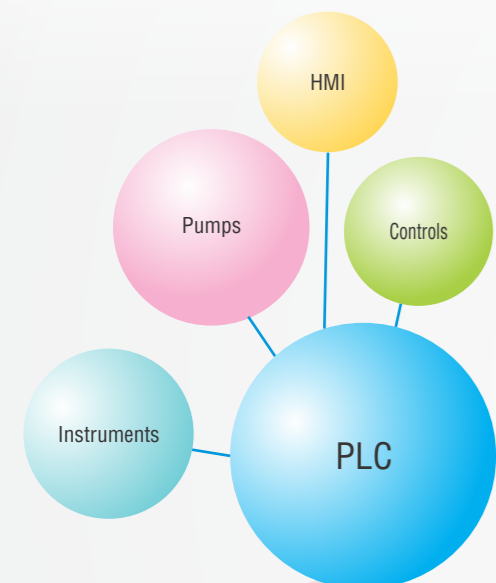
Multi Sectional Shipment Arrangement

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 5.0×10^{-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.



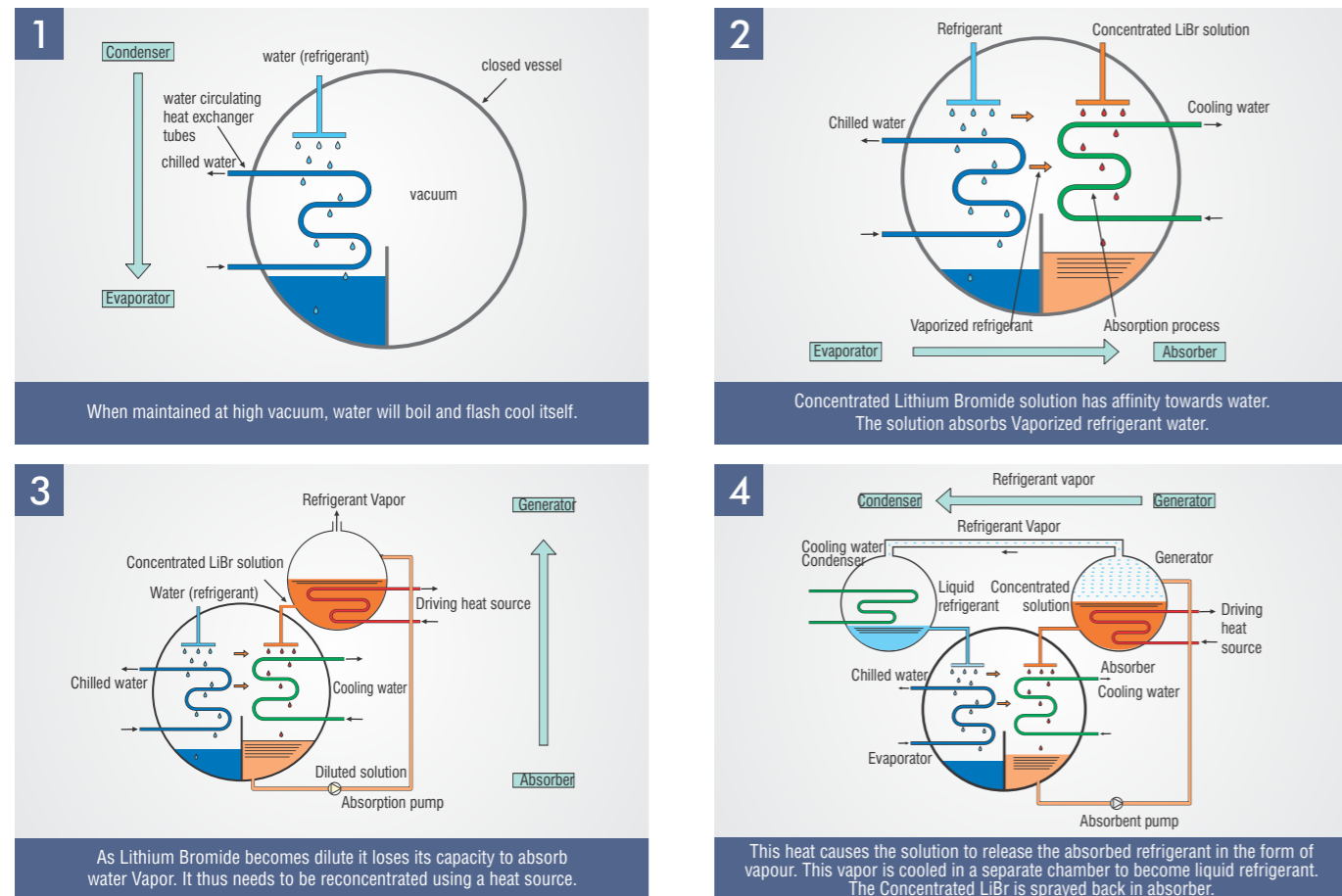
■ Specifications - Single effect Steam Fired Chillers

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							
Cooling Capacity	TR	122	146	184	218	265	298	350	400	450	495	611	620	700	775	860	955	1105	1207	1380	1510	1730	1870							
Chilled Water Circuit	Flow rate	gpm	295	353	444	526	640	719	845	966	1086	1195	1475	1497	1690	1871	2076	2305	2668	2914	3331	3645	4177	4514						
	Friction loss	ft WC	5.9	7.9	16.1	20.3	14.8	16.4	25.3	18.7	6.6	20.0	7.5	21.7	6.6	4.6	6.9	7.9	5.9	6.2	5.2	5.6	8.2	8.5						
	Connection Diameter	NPS	5			6			8			8			10			12			14			16						
Cooling Water Circuit	Flow rate	gpm	431	528	652	766	933	1052	1233	1409	1585	1744	2091	2184	2466	2730	3029	3364	3875	4253	4861	5327	6094	6587						
	Friction loss	ft WC	27.9	29.2	14.4	15.4	12.8	13.1	19.7	18.4	18.7	19.4	22.6	21.3	23.3	23.9	39.7	40.7	39.0	41.3	32.5	35.4	25.9	27.6						
	Connection Diameter	NPS	6			8			10			10			12			14			16									
Steam Circuit	Steam Consumption	lb/hr	2092	2513	3144	3739	4497	5073	5992	6766	7612	8461	10297	10573	11865	13150	14579	16243	18662	20304	23269	25439	29325	31556						
	Connection Diameter (Steam)	NPS	6			8			10			10			12			14			16			18						
	Connection Diameter (Drain)	NPS	1 1/2			1 1/2			2			2			2 1/2			2 1/2			3			4						
Overall Dimensions	Length	inches	116		157		163		187		194		199		262		310		309		328		380							
	Width	inches	74				87				92				101				105				113				132			
	Height	inches	111				116				131				134				150				165				185			
Operating Weight	x 1000 lb	12.0	12.3	14.6	15.0	19.0	19.6	21.6	27.5	28.5	29.2	33.8	34.6	49.6	51.0	56.9	58.9	75.0	76.9	100.5	102.0	112.9	114.7							
Max. Shipping Weight	x 1000 lb	10.8	11.0	13.1	13.3	16.7	17.2	18.9	23.8	24.5	25.1	28.9	29.4	42.7	43.7	49.0	50.5	64.3	65.7	85.1	86.0	95.4	96.6							
Clearance for Tube Removal	inches	102		142		146		165		167		173		224		272		272		276		327								
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)									
	Refrigerant Pump Motor Rating	kW (A)	0.3 (1.4)										1.5 (5)																	
	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									
	Power Supply		460 V(±10%), 60 Hz (±5%), 3 Phase+N																											

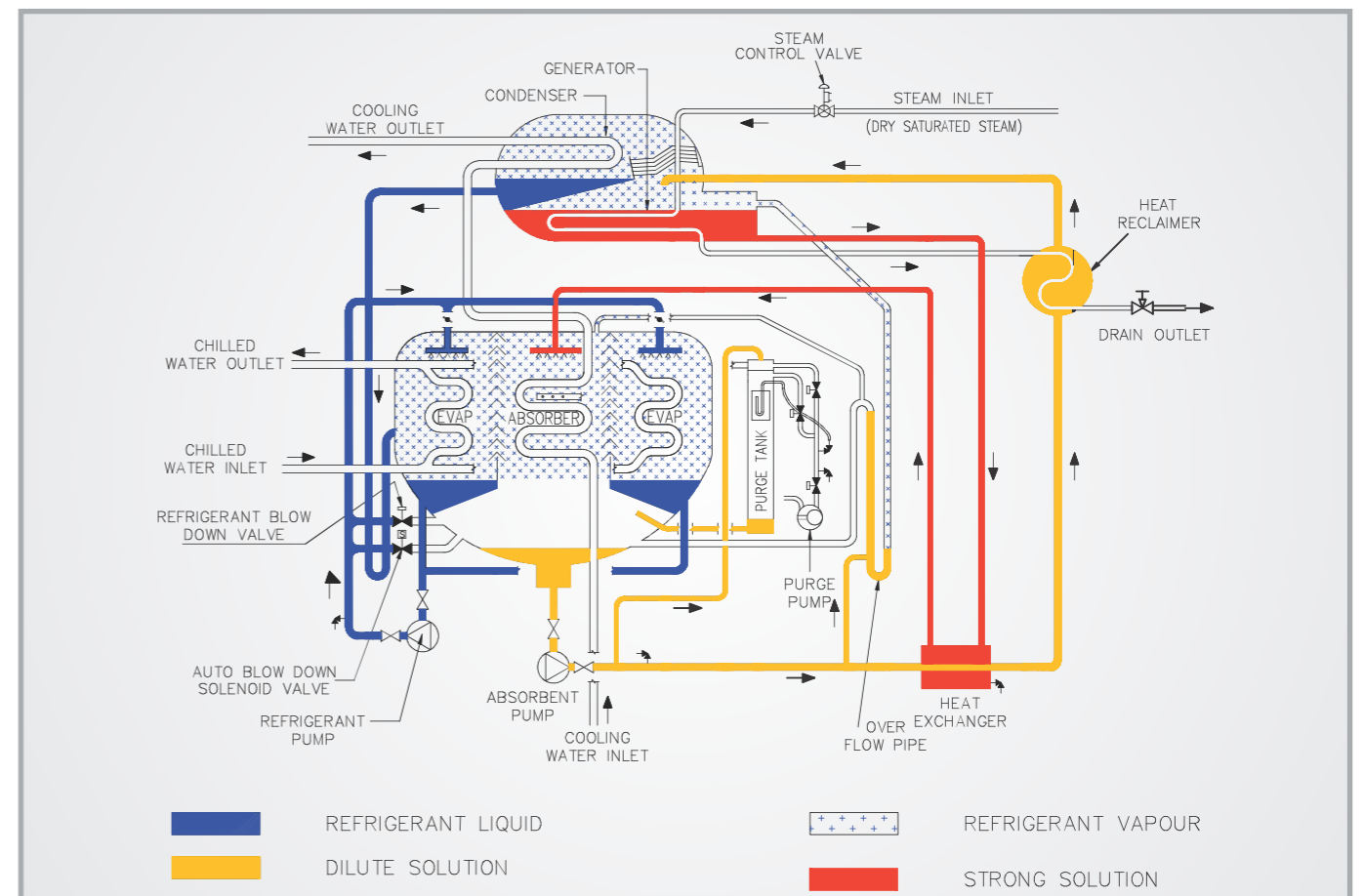
Notes: 1) Model Nos. : SS XXX - CU Steam fired Single effect Chillers
 2) Chilled water inlet / outlet temperature = 54/44°F
 3) Cooling water inlet / outlet temperature = 85/ 101.5°F
 4) Minimum Cooling water inlet temperature is 68°F
 5) Steam at Control Valve Inlet is at 21 Psig pressure in dry saturated condition.

6) Control panel Electric Input = 1 kVA
 7) Maximum Allowable pressure in chilled / cooling water system = 115 Psig
 8) Maximum Allowable pressure in steam system = 71 Psig
 9) Ambient condition shall be between 41 to 113°F
 10) All Water Nozzle connections to suit ASME B16.5 Class 150
 11) Technical specification is based on ARI 560 : 2000

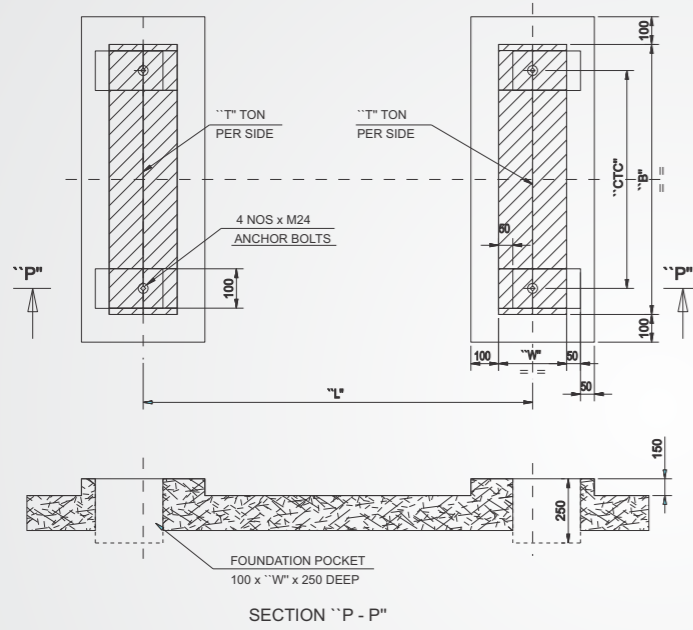
■ Operating Principle



■ Cycle Diagram

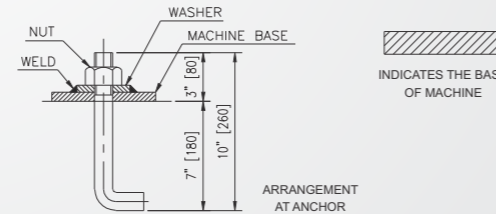


Foundation Drawing



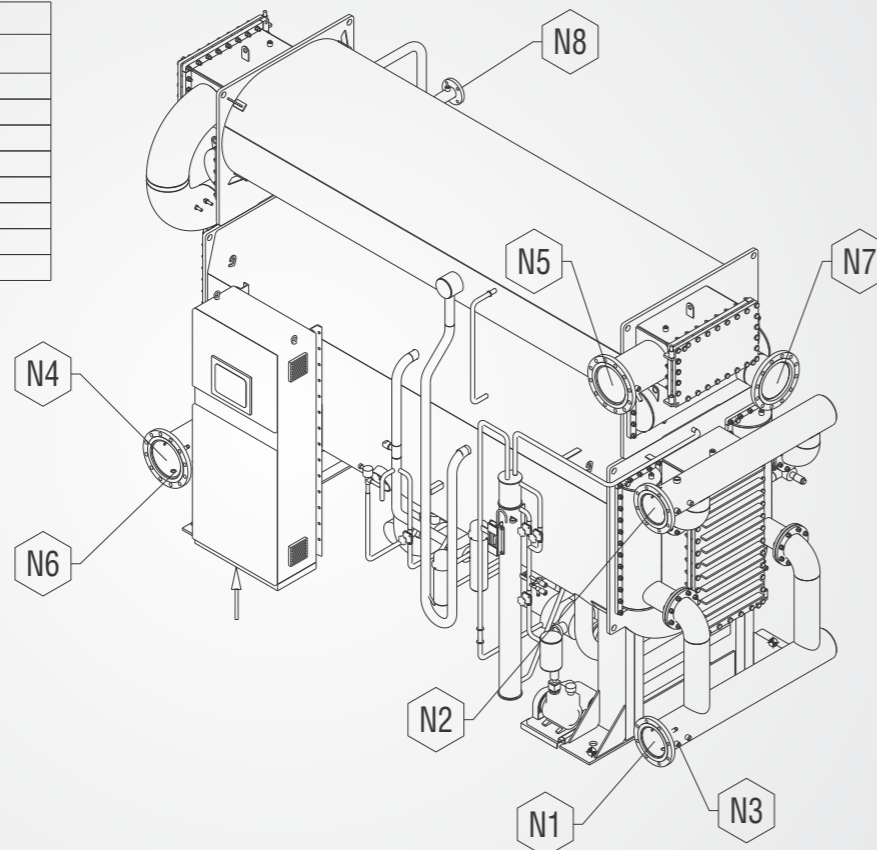
MODEL	"L" inches	"W" inches	"B" inches	"CTC" inches	"T" X 1000 lb
SS 20A CU	74.6	6.7	54.7	49.2	5.4
SS 20B CU	74.6	6.7	54.7	49.2	5.6
SS 20C CU	112.8	8.7	54.7	49.2	6.6
SS 20D CU	112.8	8.7	54.7	49.2	6.8
SS 30A CU	110.9	10.6	62.2	54.3	8.6
SS 30B CU	110.9	10.6	62.2	54.3	9.0
SS 30C CU	134.8	10.6	62.2	54.3	9.8
SS 40A CU	134.8	10.6	64.6	56.7	12.4
SS 40B CU	134.8	10.6	64.6	56.7	13.0
SS 40C CU	134.8	10.6	64.6	56.7	13.2
SS 50A CU	134.8	10.6	72.4	59.1	15.4
SS 50B CU	134.8	10.6	72.4	59.1	15.6
SS 60A CU	180.8	12.6	77.8	44.7	22.6
SS 60B CU	180.8	12.6	77.8	44.7	23.2
SS 60C CU	229.4	12.6	77.8	44.7	25.8
SS 60D CU	229.4	12.6	77.8	44.7	26.8
SS 70A CU	225.4	16.5	95.0	89.4	34.0
SS 70B CU	225.4	16.5	95.0	89.4	34.8
SS 80A CU	225.4	16.5	104.7	99.2	45.6
SS 80B CU	225.4	16.5	104.7	99.2	46.2
SS 80C CU	278.6	12.6	104.7	99.2	51.2
SS 80D CU	278.6	12.6	104.7	99.2	52.0

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. All the measurements are in mm



Typical Machine Illustration

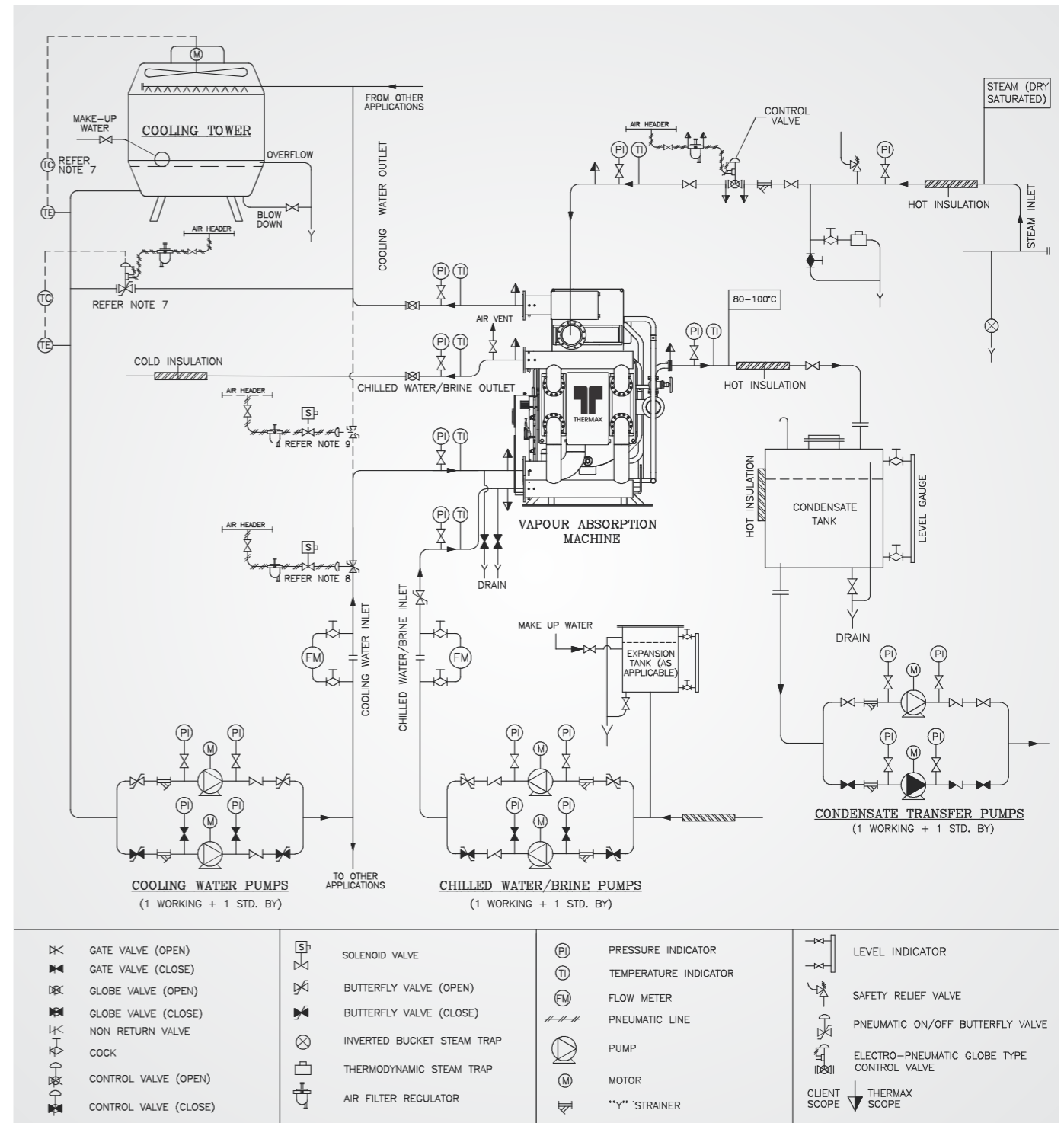
NOZZLE SCHEDULE		
NOZZLE	NOZZLE FL. RATING	DESCRIPTION
N1	ASA 150	CHILLED WATER INLET
N2	ASA 150	CHILLED WATER OUTLET
N3	-	CHILLED WATER DRAIN PLUGGED
N4	ASA 150	COOLING WATER INLET
N5	ASA 150	COOLING WATER OUTLET
N6	-	COOLING WATER DRAIN PLUGGED
N7	ASA 150	STEAM INLET
N8	ASA 150	CONDENSATE OUTLET



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 : 50"
TOP : 10"
OTHERS : 20"

Piping and Instrumentation Guidelines



Notes:

- 1) Pressure reducing station and a safety valve to be provided on steam inlet line, if the design / operating pressure is more than 50 Psig.
- 2) De-superheating to be installed on steam inlet line if the degree of superheat of steam exceeds 50°F.
- 3) The back pressure in the condensate drain line should not be more than 78°WC.
- 4) Automatic arrangements should be provided to stop cooling water flow through the machine, if the chilled water/brine flow stops.
- 5) Maximum working pressure in water headers is 115 Psig. This should be noted for design of chilled water and cooling water system.
- 6) Clean & dry compressed air supply to the instruments to be 71 Psig.
- 7) Necessary arrangements to be made to maintain constant cooling water inlet temperature to chiller. Minimum allowable cooling water inlet temperature is 50°F.
- 8) Install automatic shut off valve on the cooling water inlet line, if cooling water pumps are not dedicated to the machine.
- 9) If cooling water pumps are dedicated to the machine and chilled water/ brine temperature is < 40°F install cooling water automatic shut off valve only on the bypass line between cooling water inlet and outlet.

References



- Refinery & Petrochemical**
- Exxon Mobil, Saudi Arabia
 - Reliance Industries, India
 - Sipchem, Saudi Arabia
 - IOCL, India

- Metals**
- Tata Steel, India
 - Bhilai Steel Plant, India
 - Concord Steel, Brazil
 - Maklada Prestressed Steel, Tunisia



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

- Paper & Packaging**
- Phoenix Pulp And Paper, Thailand
 - BILT, India
 - Double A Paper, Thailand
 - TNPL, India



- Food & Beverage**
- Nestle, Philippines
 - Cadbury, Nigeria
 - Ferrero, Italy
 - Coca Cola, India

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



- Chemical**
- SFCCL, Saudi Arabia
 - Aditya Birla Chemicals, India
 - Eka Chemicals, China
 - Tata Chemicals, India

- Commercial Centers**
- BBC Studio, UK
 - Revel Casino, USA
 - Henry Ford Museum, USA
 - Lotus TESCO, Thailand



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Thermax Business Portfolio

Water & Waste Solutions

Air Pollution Control

Chemicals

Boilers & Heaters

Absorption Cooling

Captive Power

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