Direct Fired
Vapour Absorption Chiller
120 TR to 1439 TR (420 kW to 5050 kW)
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 it’s clients and exhibits in it’s 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 it’s valuable customers.

**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**

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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.

Manufacturing & Testing World-Class Facilities

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

Advanced Series Flow Cycle
Advanced Series Flow Cycle to avoid simultaneous occurrence of high temperature and high concentration, thereby minimizing the probability of corrosion.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parallel Flow</th>
<th>Advanced Series Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTG Temperature</td>
<td>162°C</td>
<td>155°C</td>
</tr>
<tr>
<td>LiBr Concentration</td>
<td>64 - 65%</td>
<td>60.5%</td>
</tr>
<tr>
<td>LGT Temperature</td>
<td>88°C</td>
<td>90°C</td>
</tr>
<tr>
<td>LiBr Concentration</td>
<td>62 - 64%</td>
<td>63%</td>
</tr>
</tbody>
</table>

Unique Two Stage Evaporation Technology
Thermax chillers are designed based on unique two stage evaporation technology. This ensures that the specific heat input is one of the lowest in the industry, resulting in higher cooling output for the same heat input. Also, larger temperature difference in chilled water to the tune of 30°C, is possible.

Split Absorber Design
Split absorber 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.

Best-in-class Coefficient of Performance
Process design to ensure maximum internal Heat recovery to give the lowest fuel consumption benefit to the customer.

<table>
<thead>
<tr>
<th>Avenues for COP improvement</th>
<th>Done by all manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enlargement of heat transfer area</td>
<td>Unique feature of Thermax chillers</td>
</tr>
<tr>
<td>Two stage evaporation</td>
<td>Unique feature of Thermax chillers</td>
</tr>
<tr>
<td>Advanced series flow</td>
<td>Design unique to Thermax chillers</td>
</tr>
<tr>
<td>Refrigerant heat exchanger</td>
<td>Unique feature of Thermax chillers</td>
</tr>
</tbody>
</table>

Stainless Steel Plate Heat Exchangers
All regenerative heat exchangers are high efficiency plate type heat exchangers with SS316 plates, for improved reliability & maximum internal 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 Generators
Titanium stabilized ferritic stainless steel tubes (SS430 Ti) used in low temperature generator for lowest differential thermal expansion, thereby protecting the tubes from stress corrosion cracking.

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.

Wet Back & Wet front Design
The fuel firing furnace has wet back and wet front design, eliminating the need of extensive refractory and preventing over heating of tube sheet and shell.
Improved Online Purge System

Factory fitted high efficiency purge system with purge cooler, continuously removes non-condensable gases from the chiller into the storage tank while in operation.

PLC Based Control Panel

Thermax chillers are provided with State-of-the-Art PLC based control panel, user friendly 7 inch touch screen operator interface and data logging system.

Non-clogging Filters to protect Solution Heat Exchangers

Stainless steel filters provided on both high temperature and low temperature generator outlet to safe guard the solution heat exchangers. Non-clogging design ensures uninterrupted circulation of lithium bromide, resulting in smooth operation.

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.
**Customized Offering**

**LiBr Absorption Chillers for Sub-Zero Cooling Applications**
Double effect Lithium bromide absorption chillers can be offered for leaving brine temperatures as low as -5.0°C, offering great savings in operating costs.

**Hot Water for Heating**
For catering to heating and cooling applications, this product can be upgraded to a chiller heater. Chiller heater is customized with dedicated heat exchanger which can provide hot water for heating applications, thereby eliminating the need of separate equipment for heating. This chiller heater can be configured to operate alternately on heating and cooling mode or for simultaneous heating and cooling operation.

**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.

**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**

**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.

**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.
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**

### Operating Principle

1. **Water Absorber**
   - Water circulating heat exchanger on chilled water.
   - Chilled water (refrigerant) is sprayed on the solution.
   - The water vapor is absorbed by the solution.
   - The solution becomes concentrated.

2. **Absorption Pump**
   - The concentrated solution is sprayed back into the absorber.
   - This causes the vapor to release the absorbed refrigerant in the form of vapor.
   - The condensed vapor is cooled in a separate chamber.
   - The liquid refrigerant is collected.

3. **Refrigerant Pump**
   - The refrigerant is pumped to the generator.
   - The heat source causes the solution to release the refrigerant in the form of vapor.
   - The vapor is condensed to become liquid refrigerant.

4. **Evaporator**
   - The liquid refrigerant is sprayed on the evaporator to absorb heat.
   - The refrigerant becomes vapor.

### Cycle Diagram

[Diagram showing the flow of water, refrigerant, and heat through different components of the system.]

### Table

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Units</th>
<th>2V 1C</th>
<th>2V 2C</th>
<th>2V 3C</th>
<th>2V 4C</th>
<th>2V 5C</th>
<th>2V 6C</th>
<th>2V 7C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chilled Water</strong></td>
<td>Flow rate</td>
<td>m³/hr</td>
<td>120</td>
<td>143</td>
<td>182</td>
<td>217</td>
<td>269</td>
<td>304</td>
</tr>
<tr>
<td><strong>Chilled Water</strong></td>
<td>Pressure Loss</td>
<td>m LC</td>
<td>1.2</td>
<td>1.4</td>
<td>3.7</td>
<td>4.4</td>
<td>4.1</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Chilled Water</strong></td>
<td>Connection Diameter</td>
<td>mm</td>
<td>150</td>
<td>200</td>
<td>250</td>
<td>300</td>
<td>350</td>
<td>400</td>
</tr>
</tbody>
</table>

### Fuel Circuit

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Units</th>
<th>2V 1C</th>
<th>2V 2C</th>
<th>2V 3C</th>
<th>2V 4C</th>
<th>2V 5C</th>
<th>2V 6C</th>
<th>2V 7C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Dimensions</strong></td>
<td>Length</td>
<td>mm</td>
<td>3005</td>
<td>3605</td>
<td>3985</td>
<td>4590</td>
<td>4700</td>
<td>4590</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Maximum Shipping</td>
<td>kg</td>
<td>120</td>
<td>143</td>
<td>182</td>
<td>217</td>
<td>269</td>
<td>304</td>
</tr>
<tr>
<td><strong>Clearance</strong></td>
<td>Tubing Cleaning / Removal</td>
<td>mm</td>
<td>3500</td>
<td>4100</td>
<td>4000</td>
<td>4300</td>
<td>4000</td>
<td>4300</td>
</tr>
<tr>
<td><strong>Electric Supply</strong></td>
<td>Absorbed Pump Motor Rating</td>
<td>kW (A)</td>
<td>2.2 (6.0)</td>
<td>2.2 (6.0)</td>
<td>5.0 (8.0)</td>
<td>3.0 (6.0)</td>
<td>3.0 (6.0)</td>
<td>3.7 (8.0)</td>
</tr>
<tr>
<td><strong>Fuel Circuit</strong></td>
<td>Oil Consumption</td>
<td>kg/hr</td>
<td>0.3 (1.4)</td>
<td>1.5 (6.1)</td>
<td>4.0 (8.7)</td>
<td>7.5 (14.7)</td>
<td>7.5 (15.2)</td>
<td>11.0 (22.8)</td>
</tr>
<tr>
<td><strong>Power Supply</strong></td>
<td>Power Supply</td>
<td>415 V (±10%), 50 Hz (±5%), 3 Phase+N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

1. Model Nos.: 2V XX C Direct fired Double effect Vapor Absorption Chiller  
2. Chilled water inlet/outlet temperature = 12/ 7°C  
3. Cooling water inlet/outlet temperature = 30/ 37°C  
4. D.C. V. for Oil is 10960 kcal/kg  
5. Minimum Cooling water inlet temperature is 10°C (For GD10A-10C CU -20°C)  
6. Ambient condition shall be between 5 to 45°C  
7. Maximum Allowable pressure in chilled/cooling water system = 8 kg/cm²(g)  
8. All Water Nozzle connections to suit ASME B16.5 Class 150  
9. Technical specification is based on JIS B 8622  
10. Please contact Thermax representative/ office for customized specifications  
11. Please contact Thermax representative/ office for lower cooling water flow  
12. Control panel Electric Input = 1kVA
1) There should be a drain ditch around the foundation.
2) The floor surface should be made as waterproof for ease of maintenance work.
3) Finish the foundation work horizontally flat & smooth at the horizontal grade of above 1/1000.
4) The foundation shall be designed to suit the soil conditions and other design considerations at site.
1. Pressure reducing station should be installed on the gas supply line if the supply pressure is more than 100 m bar.

2. The flue gas pressure at the outlet nozzle of machine is 0-5 mm WC. The flue gas ducting and chimney/stack height should be designed considering this.

3. Local regulations are to be strictly followed for chimney design, storage of fuels, emission of gases etc. Chimney discharge should be located at a sufficient distance away from cooling tower.

4. If same stack is used to discharge flue gas from more than one machine, provide automatic shut off damper on the flue gas outlet duct to prevent back flow of flue gases.

5. Automatic arrangements should be provided to stop cooling water flow through the machine, if the chilled water/brine flow stops.

6. Maximum working pressure in water headers is 8.0 kg/cm²(g). This should be noted for design of chilled brine and cooling water system.

7. Necessary arrangements to be made to maintain constant cooling water inlet temperature to chiller. Minimum allowable cooling water inlet temperature is 10°C.

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 < 4.5°C install cooling water automatic shut off valve only on the bypass line between cooling water inlet and outlet.

10. Rupture disk piping should be adequately supported. Use flexible connection to avoid any load on the rupture disk flange joint.

11. Rupture disk piping elevation should not exceed the rupture disk outlet nozzle.

12. Discharge from rupture disk should be collected to facilitate reuse. Else, drain the discharge safely as per local norms/guidelines.
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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