

Double Effect Direct Fired Absorption Chiller

114 TR (400 kW) to 1413 TR (4970 kW)

COP 1.5



Absorption Cooling & Heating Solutions

Sustainable Solutions in Energy & Environment

Thermax is a USD 750 million engineering major providing sustainable solutions in the areas of energy and environment. Spanning over 90 countries, customers make use of Thermax's business-to-business solutions for heating, cooling, power and cogeneration plants; waste heat recovery units; systems for water & wastewater management and air pollution control; performance improving chemicals.

Thermax's operations are supported by ongoing Research & Development and also with tie-ups from global technology majors. With an international sales & service network spread over 27 countries, Thermax also has its state-of-the-art manufacturing facilities in 14 locations including India, Poland, Indonesia, Denmark & Germany.

Our Vision

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

We heat, we cool, we power and we clean

Thermax, an engineering company providing sustainable solutions in energy and environment, has the vision for the future, firmly anchored in the belief that to stay competitive, companies need to adopt sustainable development practices.

The systems, products and services developed by Thermax help industries achieve better resource productivity and improve bottom lines, while maintaining a cleaner environment. Even in the conversion of costs to profits, Thermax helps to protect the environment in its own way. A win-win for industry and the society at large.

Thermax's business portfolio includes products for heating, cooling, water and waste management, and specialty chemicals. The company also designs, builds and commissions large boilers for steam and power generation, turnkey power plants, industrial & municipal waste water treatment plants, waste heat recovery systems and air pollution control projects.



Thermax Cooling Business

With over 50 years of expertise in the field of Thermodynamics, Thermax helps extract even the last calorie available at your facility. Solutions in the form of absorption chillers, heat pump, chiller-heaters, composite chillers, ultra low pressure vapour chiller & multi energy chillers are used in more than 100 applications and over 50 industrial segments for air conditioning, industrial cooling and heating.

Thermax absorption chillers cater to industrial-cooling, commercial air-conditioning as well as industrial and space heating needs. Thermax's USP lies in identifying the unused heat available at your plant and provide recovery based or live energy based solutions to optimize energy thus reducing your operational cost.

Thermax offers solutions from -40°F to 356°F by utilizing hot water starting from 176°F vapour or steam from 0 psi(g) onwards/flue gases from engine and turbines from 518°F onwards and a variety of liquid and gaseous fuel.

Thermax has helped clients with Eco-friendly air-conditioning and process cooling to reduce their carbon

footprints. Thermax has a global foot print in 90+ countries across Asia Pacific, Africa, Middle East to CIS countries, USA and South America.

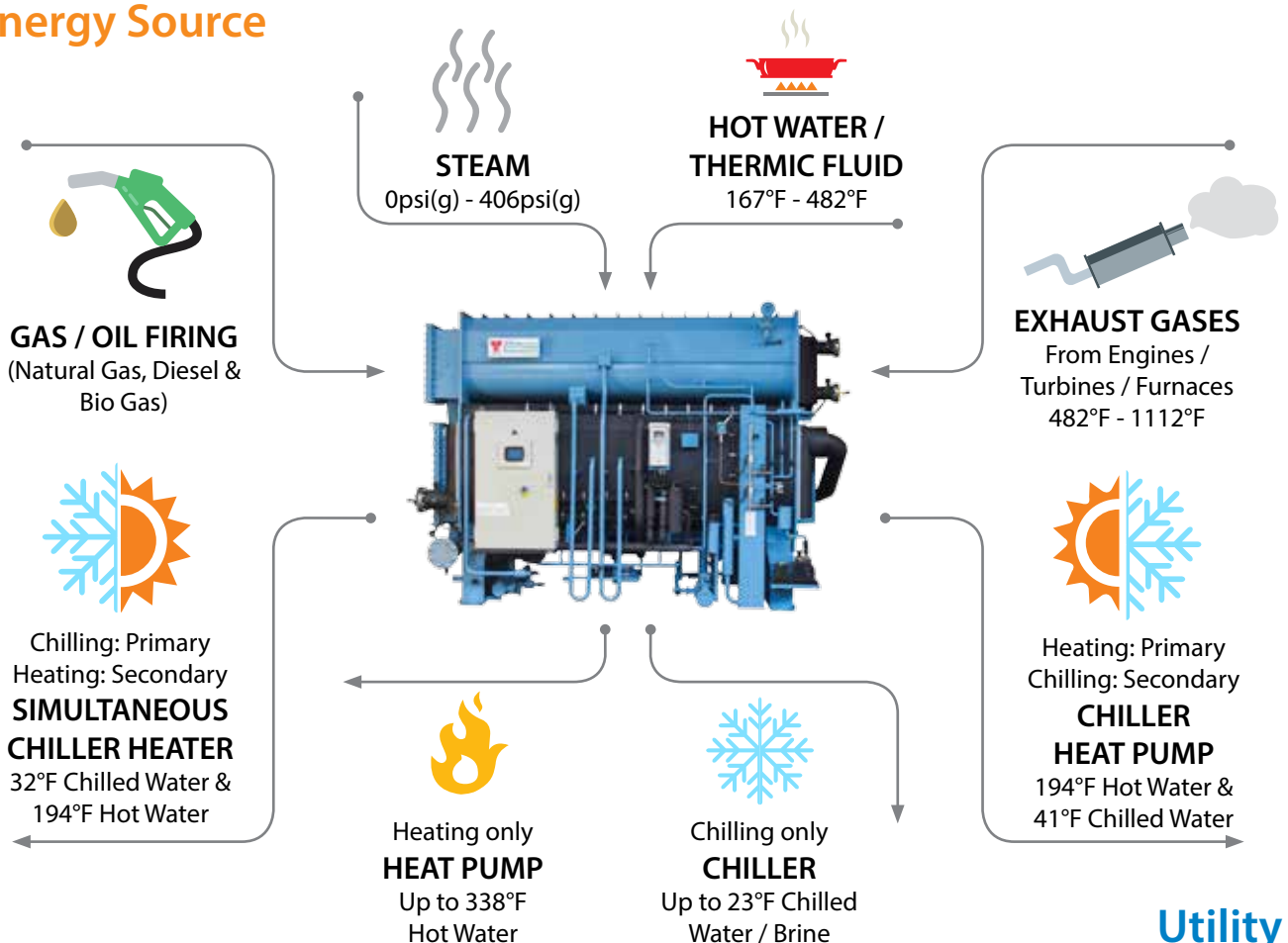
Thermax offers solutions to a wide array of industrial segments including pharmaceuticals, chemicals, fertilizers, steel, textiles, petrochemicals, food & beverages, commercial complexes, shopping complexes, office buildings, educational institutes, and airports among others.

Solutions offered by Thermax are differentiated by:

- Reduction of operational cost
- Reduction in electricity consumption
- Reduction in the GHG emissions, zero ozone depletion potential

Thermax's unique heating & cooling solutions accommodate a wide range of industrial & commercial applications across the globe. These solutions deliver high efficiency, cost effectiveness & are environment friendly.

Energy Source



Manufacturing Excellence

Inaugurated in early 2019, Thermax's manufacturing facility at Sricity, Andhra Pradesh is a state-of-the-art IGBC platinum certified green factory building and has been designed focusing on process automation, mechanisation and digitisation. This smart facility is equipped with best in class machinery and is a big step towards automation to facilitate zero-defect processes ensuring superior quality products. Critical processes such as welding are carried out with robots and CNC machines carry out the precision machining activities. Fabrication processes are mechanised using specially

designed fixtures. Entire manufacturing records are digitised for real time updates using MES software. Engineering design automation using 3D drawings, Cloud computing and MES have enabled this plant to employ contemporary technologies and follow the path of Industry 4.0 principles. The plant is equipped with a Welding Training Centre to hone the skills of operators. Products upto 3000 TR capacity can be tested for performance at its digitally controlled test bay facility. This infrastructure is created to deliver best in class quality output.

Certifications

Recognized by global standards





Salient Features

Best-in-class Coefficient of Performance

Thermax chillers come with a process design that ensures maximum internal heat recovery to give the lowest specific fuel consumption benefit.

Avenues for COP improvement	
Enlargement of heat transfer area	Done by all manufacturers
Two stage evaporation	Unique feature of Thermax chillers
Advanced series flow Design	Unique to Thermax chillers
Refrigerant heat exchanger	Unique feature of Thermax chillers

Advanced Series Flow Cycle

Thermax chillers have an advanced Series Flow Cycle to avoid simultaneous occurrence of high temperature and high concentration, thereby minimizing the probability of corrosion.

Parameter	Parallel Flow	Advanced Series Flow
HTG Temperature	323.6°F	311°F
LiBr Concentration	64 - 65%	60.5%
LTG Temperature	190.4°F	194°F
LiBr Concentration	62 - 64%	63%

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 86°F, is possible.

Gravity Feed LiBr and Refrigerant Distribution Mechanism

With a nozzle-less, non-clogging gravity feed distribution mechanism for stable and reliable operation throughout the life of the machine, Thermax chillers eliminate the drop in performance. Need for separate pump for spray eliminated, resulting in lower power consumption.

Split Evaporator Design

Split evaporator design of the chillers help to improve absorption rate of LiBr, thereby improving efficiency.

Zero Crystallization

With a unique state-of-the-art concentration monitoring & control, Thermax chillers operate even at low cooling water inlet temperature without crystallization. This unique feature virtually eliminates crystallization and is distinctly different from the conventional auto de-crystallization.

Lowest Chilled Water/ Brine Outlet Temperature

Thermax innovative absorption chillers can deliver leaving chilled water temperatures down to 33.8°F and leaving chilled brine solution up to 28.4°F, enabling absorption chillers to be used for applications involving low chilled water / brine temperature.

Stainless Steel Plate Heat Exchangers

All regenerative heat exchangers from Thermax are high efficiency plate type heat exchangers with SS 316 plates, for improved reliability & maximum internal heat recovery.

Wet Back and Wet Front Design

The fuel firing furnace has wet back and wet front design, preventing over heating of tube sheet and shell, thereby improving the reliability. This also eliminates refractory lining, which otherwise requires periodic maintenance. Thermax HTG design has LiBr entry from bottom and exit from top which enables uniform circulation of LiBr and avoids hot spot. Turbulators in smoke tubes improve the overall heat transfer coefficient, allowing higher heat recovery from exhaust and resulting in lower exhaust outlet temperature

Flue Gas Economizer

To ensure maximum heat recovery from flue gases and thereby higher COP, economizer is provided to reduce the flue gas temperature to 248°F by heating dilute LiBr solution.

Turbulators for Enhanced Heat Transfer Rates

Turbulators in smoke tubes improve the overall heat transfer coefficient, allowing higher heat recovery from exhaust and resulting in lower exhaust outlet temperature

De-oxidised Low Phosphorus Copper Tubes

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

Multi-stage Level Control

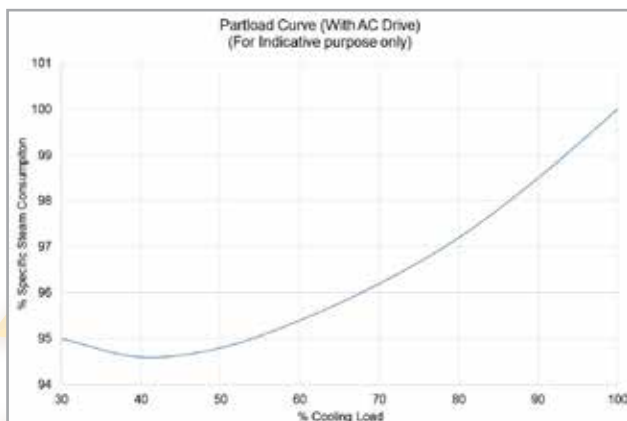
Multiple stage level control in three locations enables effective operation during part load and prevents cavitation of refrigerant and absorbent pumps.

Online Pump Health Monitor

The chiller PLC continuously monitors the health of canned motor pumps and informs user of any impending maintenance requirement.

Variable Frequency Drive on Absorbent Pump

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



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.

BAS/DCS Connectivity

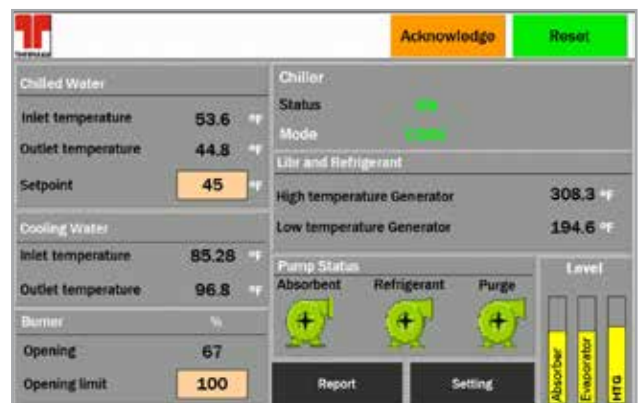
Direct connectivity of machine PLC panel with Third party monitoring systems like BAS (Building Automation System), DCS (Distributed Control System) or PLC (Programmable Logic Controller) can be provided via Modbus RTU protocol on RS485 network.

Fully Automatic Purging

Factoryfitted high efficiency Automatic purge system with purge cooler, continuously removes noncondensable gases from the chiller into the storage tank while in operation. A high efficiency multi-location purging system helps to independently remove noncondensable gases from different pressure levels. This also eliminates the need for periodic monitoring of purge tank pressure and manual operation of purge system.

PLC Based Control Panel

Thermax chillers are provided with advanced PLC based control panel, user friendly 7 inch touch screen operator interface and data logging system.



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.

Customised Solutions

Customized Electrical and Instrumentation

Thermax possesses rich experience supplying chillers for critical applications in refinery and petrochemical plants across the globe. Thermax has in house capability to address critical applications such as:

- Hazardous area design for gas group class 1, division 2, IIA/IIB, per IEC and NEC Standards
- Redundant PLC systems, with redundancy at all levels, of various makes for fail safe operations
- Centralized Load management systems for multiple machines operating in tandem
- SCADA connectivity for remote monitoring and control of machines.

LiBr Absorption Chillers for Sub-Zero Cooling Applications

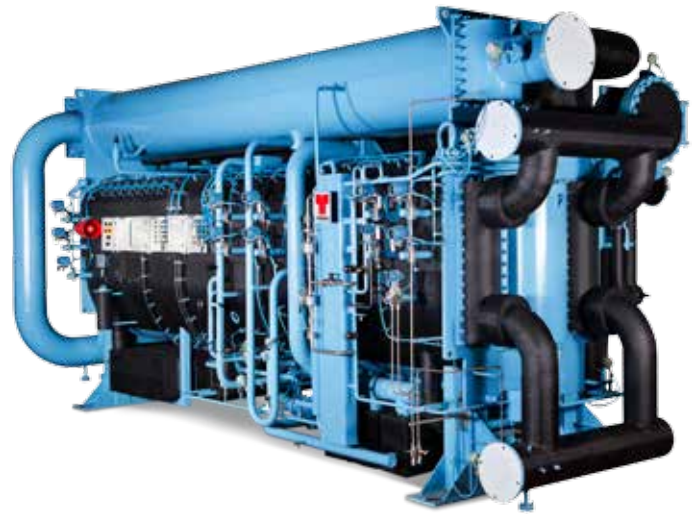
Direct Fired Lithium bromide absorption chillers can be offered for leaving brine temperatures as low as 23°F, offering great savings in operating costs.

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.

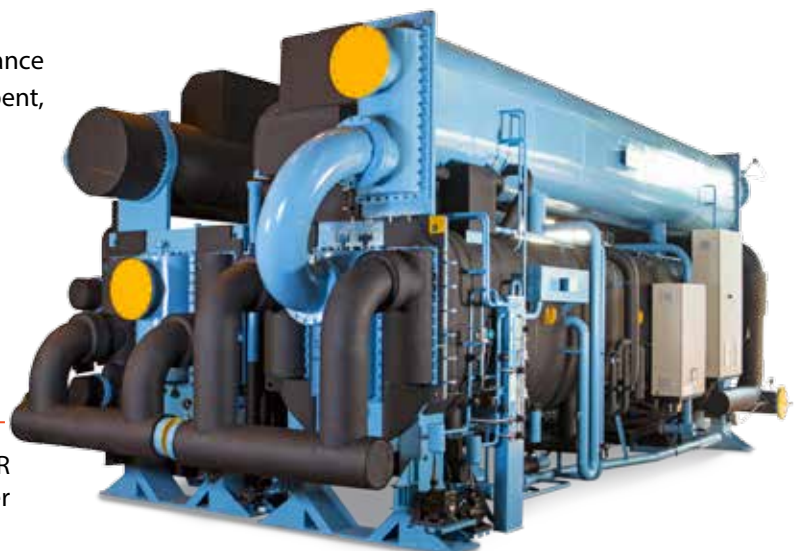


Multi Sectional Shipment Arrangement

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.

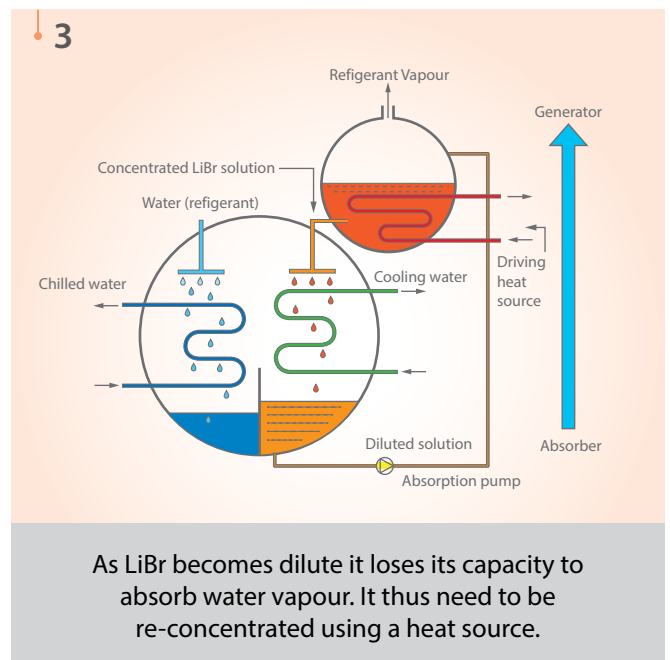
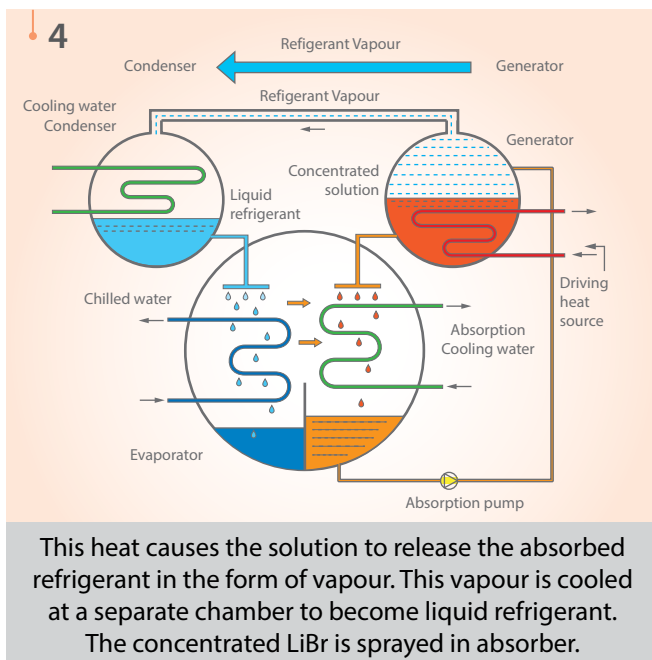
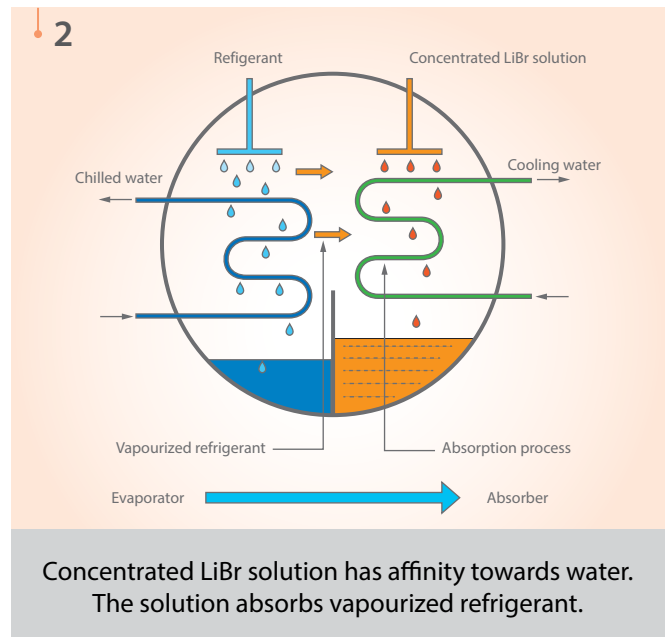
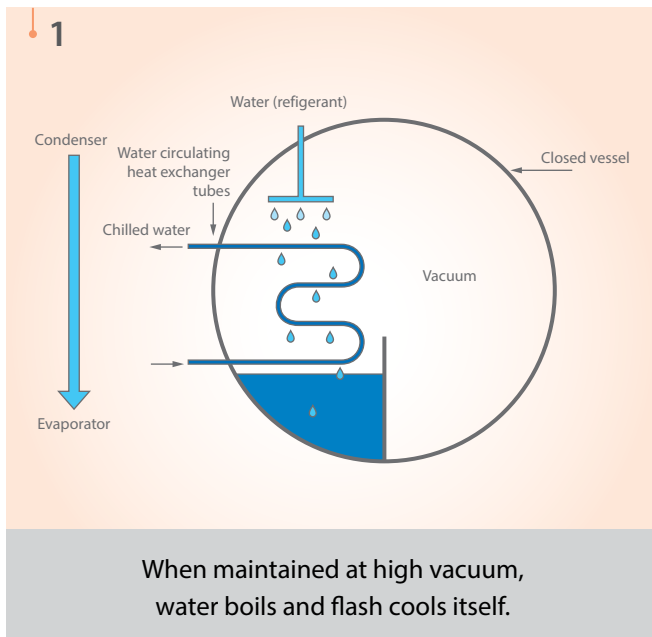


3500 TR
Absorption Chiller

Basic Principle

Vapour Absorption Machine uses water as the refrigerant and Lithium Bromide (LiBr) solution as the absorbent. The process of cooling goes through stages such as evaporation of refrigerant in evaporator, absorption of refrigerant by concentrated LiBr solution in absorber, boiling of dilute LiBr solution to generate refrigerant vapour in generator and condensation of refrigerant vapour in condenser.

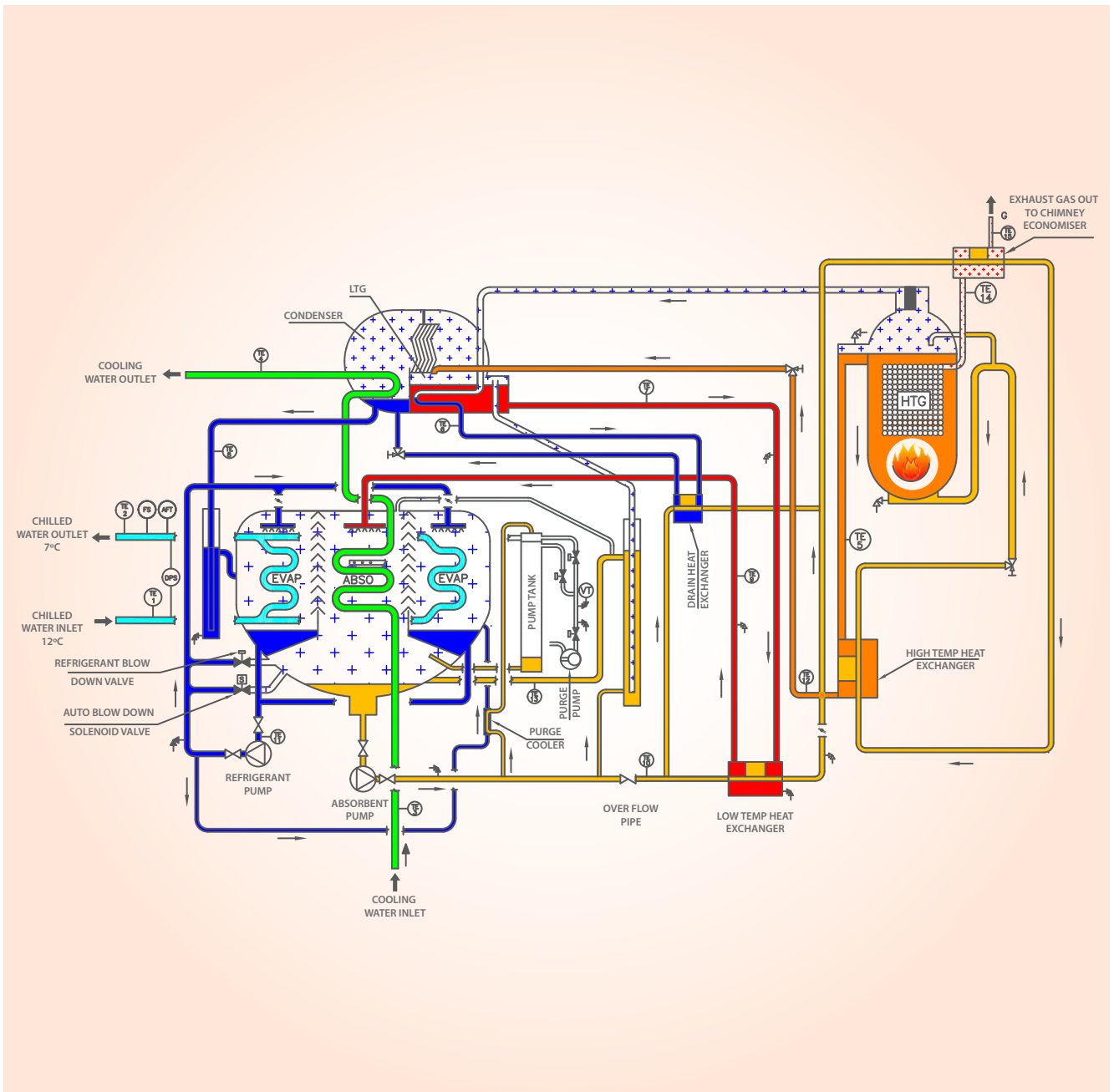
The boiling point of water is directly proportional to pressure. At 6mmHg absolute pressure the boiling point of water is 38.66°F. To change water from liquid to vapour it has to be heated. The heat, required to change the phase of a liquid to vapour, is called the Latent heat of evaporation.



LiBr is a chemical similar to common salt (NaCl). LiBr is soluble in water. The LiBr water solution has a property to absorb water due to its chemical affinity. As the concentration of LiBr solution increases, its affinity towards water vapour increases. Also as the temperature of LiBr solution decreases, its affinity to water vapour

increases. Further, there is a large difference between vapour pressure of LiBr and water. This means that if we heat the LiBr water solution, the water will vapourise but the LiBr will stay in the solution and become concentrated.

Cycle of Operation



Chilled Water
 Cooling Water
 Exhaust Gas

Refrigerant Liquid
 Refrigerant Vapour
 Strong Solution

Intermediate Solution
 Dilute Solution

Evaporator

The evaporator consists of a tube bundle, an outer shell, distribution trays, and a refrigerant pan. The process water to be cooled flows inside the evaporator tubes. A refrigerant pump circulates the liquid refrigerant from the refrigerant pan into the distribution trays. From the trays, the refrigerant falls on the evaporator tubes.

The shell pressure is very low ($\approx 6\text{mmHg}$). At this pressure the refrigerant evaporates at a low temperature and extracts latent heat of evaporation from the water being circulated through the evaporator tubes. Thus the heat is extracted from the process water being circulated through the tubes and it gets cooled.

Absorber

The absorber consists of a tube bundle, an outer shell (common with the evaporator), distribution trays, and an absorbent collection sump. Concentrated absorbent solution ($\approx 63.4\%$) from the Low temperature generator (LTG) is fed into the distribution trays. This solution falls on the absorber tubes.

Concentrated absorbent has an affinity to water vapour. Hence the vaporized refrigerant from the evaporator section is absorbed by the concentrated absorbent. Due to this absorption the vacuum in the shell is maintained and ensures the heat extraction from the chilled water.

The concentrated absorbent becomes diluted. During this dilution the 'Heat of Dilution' is generated. This increases the temperature of the absorbent solution. The cooling water being circulated in the absorber tubes removes the heat of dilution.

As it loses its heat to the cooling water, the absorbent is able to absorb more refrigerant vapour and gets further diluted. The diluted absorbent ($\approx 57.0\%$) collects in the bottom of the shell.

Solution Heat exchangers

The absorbent pump pumps the diluted absorbent to the high temperature generator. A part of it first passes through drain heat exchanger where it absorbs heat from the condensed refrigerant from the low temperature generator. It then goes and meets the main solution line before the high temperature heat exchanger. The other part of liquid passes through the low temperature heat exchanger where it absorbs heat from the concentrated absorbent.

It next flows through the high temperature heat exchanger where it absorbs heat from the intermediate absorbent solution. The combined solution then enters the high temperature generator. The heat exchangers serve to heat up the absorbent solution before it enters the high temperature generator for regeneration. This reduces the heat input required in the high temperature generator. This increases the efficiency of the cycle.

High Temperature Generator

The high temperature generator (HTG) consists of a furnace, smoke chamber, tube bundle, an outer shell and a set of eliminators. Fuel (HSD / NG etc.) is fired in the burner attached to the furnace. Hot Flue gases so generated are then passed through the tube bundle kept above the furnace. The diluted absorbent flows around these tubes and is heated. The temperature of the solution increases until it reaches its boiling point. The absorbed refrigerant boils out of the solution. The solution concentration increases (to 61%) and is referred to as the intermediate concentration. The refrigerant vapour generated passes through the eliminators and goes to the low temperature generator.

Low Temperature Generator

The low temperature generator (LTG) and condenser tube bundles are enclosed in a shell and are separated by an insulation plate. The vaporised refrigerant flows into the LTG tubes. It heats the intermediate absorbent outside the tubes and condenses. The condensed refrigerant flows to the condenser through drain heat exchanger.

Condenser

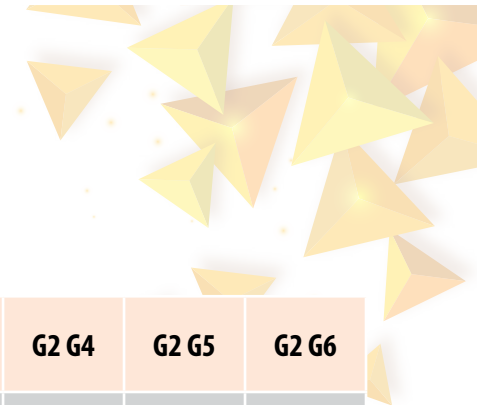
Refrigerant vaporised from the intermediate absorbent passes through the eliminators to the condenser. Here it is cooled by cooling water being circulated inside the condenser tubes. The refrigerant vapour condenses on the outside of the condenser tubes and collects in the bottom of the condenser. The condensed refrigerant from the LTG and the condenser mix and flows to the evaporator. The absorbent which has become concentrated in the LTG drains to the absorber to begin a new absorbent cycle.

Technical Specifications

Parameters		Model Number - TAC	G2 C3	G2 C4	G2 D1	G2 D2	G2 D3	G2 D4	G2 E1
Capacity	Cooling Capacity	TR	117	147	186	221	273	308	367
Chilled Water Circuit	Flow rate	gpm	279.4	351.3	444.5	528.2	652.4	736.1	877.3
	Connection diameter	NPS	5				6		
Cooling Water Circuit	Flow rate	gpm	515	647	819	973	1202	1356	1616
	Connection diameter	NPS	6				8		
Fuel Circuit	Gas consumption (+ 3 %)	Ncu.ft/hr	952	1193	1507	1793	2201	2480	2961
	Oil consumption (+ 3 %)	lbs/hr	52	66	83	99	121	137	163
	Flue Gas Connection Diameter	NPS	6		8		10		
Electrical Data	Power supply								
	Power consumption	kVA	9.9	9.9	9.9	10.9	13.3	13.3	16.9
	Absorbent pump motor rating	kW (A)	2.2 (6.0)		2.2 (6.0)		3.0 (9.0)		3.7 (12.0)
	Refrigerant pump motor rating	kW (A)	0.3 (1.4)		0.3 (1.4)		0.3 (1.4)		0.3 (1.4)
	Vacuum pump motor rating	kW (A)							
	Maximum Burner Rating	kW (A)	0.8 (2.0)		0.8 (2.0)	1.5 (3.2)	1.5 (3.2)		2.2 (4.8)
Overall Dimensions	Length	inches	116		174				198
	Width	inches	97		110		122		124
	Height	inches	114		113		119		
Weights	Operating weight	x 1000 lbs	17.2	17.9	22.9	23.8	28.4	29.8	33.3
	Shipping Weight	x 1000 lbs	16.1	16.8	22.0	22.7	28.0	29.1	32.6
Clearance	For Tube Cleaning	inches	105		142		142		178

Notes:

- Model Nos. : TAC G2 XY - Direct fired Double effect Absorption Chiller
- Chilled water inlet / outlet temperature = 54 / 44 °F
- Cooling water inlet temperature / Outlet temperature = 85 / 94.1°F
- NCV for Gas is 1011.3 BTU/Ncu.ft, NCV for Oil is 18360 BTU/lbs
- Minimum Cooling water inlet temperature is 50°F
- Ambient condition shall be between 41 to 113°F
- Maximum Allowable pressure in chilled / cooling water system = 115 Psig
- All Water Nozzle connections to suit ASME B16.5 Class 150



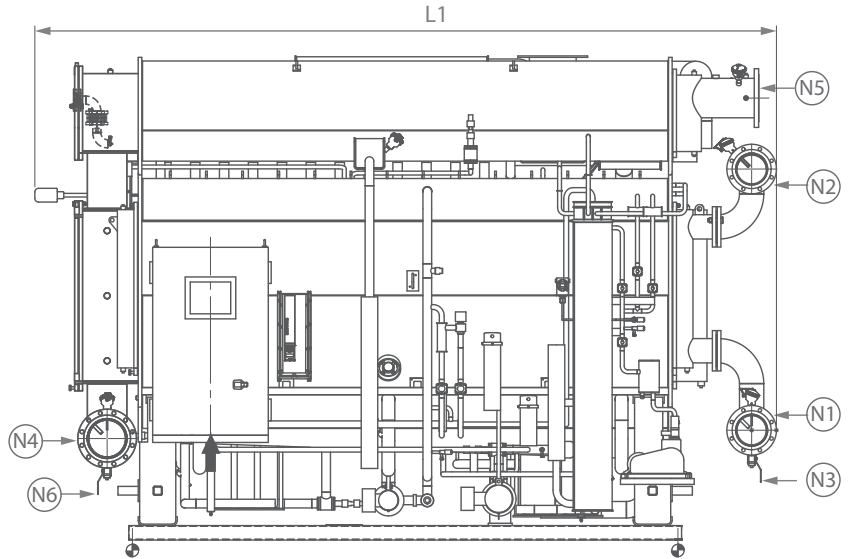
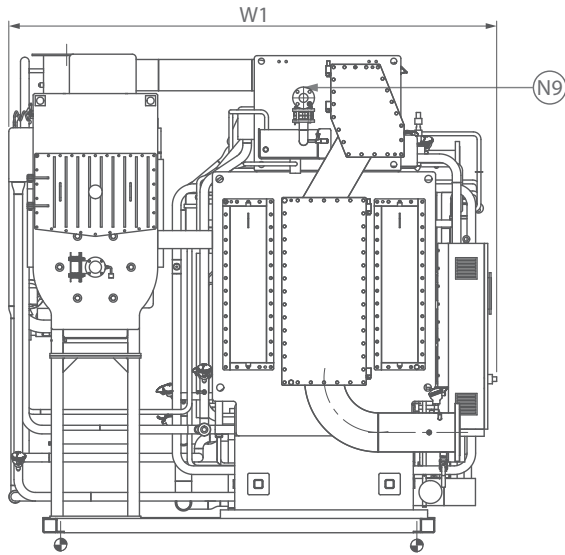
G2 E2	G2 E3	G2 E4	G2 E5	G2 E6	G2 F1	G2 F2	G2 F3	G2 G1	G2 G2	G2 G3	G2 G4	G2 G5	G2 G6	
408	468	506	561	625	672	698	778	879	985	1088	1179	1351	1462	
975.3	1118.8	1209.6	1341.1	1494.1	1606.5	1668.6	1859.9	2101.3	2354.7	2600.9	2818.5	3229.6	3495.0	
8			10			12			14					
1796	2061	2228	2470	2743	2959	3073	3425	3870	4337	4790	5191	5948	6437	
10			12			14			16			18		
3301	3787	4094	4538	5053	5415	5669	6312	7120	7958	8785	9541	10876	11796	
182	209	226	250	278	298	312	348	392	438	484	526	599	650	
12			14			16			18			20		
460 V(±10%), 60 Hz (±5%), 3 Phase+N														
20.0	20.0	21.6	21.6	23.5	28.8	28.8	31.7	34.1	34.3	34.3	39.1	44.7	50.2	
3.7 (12.0)		5.5 (14.0)		5.5 (14.0)		6.6 (17.0)		7.5 (18.0)		7.5 (18.0)		9.0 (27.0)		
0.3 (1.4)			0.3 (1.4)			1.5 (5.0)			1.5 (5.0)			1.5 (5.0)		
0.75 (1.8)														
4.0 (8.7)			4.0 (8.7)		5.5 (11.1)		5.5 (11.1)		7.5 (14.7)		7.5 (15.0)		11.0 (21.0)	
203			245			302			310			321		
135			144			149			151			168		
132			142			145			149			158		
39.2	40.8	41.9	47.8	48.9	62.0	62.8	65.0	72.5	76.1	97.2	98.8	117.9	120.8	
37.7	39.0	40.1	45.4	46.3	58.4	59.5	61.5	69.0	72.3	90.2	91.1	106.9	109.1	
166			166			217			264			268		
276			276			276			276			276		

- Technical specification is based on ARI 560:2000
- Minimum Chilled brine outlet temperature is 25°F
- Please contact Thermax representative for lower cooling water flow
- Please contact Thermax representative for customized specifications

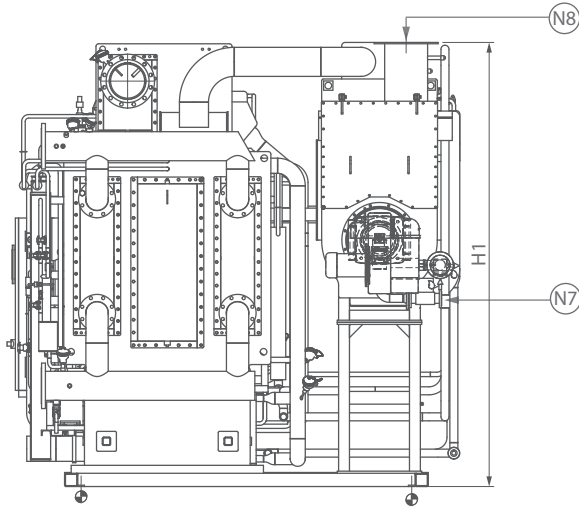
Suitable for liquid/gaseous fuels such as:

- Natural gas
- LPG
- Propane
- Kerosene
- High speed diesel
- Biogas

Physical Dimensions



Model	Machine Dimensions										
	L1	W1	H1	N1	N2	N3	N4	N5	N6	N8	N9
	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch
TAC G2 C3	116	97	114	5	5	1	6	6	1	6	2
TAC G2 C4	116	97	114	5	5	1	6	6	1	6	2
TAC G2 D1	174	110	113	5	5	1	6	6	1	8	2
TAC G2 D2	174	110	113	5	5	1	6	6	1	8	2
TAC G2 D3	174	122	119	6	6	1	8	8	1	10	2
TAC G2 D4	174	122	119	6	6	1	8	8	1	10	2
TAC G2 E1	198	124	119	6	6	1	8	8	1	10	2
TAC G2 E2	203	135	132	8	8	1	10	10	1	12	2
TAC G2 E3	203	135	132	8	8	1	10	10	1	12	2
TAC G2 E4	203	135	132	8	8	1	10	10	1	12	2
TAC G2 E5	203	144	142	8	8	1	12	12	1	14	2
TAC G2 E6	203	144	142	8	8	1	12	12	1	14	2
TAC G2 F1	245	149	145	10	10	1	14	14	1	16	3
TAC G2 F2	245	149	145	10	10	1	14	14	1	16	3
TAC G2 F3	245	149	145	10	10	1	14	14	1	16	3
TAC G2 G1	302	151	149	10	10	1	14	14	1	18	3
TAC G2 G2	302	151	149	10	10	1	14	14	1	18	3
TAC G2 G3	310	168	158	12	12	1	16	16	1	18	3
TAC G2 G4	310	168	158	12	12	1	16	16	1	18	3
TAC G2 G5	321	189	168	14	14	1	18	18	1	18	3
TAC G2 G6	321	189	168	14	14	1	18	18	1	18	3





Nozzle Schedule		
Nozzle	Nozzle FL. Rating	Description
N1	ASA 150	Chilled Water Inlet
N2	ASA 150	Chilled Water Outlet
N3	NPT(F)	Chilled Water Drain Valve
N4	ASA 150	Cooling Water Inlet
N5	ASA 150	Cooling Water Outlet
N6	NPT(F)	Cooling Water Drain Valve
N7	As per Burner	Fuel Inlet
N8	ASA 150	Exhaust Gas Outlet
N9	ASA 150	Rupture Disc Outlet

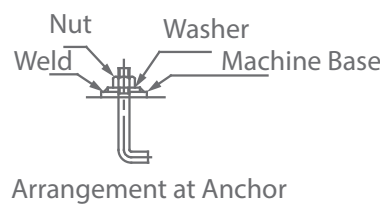
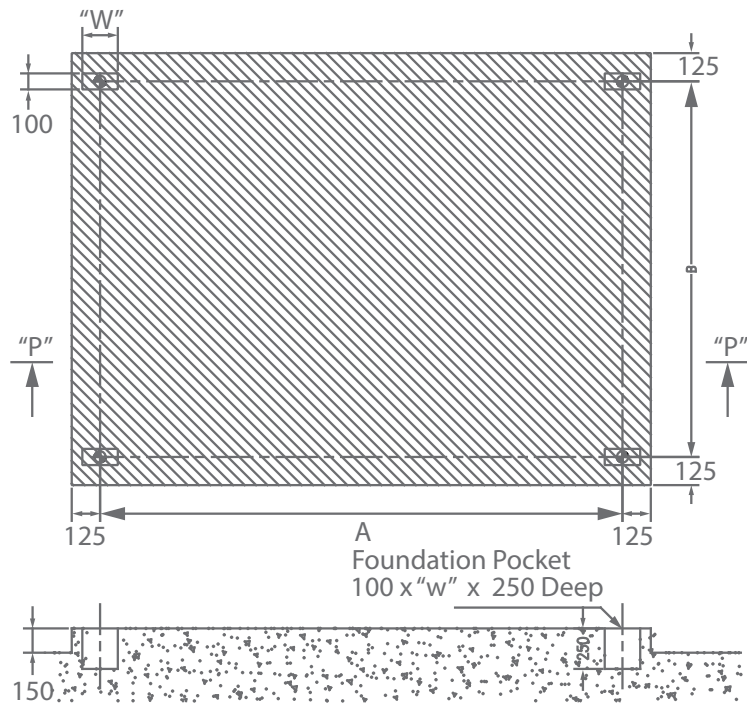
Minimum installation clearance

- Control Panel Side: 50 Inch
- Top: 8 Inch | Others: 20 Inch

Notes

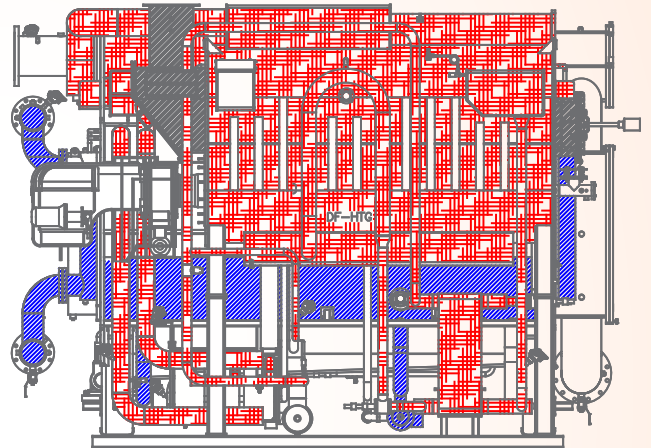
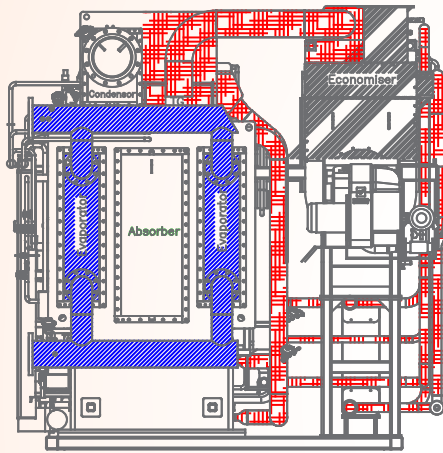
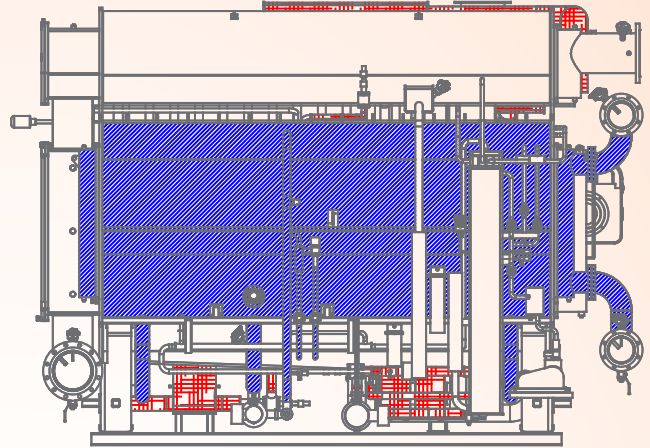
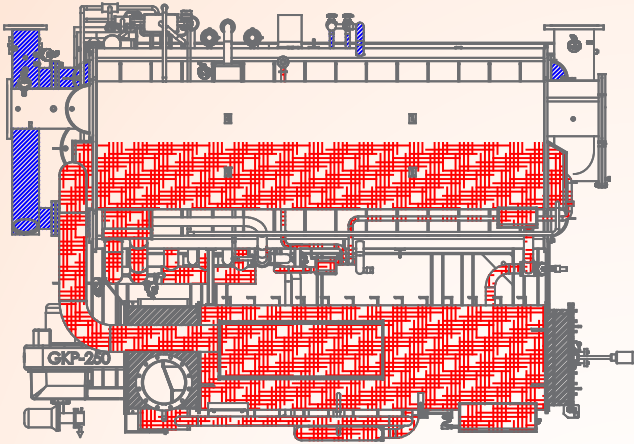
-  Indicates the position of anchor bolts
-  Indicates the position of the power supply connections on control panel

Foundation			
L	W	B	Weight
Inch	Inch	Inch	Pound
86	70	9	17196
86	70	9	17857
127	79	11	22273
127	79	11	23676
127	89	11	28430
127	89	11	29845
151	89	11	33392
151	99	11	39181
151	99	11	40691
151	100	11	41860
151	106	11	47807
151	106	11	48999
191	108	11	67826
191	108	11	68946
191	108	11	70845
249	109	11	83507
249	109	11	86702
249	123	11	112867
249	123	11	113800
249	141	11	148834
249	141	11	151122



- A drain ditch should be provided around the foundation
- The floor surface should be made water proof for ease of maintenance work
- Finish the foundation work horizontally flat & smooth at a grade of about 1/1000
- The foundation shall be designed to suit the soil conditions and other design considerations at site

Insulation Guidelines



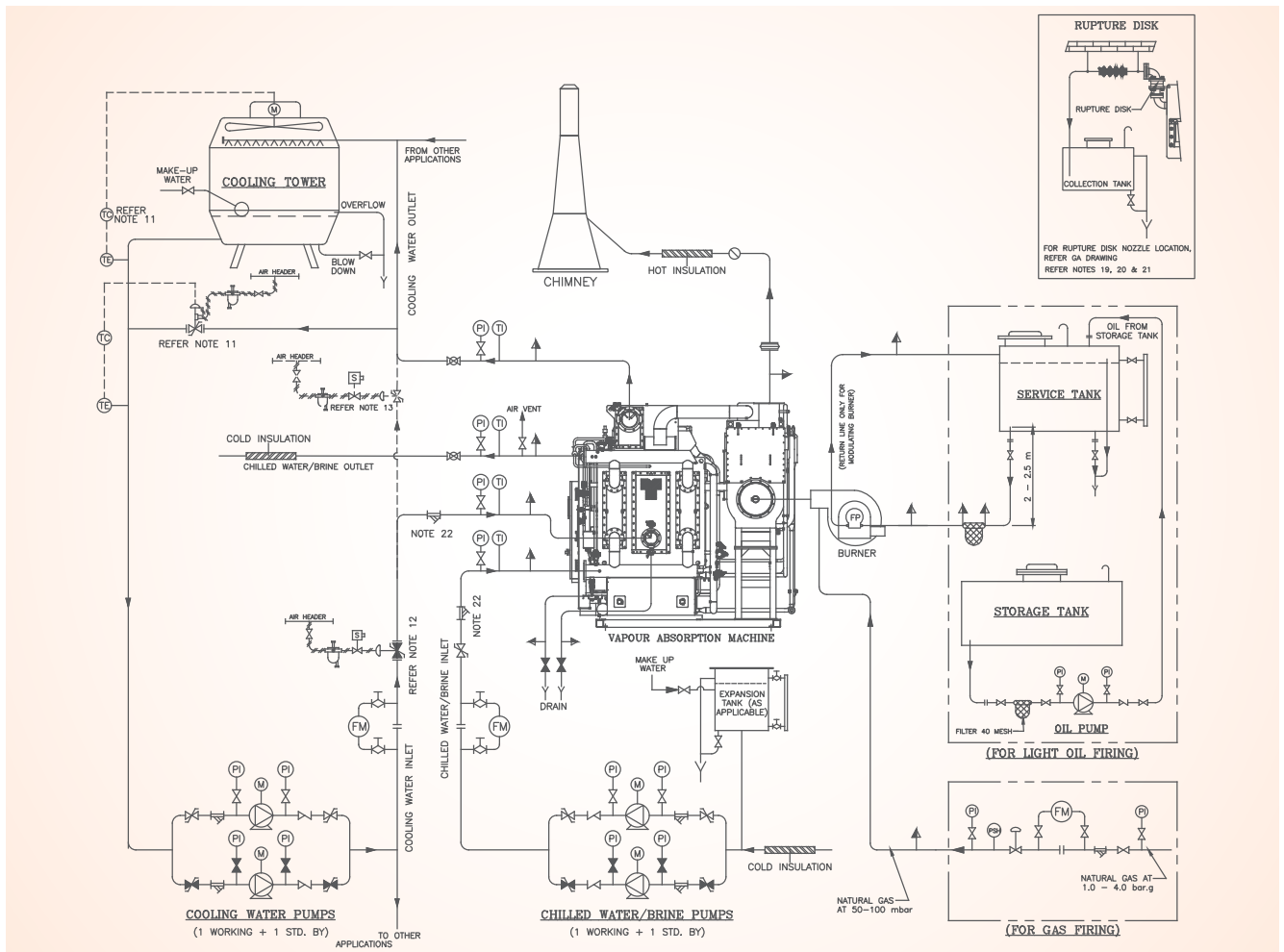
NOTES:

- The total area includes the area of pipes in the machine
- Do not cover pump Ref. motor with insulation
- Use non-combustible insulation material
- LTHE & HTHE shall be insulated with one layer of EPDM form
- Insulation areas for (¾ + ¾) Inch given in the table have been doubled assuming two layers of foam will be used
- Hot Surface : Mineral Wool
- Hot Surface : EPDM Foam
- Cold Surface : Elastomeric Foam Insulation

MODEL	COLD SURFACE INSULATION	HOT SURFACE INSULATION 1-½ Inch	HOT SURFACE INSULATION 3 Inch
	sqft	sqft	sqft
TAC G2 C3	148.60	383.40	37.60
TAC G2 C4	148.60	402.80	38.60
TAC G2 D1	185.60	458.30	42.30
TAC G2 D2	185.60	470.30	44.70
TAC G2 D3	206.40	573.50	48.60
TAC G2 D4	206.40	573.50	49.90
TAC G2 E1	226.80	626.30	54.30
TAC G2 E2	276.40	758.00	57.40
TAC G2 E3	276.40	746.00	58.90
TAC G2 E4	276.40	751.00	60.60
TAC G2 E5	308.50	868.90	62.60
TAC G2 E6	308.50	879.10	65.10
TAC G2 F1	376.00	1016.00	66.70
TAC G2 F2	376.00	1074.00	65.80
TAC G2 F3	376.00	1077.00	70.30
TAC G2 G1	450.00	1229.00	72.30
TAC G2 G2	450.00	1225.00	76.20
TAC G2 G3	520.00	1494.00	84.90
TAC G2 G4	520.00	1494.00	85.30
TAC G2 G5	610.00	1708.00	90.70
TAC G2 G6	610.00	1708.00	93.10

Symbol	Surface	Description	Temperature Range
	Cold	1 Inch Thick Elastomeric Foam Insulation for Cold Surface	41°F [5°C] Min
	Hot	3 Inch Thick Insulation of Mineral Wool for Hot Surface	356°F [180°C] Max
	Hot	1-½ Inch (¾ + ¾) Inch Thick EPDM Foam for Hot Surface	248°F [120°C] Max

Piping and Instrumentation Guidelines



	Gate Valve (Open)		Control Valve (Open)		Air Filter Regulator		Motor
	Gate Valve (Close)		Bellow/Flexible Connection		Pressure Indicator		"Y" Strainer
	Globe Valve (Open)		Solenoid Valve		Temperature Indicator		Level Indicator
	Globe Valve (Close)		Butterfly Valve (Open)		Flow Meter		Safety Valve
	Non Return Valve		Butterfly Valve (Close)		Pneumatic Line		Pneumatic on/ off Butterfly valve
	Cock		Inverted Bucket Steam Trap		Pump		Electro-Pneumatic Globe Type Control Valve

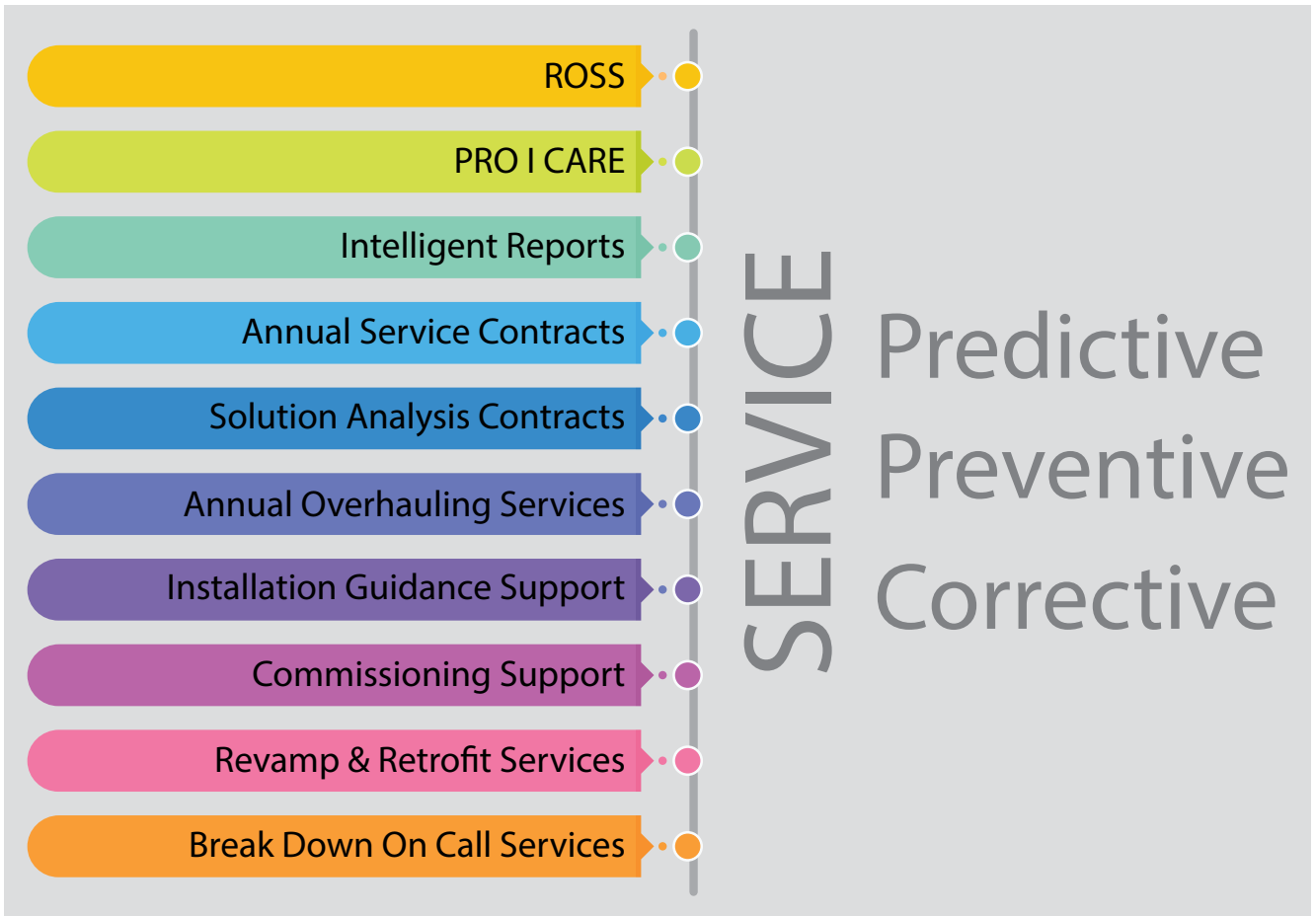
Client Scope ↓ Thermax Scope

NOTES:

- Pressure reducing station should be installed on the gas supply line if the supply pressure is more than 1.5 psi(g). Gas supply pressure fluctuation is not allowable.
- The flue gas pressure at the outlet nozzle of machine is 0-0.2Inch WC. The flue gas ducting and chimney/ stack height should be designed considering this.
- 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.
- 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.
- 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 115 psi(g). This should be noted for design of chilled brine and cooling water system.
- Necessary arrangements to be made to maintain constant cooling water inlet temperature to chiller. Minimum allowable cooling water inlet temperature is 50°F.
- 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 < 40°F install cooling water automatic shut off valve only on the bypass line between cooling water inlet and outlet.
- Rupture disk piping should be adequately supported. Use flexible connection to avoid any load on the rupture disk flange joint.
- Rupture disk piping elevation should not exceed the rupture disk outlet nozzle.
- Discharge from rupture disk should be collected to facilitate reuse. Else, drain the discharge safely as per local norms/ guidelines.

Global Service Support – Cooling

Thermax has a wide network of Service Centers throughout the globe to ensure quick response to customers. With a cumulative service experience of over 6000 VACs operating for more than 30 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.



PROiCARE

PROiCARE is next generation AI based remote monitoring system. This feature enables the facility manager or Thermax engineer to monitor the performance remotely using internet. It offers features like e-logbook, status, trends, abnormal start-stops, maintenance schedules,

alerts etc and keep track of their chiller. It's a round the clock service that gives you a unified view so you can track the performance of your machine from anywhere and resolve issues faster.(This feature is available on request)

Remote Services at Your Fingertip

This technology offers a single point window to access and monitor the chiller performance along with easy and secure remote access to real-time operations, performance data, and historical analysis.

Advanced Monitoring

ROSS offers a wide range of services which includes remote monitoring, advance trend analysis, data logging and diagnostic, enabling Thermax to provide proactive and well advance recommendation to keep the chiller performance intact and eliminating any future downtime.

Expert Opinion

Real-time data and historical data from the chiller is collected and analyzed by Thermax experts, which enables identification of a potential threat to the chiller and provides resolution to the problem in time to enable unhindered continuous process by smooth operation of the chiller. In case of any major breakdown, the data analytics provides insight into the nature of the problem and hence enables a quick turnaround time.



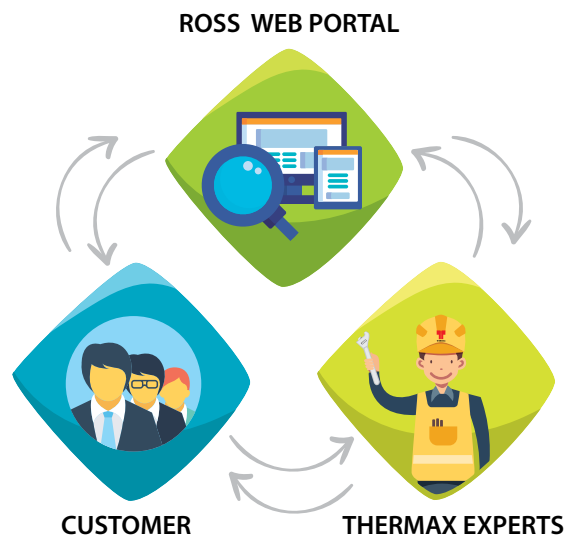
Multi-layered security

ROSS operates on an optimum level of security for remote connections and runs on VPN network, eliminating any security breach along with two point authentication and advanced user management ensures that data remains in safe hands at any given point.

Analytical Reports

Customized reports are being generated with the intent to make a precise decision regarding the process, ensuring the optimum performance is delivered.

Architecture



A tailor-made offering for your specific needs

FEATURES	BASIC	ADVANCED	PRO
REMOTE ACCESS (24*7*365 days easy real-time access to the chiller)	✓	✓	✓
ALARM NOTIFICATION (Notification with the set of customized alarms)	✓	✓	✓
DATA LOGGING (Timely data logging of equipment)	✓	✓	✓
CORRECTIVE ACTION (Expert opinion & intervention whenever required to maximize the uptime of chiller)	✓	✓	✓
EVENT STATISTICS (Analysis of any recurring alarm & abnormality)		✓	✓
REPORTING (Precised reports)		✓	✓
OPERATIONAL DATA INSIGHT (Operational data analysis)			✓
EQUIPMENT PERFORMANCE ANALYSIS (Overall chiller performance analysis)			✓

We believe in increasing uptime, reducing unscheduled interruption and optimizing chiller efficiency.

Our Prestigious Installations

Rixos Alamein , Egypt

Rixos Alamein, located on the beautiful shores of the Mediterranean Coast in the famous El Alamein, uses Thermax's 500 TR X 2 nos., direct fired chiller for the air Conditioning of Hotel.



Nestle Inc, USA

Three of Thermax's direct fired chillers with a cumulative capacity of 1064 TR are used by F&B giant Nestle Inc in USA for process cooling application in their production plant. Thermax has supplied chillers to Nestle plants in Russia, Brazil, Philippines, Nigeria and India.



Petrobras, Brazil

Brazilian Oil and Gas company, Petrobras, uses Thermax's direct fired chiller of capacity 840 TR for their process cooling application.



YTY Group, Malaysia

Thermax's direct fired chillers are used by YTY Group, a glove manufacturing major based in Malaysia. Two of the chillers supplied by Thermax with a total capacity of 1764 TR are being used for the cooling of glove moulds. The latex is kept hot to be poured into the glove mould to give it the shape.



Made In India for the World

Thermax adopts a partnering relationship with customers to address their energy and environmental challenges and enhance their performance and profits. With integrated energy-environment expertise and a proven track record in global markets, Thermax is the preferred partner of enterprises across industrial sectors in more than 85 countries.

Automobile



- BMW (Germany)
- Ducati (Italy)
- Volkswagen (Germany)
- Ford Motors (India)
- Honda (Thailand)

Healthcare



- Niguarda Hospital (Italy)
- Brookedale Hospital (USA)
- DM Hospital (India)
- VallD'Herbron Hospital (Spain)
- Royal Free Hospital

Refinery & Petrochemical



- SABIC (KSA)
- Essar Oil (UK)
- Petrobras (Brazil)
- Reliance Industries (India)
- Covestro (USA)

Breweries



- Karmeliten Brauerei (Germany)
- Carlsberg (India)
- Guinness Brewery (Nigeria)
- Peroni Brewery (Italy)
- United Breweries (India)

Education



- Fordham University (USA)
- University Of Central Florida (USA)
- University of Magna Graecia (Italy)
- Shanghai Tech University (China)
- Michigan State University (USA)

Pharma



- GSK (India)
- Novartis (China)
- Sanofi (Italy)
- Astra Zeneca (UK)
- Zydus Cadilla (India)

Chemicals



- Nirma (India)
- Celanese Corporation (USA)
- Gulf Flour (UAE)
- JBF RAK (UAE)
- Yaroslavl Paraffin Plant (Russia)

Beverages



- Coca Cola (KSA)
- Silver Mill Natural Beverages (Sri Lanka)
- Cardinal Agri (Philippines)
- Niagra Bottling (USA)
- Tata Global Beverages (India)

Metal



- Maklada Prestressed Steel (Tunisia)
- Vedanta Alumina Limited (India)
- PT Jindal Stainless Steel (Indonesia)
- TATA Steel (India)
- Arcelor Mittal Steel (KSA)

Commercial / Hospitality



- Hyatt Plaza (Qatar)
- Carlyle Hotel (USA)
- Hudson Yards (USA)
- Atlantic City Casino (USA)
- Gardens by the Bay (Singapore)

Food Processing



- Ferrero (Italy)
- Cadburys (Nigeria)
- Perfetti Van Melle (Bangladesh)
- PepsiCo (South Africa)
- Tipco Foods (Thailand)

Dairy



- PT Santos Krimer (Indonesia)
- Lilongwe Dairy (Malawi)
- Alpro (Belgium)
- Mother Dairy (India)
- Milkfarm Bahnitz (Germany)

Airport



- Rome Airport (Italy)
- Perth Airport (Australia)
- Berlin Airport (Germany)
- Istanbul Ataturk Airport (Turkey)
- Venice Airport (Italy)

Textile



- Polyplex (Turkey)
- DeMillus (Brazil)
- Gildan TM (Honduras)
- Envoy Textiles (Bangladesh)
- Indorama (Thailand)

Edible Oil



- Cargill (Brazil)
- Shabnam Vegetable Oil (Bangladesh)
- Malabon Soap & Oil (Philippines)
- PZ Wilmar (Nigeria)
- Pan Century Edible Oils (Malaysia)

Recommended Water Quality

Water quality is a critical factor for the smooth operation of the machine. Poor water quality can result in scaling of tubes, corrosion, choking or failure of tubes. Hence

it is highly recommended that proper water quality be maintained throughout the life of the VAM.

Allowable Range for Circulating Water in Chilled water and cooling water (< 104°F)

Items	Units	Copper	Cu:Ni (90:10)	SS316L	Titanium
pH (25°C)		6.8 - 8.5	6.8 - 8.5	6.8 - 8.5	6.8 - 8.5
TDS	ppm	< 600	< 20000	< 2500	4.00%
Turbidity	NTU	< 10	< 10	< 10	< 10
M Alkalinity	ppm	< 100	< 100	< 100	< 100
Chloride Ion Cl ⁻	ppm	< 300	< 10000	< 200	< 25000
Sulphates Ion SO ⁴	ppm	< 300	< 300	< 300	< 300
Silica	ppm	< 50	< 75	< 50	< 50
Total Hardness	ppm	< 300	< 300	< 300	< 300
Calcium Hardness	ppm	< 200	< 200	< 200	< 200
Total Iron Fe	ppm	< 0.5	< 0.5	< 0.5	< 0.5
Sulphide Ion S ⁻	ppm	ND	ND	ND	ND
Ammonium Ion NH ₄ ⁺	ppm	< 1	< 1	NA	NA
Biological Oxygen Demand	ppm	< 50	< 50	< 50	< 50
Chemical Oxygen Demand	ppm	< 100	< 100	< 100	< 100
Free Chlorine	ppm	< 0.2	< 0.2	< 0.2	< 0.2
Oil & Grease	ppm	< 1	< 1	< 1	< 1
Free Carbon dioxide	ppm	< 3	< 3	< 3	< 3
Phenol, cyanide, lead, manganese etc.	ppm	ND	ND	< 0.1	< 0.1

*ND – Not Detected

*NA – Not Applicable

NOTES:

- Avoid stagnant water in Machine for longer period. In case of more than 1 day of shut down, circulate water for 30 minutes in the Machine every day. For longer duration, drain the water from Machine and keep the Machine in dry conditions. There should be no stagnant zone in the water circuit near the Machine
- When the temperature is high (104°F or higher), generally the corrosion behaviour is noticeable, and when especially the steel material is directly in contact with water without the protective coating, the effective corrosive protection, such as the addition of corrosion inhibitor, degassing treatment should be applied.

Notes



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Sustainable Solutions in
Energy & Environment

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Thermax Business Portfolio

-  Heating
-  Cooling
-  Power
-  Air Pollution Control
-  Chemicals
-  Water and Wastewater Solutions
-  Solar
-  Specialised Services



This brochure presents only some of our products and we reserve the right to amend any product details without notice. The photographs used in the brochure are indicative and may not match the actual plant.

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