TRiGENIE™ Multi-energy Vapour Absorption Machines

40 TR - 4000 TR (140 kW to 14000 kW)

From the leader in innovative cooling and heating solutions
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 1 million 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 and the US. 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 requirement of 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, Textiles, Petrochemicals, Food & Beverages and Automobile industries as well as in Hotels, Commercial Complexes, Shopping Complexes, Office Buildings, Educational Institutes, Airports and Cinema halls.

Manufacturing capabilities of Thermax’s Cooling SBU are confirmed by the fact that, over the years, Thermax has installed numerous machines in more than 70 countries including USA, 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 Thermix Inc. in USA, Thermex 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.
Engine gensets normally have about 40% overall electrical efficiency. The balance 60% is wasted to the atmosphere. The conventional method is to recover the waste heat through individual recovery equipment to cater to heating/cooling requirements. Get double the overall system efficiency!

Sankey Diagram for IC engine WITH HEAT RECOVERY 75 - 80%

Engine gensets normally have about 40% overall electrical efficiency. The balance 60% is wasted to the atmosphere. The conventional method is to recover the waste heat through individual recovery equipment to cater to heating/cooling requirements.

Unique features of Trigenie
- Dump condenser - crystallisation prevention during shutdown of VAM
- Common chiller for up to 3 engines without mixing of gases - optimised capex as well as floor space
- Approximately 12 to 15% higher heat recovery from the same exhaust flow parameters with heat exchanger design - improved ROI
- Separate generator for hot water recovery - better recovery at engine part load conditions, higher COP of VAM at part load operations
- Customised exhaust gas inlet/outlet connection to suit a site layout
- Maximising heat recovery - customised design to recover maximum heat from jacket hot water with outlet temperature as low as 70 to 75 °C
- Back pressure management - engine/turbine always accorded first priority

Highest COP
Process design that ensures maximum internal heat recovery to give the lowest specific heat input benefit to the customer.
- Enlargement of heat transfer area - Done by all manufacturers
- Two stage evaporation - Feature unique to Thermax VAM
- Large temperature difference of chilled water - Thermax can offer ΔT as high as 30 °C
- Refrigerant heat exchanger - Feature unique to Thermax VAM
- Exhaust gas heat exchanger - Feature unique to Thermax VAM
Trigenie - designed and engineered to perform

Latest two stage evaporation technology

The unique two stage evaporation technology ensures the Lowest Specific Heat Input requirement resulting in lowest heat and water consumption.

Two stage evaporation also gives 5 to 7% higher COP than conventional single stage evaporation technology.

Advanced series flow

<table>
<thead>
<tr>
<th>Parameter for HTG</th>
<th>Unit</th>
<th>Para Flow</th>
<th>Advanced Series Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTG temperature</td>
<td>°C</td>
<td>162</td>
<td>155</td>
</tr>
<tr>
<td>LiBr concentration</td>
<td>%</td>
<td>64-65</td>
<td>60.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter for LTG</th>
<th>Unit</th>
<th>Para Flow</th>
<th>Advanced Series Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTG temperature</td>
<td>°C</td>
<td>88</td>
<td>90</td>
</tr>
<tr>
<td>LiBr concentration</td>
<td>%</td>
<td>62-64</td>
<td>63</td>
</tr>
</tbody>
</table>

Advanced series flow cycle to avoid simultaneous occurrence of high temperature and high concentration, thereby minimising the probability of corrosion.

Zero crystallisation

Unique state-of-the-art concentration control and display that virtually eliminates crystallisation and is distinctly different from the auto decrystallisation offered by other manufacturers. This permits the VAM to run smoothly even at 10 °C cooling water inlet temperature.

AC drives

Variable frequency control on absorbent pump for higher reliability & savings in power, especially during part load operation.

Isolation valves

Isolation valves with special seals for vacuum application and bolted pumps to facilitate machine mounted pump maintenance without any loss of vacuum in the system due to exposure to atmosphere.

Chilled brine outlet temperature up to 0°C. In applications where temperature of less than 4 °C is critical, vapour absorption technology can now be put to use.

**PLC control**

PLC based control panel with display, user friendly interface and data logging system. Remote performance monitoring / DCS / BMS connectivity also possible.

**Customised tube metallurgy**

Special tube materials like Cupro Nickel, SS-316L, Titanium depending on water quality on site.

**Corrosion inhibitor**

Non-precipitating and non toxic Molybdenum based corrosion inhibitor that ensures smooth and stable performance.

**Deoxidised Low Phosphorus copper tubes**

These tubes conform to ASTM standards and presence of phosphorus is maintained at less than 0.005 ppm which protects the tubes from Hydrogen embrittlement in LiBr environment.

**Multistage level control**

Multistage level control provided in the three heat exchangers enable effective operation during part load and help avoid cavitation of solution pump.

**Test bay**

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 - 1380 TR (30 kW to 4850 kW)
- **Fuel Fired**: 50 - 3000 TR (175 kW to 10540 kW)
Online standby solution and refrigerant pumps
Thermax can offer machine mounted, standby absorbent and refrigerant pump.

Multi-sectional shipment arrangements
For convenient shipping and rigging, Thermax Vapor Absorption Machines can be shipped in two or more sections depending upon the site requirements.

Auto purging

Remote Performance Monitoring System (RPMS)

Holistic customer care
Thermax Absorption Cooling Division has a wide network of Service Centres across the globe to ensure quick response to customers. With a cumulative service experience of over 4000 VAMs operating for more than 25 years, Thermax service personnel are equipped to deliver the right solution to users.

In fact, in keeping with the company’s proactive approach, Thermax has developed specific service modules for different types of users; depending on their usage pattern. For the benefit of its customers, Thermax offers various value-added services like:
- Preventive maintenance contract
- Operation & manning
- Localized customer training programs

Backed by quality assured manufacturing to international codes
Reference list of CHPC installations

**Electronics**
- Videocon Narmada Glass, Bharuch, India
- AT&S, Mysore (India), Shanghai (China)
- Moser Baer, Noida, India

**Polyfibres/ Spinning Mills**
- Gujarat Polyfilms, Surat, India
- Recron Synthetics, Allahabad, India
- United Weaving, Bangladesh

**Shopping Malls/ Multiplexes**
- Pacific Mall, New Delhi, India
- Cross River Mall, New Delhi, India
- Atlantis Mall, Allahabad, India
- Grand Venezia, Noida, India

**Food Processing/ Packaging**
- Perfetti Van Malle, Chennai, India
- Amul Dairy, Ahmedabad, India
- Mother Dairy, Ahmedabad, India
- Tetra Pak, Pune, India

**Chemicals & Pharmaceuticals**
- Bayer India Ltd., Ankleshwar, India
- Sunpharma, Panoli, India
- Cadila Pharma Ltd., Ankleshwar, India
- Astrazeneca UK and India

**Glass, Plastics and others**
- Neutral Glass, Ankleshwar, India
- PTT, Thailand
- Arashi Hitech, Coimbatore, India
- Murundeshwar Ceramics, Karaikal, India

**Software Parks**
- ITPL, Bangalore, India

**Commercial/ Institution**
- California State University, Fullerton, USA
- Rome Airport, Italy
- Berlin Airport, Germany

**Data Centres**
- T - Systems, Germany
- IBM Data Centre, Syracuse University, USA
## Technical Specification Sheet

### Double Effect Exhaust Fired Series

#### Cooling Capacity

<table>
<thead>
<tr>
<th>Model Number</th>
<th>UNIT</th>
<th>ED-10A HU/ED-10A CU</th>
<th>ED-10B HU/ED-10B CU</th>
<th>ED-10C HU/ED-10C CU</th>
<th>ED-20A THU/ED-20A TCU</th>
<th>ED-20B THU/ED-20B TCU</th>
<th>ED-20C THU/ED-20C TCU</th>
<th>ED-20D THU/ED-20D TCU</th>
<th>ED-30A THU/ED-30A TCU</th>
<th>ED-30B THU/ED-30B TCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR</td>
<td>kW</td>
<td>4.1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
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<tr>
<td>172</td>
<td>m³/hr</td>
<td>284</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>48</td>
<td>°C</td>
<td>105</td>
<td>132</td>
<td>147</td>
<td>172</td>
<td>172</td>
<td>172</td>
<td>172</td>
<td>172</td>
<td>172</td>
</tr>
<tr>
<td>48</td>
<td>kVA</td>
<td>150</td>
<td>200</td>
<td>260</td>
<td>320</td>
<td>370</td>
<td>470</td>
<td>530</td>
<td>670</td>
<td>770</td>
</tr>
</tbody>
</table>

#### Chilled Water Circuit

| Flow Rate | m³/hr | 29.6 | 45.2 | 62.7 | 79.6 | 85.3 | 120.6 | 143.6 | 178.6 | 202.7 |
| Inlet Outlet Temperature | °C | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 | 12.7 |
| Friction loss | m/sec² (kPa) | 2.9 (28.4) | 4.7 (46.1) | 5.0 (49.0) | 1.7 (16.7) | 2.1 (20.6) | 5.0 (49.0) | 6.0 (58.8) | 5.4 (53.0) | 6.0 (58.8) |

#### Exhaust Gas Circuit

| Exh Gas Outlet Temperature | °C | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 | 29.4/34.9 |
| Friction loss | m/sec² (kPa) | 3.8 (37.3) | 5.8 (56.9) | 6.9 (67.7) | 2.5 (24.5) | 2.7 (26.6) | 6.9 (67.7) | 7.0 (68.6) | 6.5 (64.7) | 6.7 (65.7) |

### Notes:

1. Model Nos.: ED XXX - HU/THU/THU/THU Exhaust Gas Driven Double Effect Chillers
2. Dimensions & weights are approximate and should be used for indicative purpose only.
3. These are custom built chillers, designed based on the engine and its loading condition.
4. Minimum Cooling water inlet temperature is 10°C.
5. Ambient condition shall be + N °C (±10%), 3 Phase, 50 Hz (±5%).
6. Maximum Allowable pressure in Chilled / Cooling water system = 8 kg/cm² (784.5 kPa(g)).
7. All Water Nozzle connections to suit ASME B16.5 Class 150.
8. Control panel Electric Input = 1kVA.
9. Power supply required is 415 V (±10%), 3 Phase, 50 Hz (±5%)
10. Above specifications are valid for insulated machine.
### Technical Specification Sheet

#### Double Effect Exhaust + Jacket Water Fired Series

<table>
<thead>
<tr>
<th>Model Number</th>
<th>UNIT</th>
<th>EJ 60D TCU</th>
<th>EJ 70A TCU</th>
<th>EJ 70B TCU</th>
<th>EJ 80A TCU</th>
<th>EJ 80B TCU</th>
<th>EJ 80C TCU</th>
<th>EJ 80D TCU</th>
<th>EJ 10A HU</th>
<th>EJ 10B HU</th>
<th>EJ 10C HU</th>
<th>EJ 20A TCU</th>
<th>EJ 20B TCU</th>
<th>EJ 20C TCU</th>
<th>EJ 20D TCU</th>
<th>EJ 30A TCU</th>
<th>EJ 30B TCU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cooling Capacity</strong></td>
<td>kW</td>
<td>304</td>
<td>440</td>
<td>677</td>
<td>910</td>
<td>1136</td>
<td>1373</td>
<td>1610</td>
<td>1610</td>
<td>1610</td>
<td>1610</td>
<td>1610</td>
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<td>1610</td>
<td>1610</td>
<td>1610</td>
<td>1610</td>
</tr>
<tr>
<td><strong>Connected Power kVA</strong></td>
<td>82</td>
<td>126</td>
<td>174</td>
<td>200</td>
<td>240</td>
<td>304</td>
<td>361</td>
<td>449</td>
<td>510</td>
<td>570</td>
<td>647</td>
<td>784.5</td>
<td>820</td>
<td>880</td>
<td>947</td>
<td>1012</td>
<td>1182</td>
</tr>
<tr>
<td><strong>Flow Rate m³/hr</strong></td>
<td>125</td>
<td>180</td>
<td>240</td>
<td>300</td>
<td>350</td>
<td>400</td>
<td>450</td>
<td>500</td>
<td>550</td>
<td>600</td>
<td>650</td>
<td>700</td>
<td>750</td>
<td>800</td>
<td>850</td>
<td>900</td>
<td>950</td>
</tr>
<tr>
<td><strong>Operating Weight Tons</strong></td>
<td>6.6</td>
<td>8.6</td>
<td>10.2</td>
<td>12.2</td>
<td>14.8</td>
<td>17.5</td>
<td>20.2</td>
<td>22.8</td>
<td>25.4</td>
<td>28.0</td>
<td>30.6</td>
<td>33.2</td>
<td>35.8</td>
<td>38.4</td>
<td>41.0</td>
<td>43.6</td>
<td>46.2</td>
</tr>
<tr>
<td><strong>Commercial Power kW</strong></td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
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<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**Notes:**
1. Model No.: EJ 60D - THU/THU/CU/THU Exhaust Gas + Jacket water fired Multi Energy Chillers
2. Dimensions & weights are approximate and should be used for indicative purposes only.
3. Control panel electric input = 1 kVA
4. Minimum cooling water inlet temperature = 5°C
5. All specified capacities are based on ASME B16.5 Class 150, suit ASME B16.5 Class 150

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### Technical Specifications

- **Connected Power kVA:**
  - 8.2
  - 14.8
  - 21.3
  - 25.6
  - 30.3

- **Operating Weight Tons:**
  - 16.3
  - 20.1
  - 23.5
  - 31.6
  - 45.1

- **Dimensions Width mm:**
  - 2100
  - 2250
  - 2600
  - 2800
  - 3100

- **Overall Length mm:**
  - 2600
  - 2850
  - 3100
  - 4100
  - 4400

- **Height mm:**
  - 2200
  - 2400
  - 2900
  - 3000
  - 3300

- **Cooling Water Flow Rate m³/hr:**
  - 49
  - 75
  - 104
  - 132
  - 158
  - 200
  - 235
  - 296
  - 336

- **Chilled Water Flow Rate m³/hr:**
  - 29.6
  - 45.2
  - 62.7
  - 79.6
  - 95.3
  - 120.6
  - 143.6
  - 178.6
  - 202.7

- **Cooling TR:**
  - 395
  - 440
  - 501
  - 557
  - 610
  - 676
  - 786
  - 870
  - 950

- **Friction loss mWC (kPa):**
  - 4.6 (45.1)
  - 3.8 (37.3)
  - 4.0 (39.2)
  - 4.2 (41.2)
  - 3.7 (36.3)
  - 3.8 (37.3)
  - 5.6 (54.9)
  - 5.7 (55.9)
  - 6.3 (61.8)

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*Additional heat recovery from exhaust up to 185 to 140°C (unique to Thermax) available on request.*
TRiGENiE - working with all leading engine/turbine makes

- MAN B & W
- CAT
- Rolls Royce
- Cummins
- Guascor
- Waukesha
- GE Jenbacher
- Deutz
- Hyundai
- Capstone Microturbine
- Wartsila
- Deutz
- Rolls Royce
- Capstone Microturbine

Exhaust Fired Cycle

- Refrigerant Liquid
- Intermediate Solution
- Dilute Solution
- Refrigerant Vapour
- Strong Solution
Meet your cooling requirements from any heat source

**HEAT SOURCE**
- Steam - from Process
- Steam - from Boiler
- Hot Water - from Process
- Hot Water - from Engine
- Liquid/Gaseous Fuels - Natural Gas/ LPG
- Liquid/Gaseous Fuels - Bio-gas/ Producer Gas
- Liquid/Gaseous Fuels - SKO
- Liquid/Gaseous Fuels - HSD etc
- Exhaust Gas - from Engine/ Turbine
- Exhaust Gas - from Micro Turbine/ Furnace
- Combination of any two or more of above

**APPLICATIONS**
- THERMAX Vapour Absorption Machine
- Air Conditioning
- Process Cooling

**THERMAX Business Portfolio**
- Water & Waste Solutions
- Air Pollution Control
- Chemicals
- Boilers & Heaters
- Absorption Cooling
- Captive Power

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