Trane Horizon® Absorption Series

Direct-Fired
Absorption Water Chillers
380-750 Tons – 50-60 Hz

Built for Industrial and Commercial Applications

November 2000

ABS-PRC002-EN

Introduction

History of Trane Absorption Chillers

Trane has led in absorption chiller design and manufacturing for 40 years. Dedicated to the advancement of absorption chiller technology, Trane is the only North American chiller manufacturer to commercialize double-effect absorption, over 25 years ago. Since then, Trane has manufactured and shipped over 10,000 absorbers to commercial, industrial and process applications worldwide. Innovations such as microelectronic controls, adaptive frequency drives and smart purge systems have modernized the technology, making it more capable, more reliable and in many applications, more economical.

Plant Engineering
Product of the Year
1996 Gold Award
Heating, Ventilation and Air Conditioning

ISO 9001
Quality System
Certified
DNV
La Crosse
Business Unit

Contents

Better By Design

In the early 1990's, with the assistance of the Gas Research Institute, Trane began development of an advanced series of absorption chiller designs. The new design was expected to redefine the industry standards for overall system performance, efficiency and reliability.

In 1995, Trane announced the Horizon® line of steam/hot water and gas fired absorption chillers. True to its name and true to the high standards for its design, the Trane Horizon chiller offers system advantages that go beyond that of other absorption chillers currently on the market.

- Produces chilled water to as low as 40°F (4.4°C).
- Unlike other absorbers, Horizon chillers apply to tower water flow as low as 3.6 gpm/ton.
- Start-up capability with tower water temperatures as low as 45°F (7.2°C).
- Can operate with tower water temperatures as low as 55°F (12.8°C).
- **Includes** factory installed **crossover pipe and steam valve** as standard.
- Pumps designed for 50,000 life hours.
- Key components made of stainless steel or CuNi.
- Marine water boxes on cooling-water connections.
- Design special capability.
- Factory-mounted and wired Weishaupt low NOx burner.
- 8 to 1 turndown on burner.

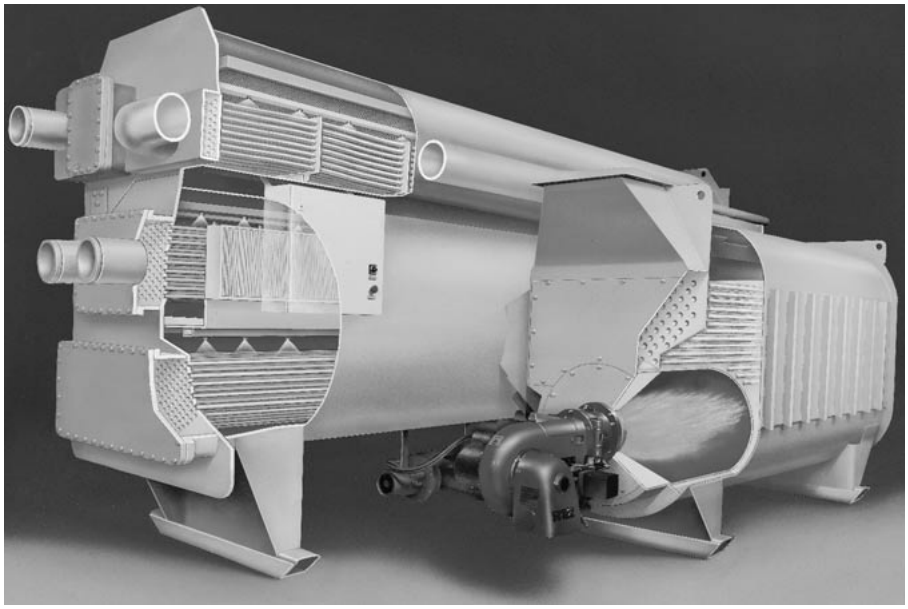
Features and Benefits

General

Efficiency

The Trane direct-fired absorption water chiller has the highest efficiency in the industry, 1.03 COP at ARI Standard rating conditions. Full load is not the whole story. Trane's microprocessor-based control (UCP2) optimizes the machine's performance at partload conditions to provide significant operating cost savings.

Chilled water temperatures down to 40 F (4.4 C) can take advantage of lower HVAC equipment costs and reduced operating costs. Low temperature chilled water systems can improve IAQ by reducing the humidity in the occupied spaces.



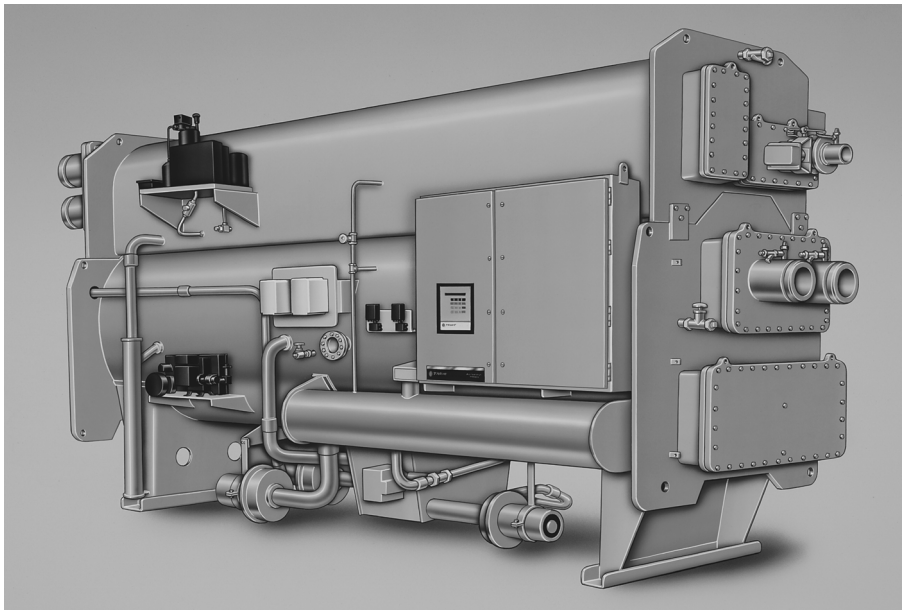
Lowest Emissions and Environmentally Safe

We have built our policy of balanced environmental responsibilities into our new line of absorption chillers. These features include:

- Clean-burning natural gas as the fuel source
- Standard low NO_x burner
- Optional ultra-low NO_x burner
- Environmentally acceptable molybdate corrosion inhibitors

Reliability

Trane's new purge system purges non-condensables from the machine continuously and automatically while logging important information through the UCP2 control panel. This prevents damage to the machine while improving performance. This purge system includes cupronickel collection tubes and a collection chamber in the absorber section, an eductor for moving non-condensables to the condenser, Purifier™ purge to collect the non-condensables in an external storage tank, and vacuum pump for automatic removal of the non-condensables. The purge will operate automatically to remove non-condensables from the unit during periods of chiller operation and shutdown.



The new SDR (Sensing-Detection-Recovery) system is the next generation of crystallization prevention. By **Sensing** the concentration of the solution in the machine we can provide early **Detection** of any problems which may be occurring in the machine. This strategy goes further to automatically **Recover** from this condition and provide safe and reliable operation.

Features and Benefits

General

The Trane Horizon direct-fired absorption chiller is designed to operate efficiently and more importantly, reliably in your system. Here are some other features which provide for dependable performance:

- UCP2 controls including:
  - — Unique controls system can respond to changing loads 10 times faster than other absorbers
  - — Optional controls to handle variable chilled water flow
- Industrial grade quality materials which include:
  - — Stainless steel material for key components of the chiller including:
    - — Direct-fired generator tube sheets
    - — Eliminators
  - — Cupronickel tubes in the absorber and second stage generator
  - — Effective, environmentally safe corrosion inhibitor, lithium molybdate
- Fixed and floating tube supports which allow for expansion of tubes without problems of high stress in the low temperature generator
- Up to 50,000 hours of operation before required pump service
- Standard design working pressures of 150 psig for all water boxes
- Hermetic integrity
- Factory leak-tested
- Conservative direct-fired generator design

Ease of Installation

- Modular design to facilitate reliable disassembly and reassembly for easy access into existing buildings
- Victaulic® water connections
- Factory-mounted and commissioned controls complete with sensors, drives, valves, actuators and purge
- Factory-mounted burner and gas train
- Factory-installed/crossover pipe cuts down on field fabrication and labor
- Simplified burner commissioning

Dedicated Support

- Over 35 years of continuous absorption production and customer support
- Factory trained start-up
- The only North American chiller manufacturer to commercialize double effect absorption, over 20 years ago
- Professional engineering expertise from your local sales office with headquarters applications, service, and engineering support

Serviceability

- All tubes individually replaceable
- Removable absorber, evaporator and generator spray tree systems
- Marine style waterboxes on absorber and condenser to allow for tube cleaning without removing water connections
- Training of owner's operating personnel
- Quality post-warranty service from trained technicians
- All parts readily available
- Professionally trained service personnel available locally and backed by headquarters experts
- Customizable extended warranty plans

Horizon® Direct-Fired Absorption Water Chiller Component Identification

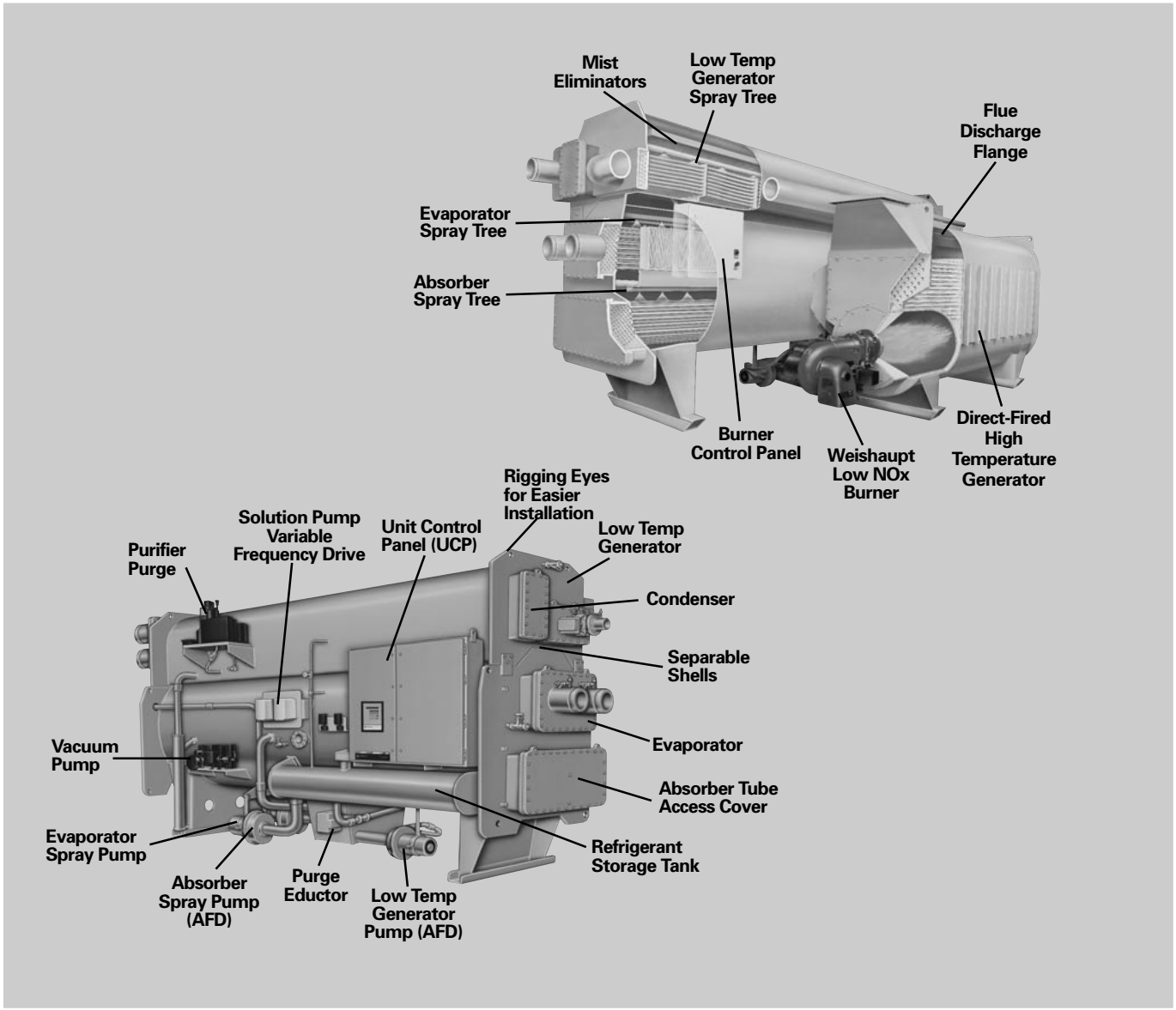
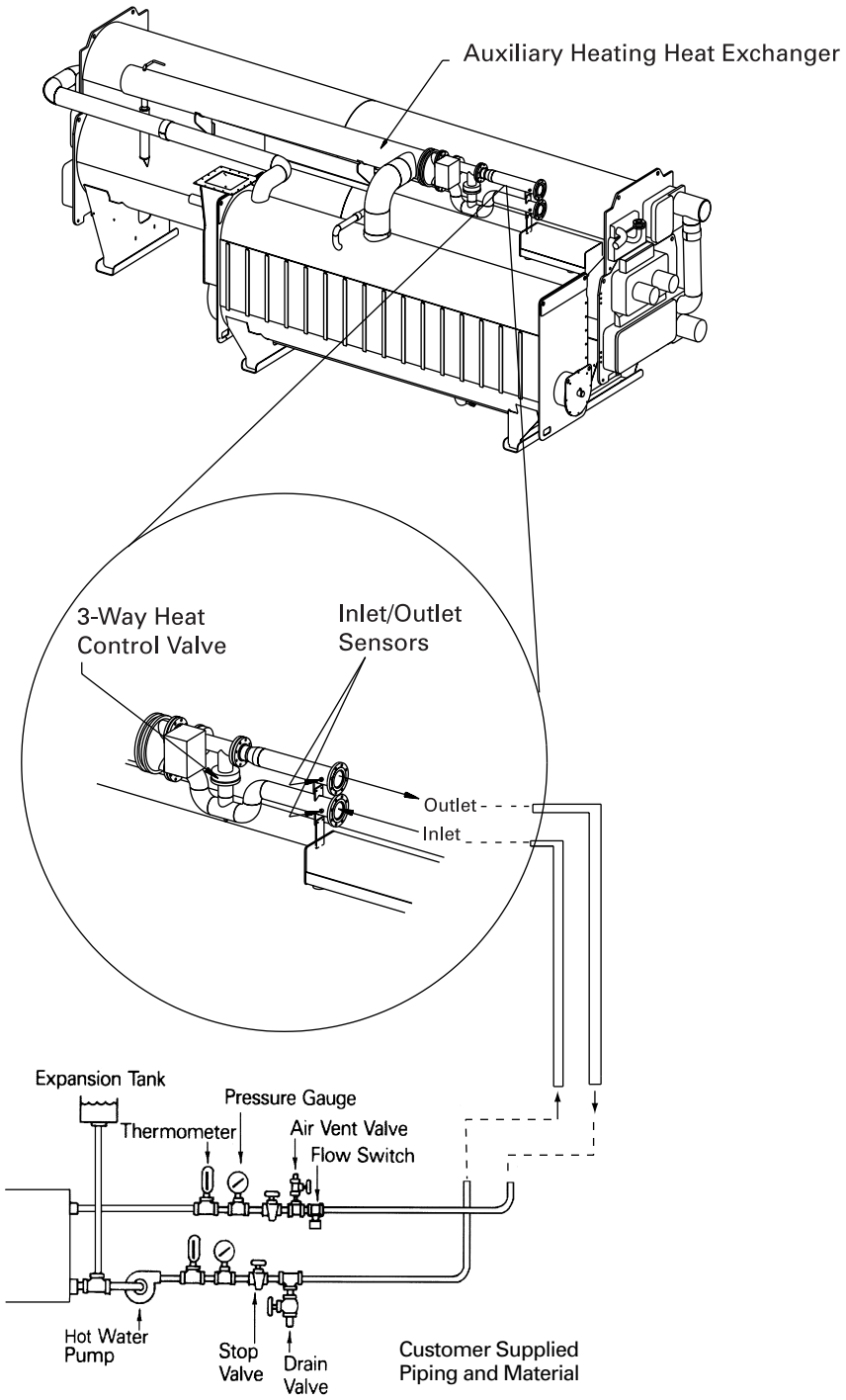


Figure FB-1 – Horizon® Direct-Fired Absorption Chiller Auxiliary Heating Component Identification



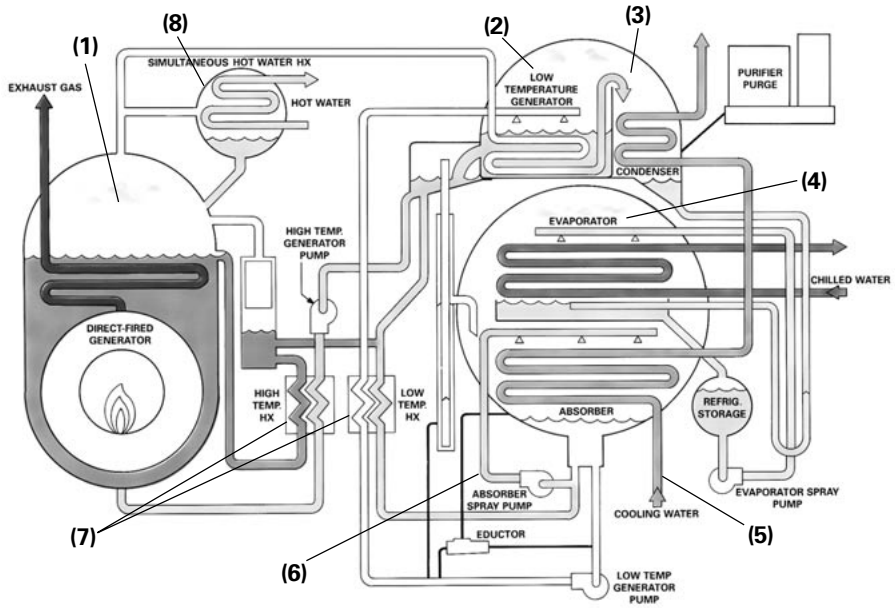
Absorption Refrigeration Cycle

Figure FB-2 is an example of typical machine operation at a standard rating point condition (i.e., 85° tower, 44° leaving chilled water) at full load. Dilute solution has a relatively high refrigerant content and low lithium bromide content. An intermediate solution is a mixture of dilute and concentrated solutions. A concentrated solution is one with a relatively low refrigerant content and high lithium bromide content.

High Temperature Generator (1)
Solution (intermediate) enters the bottom of the direct-fired high temperature generator where it is boiled by heat from the combustion of gas or oil and refrigerant vapor is created. The firing rate of the burner is controlled by the unit control system algorithms. The heat released by the combustion process and transferred to the solution, generates refrigerant vapor which in turn, provides a heat source for the LTG (and/or auxiliary heating bundle). The refrigerant vapor travels to the tube side of the low temperature generator. The now-concentrated solution returns to the absorber after passing through the high temperature heat exchanger mixing tee from the low temperature generator and low temperature heat exchanger.

Low Temperature Generator (2)
Solution (dilute) is pumped into the low temperature generator, where the solution is boiled creating additional refrigerant vapor via the refrigerant vapor inside the tube bundle. The refrigerant vapor then condenses and flows to the condenser. The now intermediate solution then flows to one of two locations: the absorber spray system to mix with strong concentrated solution from the high temperature generator or to the high temperature generator.

Figure FB-2 – Absorption Refrigeration Cycle



Condenser (3)
Refrigerant vapor (produced by the low temperature generator) and refrigerant liquid (via the tube bundle) enter the condenser to be reduced in pressure/temperature via expansion device for delivery to the evaporator. The heat of condensation is rejected to the cooling water inside the tube bundle.

Evaporator (4)
System water runs through the tube bundle where its heat is transferred to the refrigerant causing the refrigerant to vaporize/boil. The refrigerant vapor flows to the slightly lower pressure in the absorber.

Features and Benefits

Refrigeration Cycle

Absorber (5)
Refrigerant vapor is absorbed by the lithium bromide solution (dilute) to be circulated and cycled again. The solution is pumped to the low temperature generator. The heat (acquired in the evaporator) is rejected via the cooling water inside the tube bundle.

Absorption Process (6)
Solution (concentrated) enters the spray system from the high and low temperature generators enters the spray system, wetting the tubes and providing a liquid surface for the refrigerant vapor (from the evaporator) to absorb into the lithium bromide solution. The solution temperature/concentration sprayed in the absorber controls the absorber pressure, thereby controlling the evaporator refrigerant temperature.

Low, High and Condensate Heat Exchangers (7)
Solution flows through the high and low temperature heat exchangers to be preheated reducing the heat energy required to induce boiling within the generators and to decrease the temperature of the solution being returned to the absorber, thus decreasing the load on the cooling tower.

Hot Water Heating (8)
Heating only or simultaneous heating with cooling, is accomplished utilizing a heat exchanger. As system heating water flows through the heat exchanger tube bundle, a relatively cool area compared to the hot refrigerant vapor is created. This cool area draws hot refrigerant vapor through the heat exchanger where the vapor condenses transferring heat to the system water within the tubes of the heat exchanger. The condensed liquid refrigerant returns to the high temperature generator.

It should be noted that there is a trade off during simultaneous heating and cooling; hot refrigerant vapor consumed during heating of the system water is no longer available for cooling loads. This creates the need to establish a priority mode of operation. The control system will utilize the available refrigerant to meet the needs of the priority mode of operation. The priority is selected at the clear language display under operator settings.

Application Considerations General

General
The Horizon two-stage direct-fired absorption chiller is designed to provide 40 F to 70 F (4.4 C - 21.1 C) chilled water, for comfort or process cooling applications, within all three market segments – commercial, industrial and institutional. Additionally, Horizon direct-fired can produce hot water for heating applications at temperatures as high as 180 F (82.2 C). The primary advantage of the absorption chiller over other chiller options, is its ability to use natural gas or oil to provide energy-saving cooling possibilities.

Operating Limits
Water flows within the limits indicated on the appropriate selection charts will insure tube water velocities not exceeding 10 feet per second in copper tubes and 11 feet per second in cupronickel tubes. Changes in condenser water temperature should not exceed 1-degree F per minute between the range of 75 -95 F.

Sound and Vibration
Absorption units are well suited for areas where low sound levels are required. The Trane Horizon direct-fired absorption chiller will operate under normal load conditions at less than an 85 dBA sound pressure level. During operation there is no vibration of any components that could be damaging to the chiller or could transmit objectionable sound or vibration to the building.

Chiller Installation
The following should be considered when installing an absorption chiller:
- Rigging and service clearances
- Foundation support
- Chiller isolation for sound/vibration reduction
- Condensate handling
- Steam supply control
- Condenser water temperature control
- Chilled water flow control
- Chilled and condenser water flow limit
- Simultaneous heat/cool application

Cooling Tower Water Flow
The ARI standard gpm/ton for absorption chillers is 4.5 but lower flow through the condenser and absorber section will present an opportunity for a smaller tower and smaller condenser pump. Trane direct-fired absorption chillers were designed around 3.6 gpm/ton but have the ability to go as low as 3.0 gpm/ton at slightly reduced capacities. By designing a system around lower flows there will likely be significant annual chiller plant electrical energy savings. For more information on lower flows on the cooling tower water circuit refer to the appropriate engineering bulletin.

Water Treatment
The use of untreated or improperly treated water may result in scaling, erosion, and corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be used to determine what treatment, if any is advisable. The Trane Company assumes no responsibility for the results of untreated, or improperly treated water.

Combination Systems
Peak energy savings can be achieved when using a combination of electric chillers and absorption chillers for air conditioning loads. The absorption chiller is used to shave seasonal billable peak power demands during summer operation, and the electric chiller is run below the allowed demand limit, reducing costly demand charges. Trane offers both electric chillers and absorption chillers with the unit control panel (UCP2) as standard. Although the chillers have different features and modes of operation, the chiller control panel looks and acts the same across all chiller lines. Each control panel is programmed to monitor the particular chiller for which it was designed but maintenance and service personnel need only become familiar with one control panel. Combined with a Trane Tracer® system a chiller plant has almost unlimited operational flexibility and all equipment is supplied from a single source.

Multiple Machines
The Trane absorption machine can be applied to series or parallel chilled water flow depending upon the design requirement. Accurate chilled water temperatures can be maintained on individual machines between 100 percent and 10 percent chiller load which allows for a wide range of control options. Each chiller has a stand-alone control system to manage the desired water temperature and also the ability to receive remote commands to support various system demands from a control center. This versatility of control makes the management of more than one machine relatively easy.

Parallel flow allows minimum chilled water pressure drop through the machines. However, with one machine "off," it is not usually possible to maintain the design chilled water temperature unless one machine is valved-off and the chilled water flow decreased.

Series flow permits design chilled water temperature at light loads with one machine "off." However, at all operating conditions, the chilled water pressure drop through the machine is high.

A decision concerning which arrangement is best for an individual system should be based on an analysis of system water and temperature rise requirements, system and machine pressure drop characteristics, and installation cost.

Application Considerations

General

Fuel Handling
The standard burner is designed for natural gas as the primary fuel source. Local codes determine how this fuel is employed. The gas supply trains are furnished by the burner manufacturer based upon the local codes, available gas pressure, and the gas flow rate. The gas train can be sized for design gas supply pressures ranging from 9 inches water column at the inlet up to 5 psi depending on the size and model of the burner. The burner, gas train, burner control panel, and burner front plate sections are provided and completely assembled, installed and wired prior to shipment.

Exhaust Gas Duct
With the installation and proper operation of fuel burning equipment, consideration of the proper sizing, configuration and control of stacks and breeching is very important.

Proper stack design balances the theoretical draft against the pressure drop in the system in order to provide the required draft pressure at the outlet of the machine at all conditions.

The Trane absorption combustion system is engineered to produce a flue gas temperature up to 425 F and a pressure of 0 ± 0.2 inch W.C. at the outlet of the first stage generator. The stack must be designed to maintain available draft between -0.2 and 0.2 inch W.C. at the outlet of the first stage generator. Whenever possible, each machine should be vented outside the building by the most direct route, with its own separate stack.

CAUTION: Whenever there is a positive stack draft pressure, there does exist the chance of leaking flue gas into the equipment room. It is highly recommended to avoid positive stack pressures to eliminate this potential problem.

To eliminate friction loss, unnecessary turbulence, vibration and resulting noise, the shape of breeching and stacks should be considered. Round breeching and stacks have a more favorable effect on burner operation and are preferred over other shapes. The basic configuration is a vertical stack mounted to a single machine. To determine the available draft at the outlet of the generator it is necessary to measure the height of the stack and the outside ambient temperature. It also should be noted that there is a square connection at the direct-fired generator flue access point. This allows connection to either square or round (preferred) gas ducting systems.

To verify the stack design, determine the available draft at the minimum and maximum ambient temperatures and the minimum and maximum flue gas flow rate. All of these pressures should fall within specifications of outlet pressure. If the outlet pressure falls outside of the required pressure, the stack diameter sizing should be changed to maintain specified outlet pressure, or a barometric damper should be added if the draft is greater than negative 0.2 inches. Other things which affect stack design are wind conditions and profiles of nearby buildings.

If the stack cannot be run vertically from the chiller, the horizontal run should be as short and straight as possible with a minimum number of bends. **For more information on exhaust ducts refer to the installation manual, or consult a local stack designer.**

Damper Considerations
In order to control the draft for proper burner regulation and combustion of air and gases, a barometric draft control is sometimes required.

Excessive drafts cause a condition that can damage the chiller and waste as much as 15 percent of the fuel.

Whenever a forced draft burner is used with a natural draft stack, the draft must be controlled to remain reasonably constant. If this is not done, the air output of the burner fan will vary in proportion to the amount of draft present. Control of draft under these conditions is important and should be accomplished by either an electric over-fire draft control system or a barometric damper. For more information on damper considerations refer to the installation manual.

Operating Ambients
The minimum recommended ambient temperature with the machine shut down is 40 F. If lower ambient temperatures are expected, special additional protective measures are required. Machines installed outdoors where ambient temperatures will drop below the minimum must be modified and have heated enclosures.

Combustion Air
The machine room must be ventilated to assure that all exhaust gas is removed and sufficient burner makeup air is available for efficient combustion. A positive or neutral room pressure must be maintained at all times. At no time should the equipment room pressure be allowed to drop below the exhaust pressure.

Four-Pipe to Two-Pipe Heating Consideration
There are many applications in which a two-pipe heating system is needed rather than a four-pipe system. The Horizon™ absorption chiller comes as a standard four-pipe system when the heating option is selected, but can be converted to a two-pipe system with the application of control valves. For more information regarding two-pipe vs. four-pipe systems see the appropriate Trane Engineering Bulletin.

Application Considerations General

Combustion Fuels
All combustible fuels have both a higher heating value (HHV) and a lower heating value (LHV). HHV includes the latent heat of vaporization of water in the hydrocarbon combustion process. LHV does not include this additional energy. US convention calls for the use of HHV. Trane publishes both HHV for conventional use in performance calculations and LHV for comparative purposes.

Commonly Used Definitions
Natural gas utilities meter gas by the cubic foot or therms. The Btu content may vary from 900 to 1,200 Btu/ft^3, the usual range at sea level. Utilities may add propane-air to liquefied natural gas during winter peak periods to meet demand.

Following are some terms and measures commonly used:

1 CF (Cubic Foot) =
Approx. 1,000 Btu HHV
1 Therm =
100,000 Btu's = 100 CF
100 CF=
.1 MCF
1 MCF =
1,000 CF = 10 Therms
1 Quad =
10^9 MCF = 10^{10} Therms =
10^{15} Btu's

Heating Values Defined
Every fuel has a characteristic heating value that describes how much heat can be extracted from it during combustion on a heat per volume or mass basis.

Heating value is defined as "the amount of heat produced by the complete combustion of a unit quantity of fuel. The higher heating value is that which is obtained when all of the products of combustion are cooled to the temperature existing before combustion, the water vapor formed during combustion is condensed, and all the necessary corrections have been made. The lower heating value is obtained by subtracting the latent heat of vaporization of the water vapor from the higher heating value."

When the heating value of a fuel is specified without designating higher or lower, it generally means the higher heating value in the United States. The LHV is approximately 90 percent of HHV.

C.O.P. and Fuel Consumption

C.O.P. = Coefficient of Performance
= The ratio of useful output to Energy Input
= $\frac{\text{Tons x 12,000 Btu}}{\text{Heat Input (MBh)}}$

M.B.H. = 1,000 Btuh

C.O.P. can be defined as the ratio of units of energy output of a system to those put into the system. Care needs to be taken that methods for determining C.O.P. for one machine are the same methods used for another. Notice that both input and output values must be expressed in the same units, as C.O.P. is dimensionless.

Using LHV results in a higher C.O.P. because it ignores the purchased energy used to vaporize the products of combustion. The C.O.P. is artificially high compared to actual consumption, and thus may be misleading to system designers and owners.

Conclusion
C.O.P. can take on different values depending on the reference point being used. The key to making a fair comparison between machines is that the same reference point is used. If not, as shown above, the calculations will yield a significantly different C.O.P.

Selection Procedure

Selection Procedure
Absorption refrigeration machines are usually selected to provide the required refrigeration capacity with the smallest practical machine of sufficient size. Machine size is based on chilled-water flow rates and temperatures specified for the air side of the system.

Total air-conditioning system first cost can be minimized by a careful analysis of system operating parameters. The effect of flow rates and temperatures, on both the building air side and the refrigeration machine selections, should be investigated to determine which system represents the best investment for the owner.

The information on the following pages provides performance data, at ARI standard conditions, for capacity in tons, efficiency, flow rates and water pressure drops. All capacities are in accordance with ARI 560 Standard and are based on fouling factors of .0001 for the evaporator waterside tubing and .00025 for the absorber and condenser tubing.

Standard Fouling
Unit performance at non-standard fouling factors may vary from standard performance. Fouling factors estimate the heat transfer penalty that coincides with the effect of typical fouling in evaporator and absorber/condenser (cooling) water circuits. All selections should use the standard fouling factor to more accurately estimate the chiller performance in an equipment room and to comply with ARI 560.

ARI Standard Fouling Factors

Evaporator	Condenser/Absorber
English Units – hr-ft²-F/Btu	
0.0001	0.00025
SI Units – m²-K/kW	
0.018	0.044

Additional Fouling
Any selection that uses a fouling factor greater than 0.0001 for the evaporator tubes, and 0.00025 for the condenser/absorber tubes, is a more conservative estimate that should only be used if there is an abnormal amount of fouling contaminants in the water systems. The ARI 560 Standard defines "additional fouling" as "Conditions such as water hardness, organic material, suspended solids and/or water velocity may necessitate the use of a greater field fouling allowance than that provided in the Standard Rating of equipment." The Trane Horizon Selection program should be used to determine the effect of nonstandard fouling factors. The following guidelines can be used for estimation prior to the selection:

ARI Standard Fouling Factors For Additional Fouling

Evaporator	Condenser/Absorber
English Units – hr-ft²-F/Btu	
0.0002	0.00026 – 0.00075
SI Units – m²-K/kW	
0.035	0.046

Part Load Performance
Horizon® absorption chillers exhibit excellent part-load performance characteristics. Air conditioning system loads are usually significantly less than full-load design conditions. Therefore, the absorption chiller operates at full load a small percentage of the time. Part-load absorption chiller operation is normally associated with reduced tower-water temperatures. At part-load operation, the heat rejected to the cooling tower is less than at full-load operation. Also, part-load operation is typically associated with reduced outside wet-bulb temperatures, resulting in improved cooling tower performance. The net result of less heat rejection and lower wet-bulb temperature is cooler tower water entering the chiller and improved unit performance.

Final Selection
A final selection must be done by the local Trane sales engineer using the Trane Horizon® Direct-Fired Absorption Selection Program. For applications greater than 1600 feet [500 meters] above sea level, final selection requires review by Absorption Product Marketing. Prior to accessing the computer selection program, the following data inputs should be tabulated:

- Temperature or pressure of the hot water or steam
- Two of the following three values must be provided[1]:
  – Evaporator Delta-T
  – Evaporator Flow
  – Cooling Capacity
- Leaving-Evaporator Water Temperature
- Entering-Absorber Water Temperature
- Cooling Water Flow
- Chilled water and tower water fouling factors

Other options that may also be selected are:

- Type and thickness of tube material
- Type of solution flowing through the evaporator and tower loop[2].

[1] Any limitations or restrictions should also be given (i.e., pressure drop, gpm etc.).

[2] Absorption chillers can be selected with a wide variety of media other than water (evaporator and absorber/condenser, or both). For media other than water, contact the local Trane sales office for chiller selections and information.

Performance Data English

Table PD-1 – Performance Data at ARI Conditions

Model	Capacity (tons)	Coefficient of Performance (COP)		Cooling Duty Fuel Consumption (MBH)		Heating Performance Fuel Consumption (MBH)		
		HHV	LHV	HHV	LHV	Capacity (MBH)	HHV	LHV
ABDA-380	392	1.03	1.14	4.560	4.114	3.739	4.560	4.114
ABDA-440	457	1.04	1.15	5.280	4.751	4.330	5.280	4.751
ABDA-500	520	1.04	1.15	6.000	5.405	4.920	6.000	5.405
ABDA-575	600	1.04	1.15	6.900	6.237	5.658	6.900	6.237
ABDA-660	692	1.05	1.17	7.920	7.125	6.494	7.920	7.125
ABDA-750	788	1.05	1.17	9.000	8.113	7.380	9.000	8.113

Based on ARI Design Conditions
4.0 GPM/(Nominal Ton) Cooling Water
54-44°F Chilled Water, 85°F Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 140-180°F Hot Water Supply Temperature, std. fouling factors

Table PD-2 – Performance Data at Trane Design Conditions

Model	Capacity (tons)	Coefficient of Performance (COP)		Cooling Duty Fuel Consumption (MBH)		Heating Performance Fuel Consumption (MBH)		
		HHV	LHV	HHV	LHV	Capacity (MBH)	HHV	LHV
ABDA-380	374	1.01	1.12	4.434	4.003	3.739	4.560	4.114
ABDA-440	438	1.01	1.12	5.194	4.688	4.330	5.280	4.751
ABDA-500	498	1.01	1.12	5.898	5.330	4.920	6.000	5.405
ABDA-575	574	1.02	1.13	6.754	6.084	5.658	6.900	6.237
ABDA-660	663	1.02	1.13	7.765	7.027	6.494	7.920	7.125
ABDA-750	755	1.02	1.13	8.840	8.002	7.380	9.000	8.113

Based on Trane Design Conditions
3.6 GPM/(Nominal Ton) Cooling Water
54-42°F Chilled Water, 85°F Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 140-180°F Hot Water Supply Temperature, std. fouling factors

Table PD-3 – Selection Data - Water Flow Rate at ARI Design Conditions

Model	Water Flow								
	Chilled Water			Hot Water			Cond/Abs.*		
	Flow Rate (GPM)	Pr. Drop (Feet H_2O)	# of Passes	Flow Rate (GPM)	Pr. Drop (Feet H_2O)	# of Passes	Flow Rate (GPM)	Pr. Drop (Feet H_2O)	# of Passes
ABDA-380	939	16.3	2	500	12.5	2	1520	26.4	2
ABDA-440	1087	16.7	2	500	13.2	2	1760	30.5	2
ABDA-500	1243	17.3	2	500	13.9	2	2000	34.9	2
ABDA-575	1436	31.5	2	700	21.9	2	2300	19.3	2
ABDA-660	1654	32.2	2	700	23.5	2	2640	20.8	2
ABDA-750	1884	33.4	2	700	25.1	2	3000	22.8	2

Based on ARI Design Conditions
4.0 GPM/(Nominal Ton) Cooling Water
54-44°F Chilled Water, 85°F Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 140-180°F Hot Water Supply Temperature, std. fouling factors
* ABDA 380-500 ton units have 2 pass absorber and single pass condenser; ABDA575-750 have 2 pass absorber and 2 pass condenser

Table PD-4 - Selection Data Water Flow Rate at Trane Design Conditions

Model	Water Flow								
	Chilled Water			Hot Water			Cond/Abs.*		
	Flow Rate (GPM)	Pr. Drop (Feet H_2O)	# of Passes	Flow Rate (GPM)	Pr. Drop (Feet H_2O)	# of Passes	Flow Rate (GPM)	Pr. Drop (Feet H_2O)	# of Passes
ABDA-380	745	10.3	2	500	12.5	2	1368	21.7	2
ABDA-440	874	10.8	2	500	13.2	2	1584	25.0	2
ABDA-500	993	11.1	2	500	13.9	2	1800	28.5	2
ABDA-575	1145	19.5	2	700	21.9	2	2070	15.9	2
ABDA-660	1320	20.1	2	700	23.5	2	2376	17.1	2
ABDA-750	1504	20.8	2	700	25.1	2	2700	18.7	2

Based on Trane Design Conditions
3.6 GPM/(Nominal Ton) Cooling Water
54-42°F Chilled Water, 85°F Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 140-180°F Hot Water Supply Temperature, std. fouling factors
* ABDA 380-500 ton units have 2 pass absorber and single pass condenser; ABDA575-750 have 2 pass absorber and 2 pass condenser

Performance Data English

Table PD-5 - Selection Data - Air Flow and Flow Rate Limitations

	Air Flow*		Air Flow*		Flow Rate Limitations			
	ARI Condition		Trane Condition		Evaporator		Condenser/Absorber	
Model	Combustion Air (CFM)	Exhaust Air (CFM)	Combustion Air (CFM)	Exhaust Air (CFM)	Min (GPM)	Max (GPM)	Min (GPM)	Max (GPM)
ABDA-380	882	1549	858	1498	500	1600	700	1800
ABDA-440	1021	1788	1005	1753	600	1800	800	2100
ABDA-500	1161	2035	1141	1994	600	2000	950	2400
ABDA-575	1335	2267	1307	2211	600	2000	1050	2700
ABDA-660	1532	2562	1502	2505	700	2300	1200	3100
ABDA-750	1741	2879	1710	2821	800	2600	1400	3200

*Results assume 20% excess air on burner.

Table PD-6 - Electrical Data - ABDA 380-750, 60 Cycle, 3 phase

Unit Size	Volts	FLA	Total Motor (HP)	Total Motor (kW)	Control CKT Amps	MCA	Max. Fuse Size
ABDA-380	208	78.9	20.7	15.6	10	94	100
	230	72.4	20.7	15.6	8.7	86	100
	460	36.2	20.7	15.6	4.4	43	45
	575	29.7	20.7	15.6	3.5	35	40
ABDA-440	208	78.9	20.7	15.6	10	94	100
	230	72.4	20.7	15.6	8.7	86	100
	460	36.2	20.7	15.6	4.4	43	45
	575	29.7	20.7	15.6	3.5	35	40
ABDA-500	208	86.9	22.7	17	10	102	125
	230	80.4	22.7	17	8.7	94	125
	460	40.2	22.7	17	4.4	47	60
	575	32.7	22.7	17	3.5	38	50
ABDA-575	208	130.4	30.9	23.1	10	149	175
	230	116.0	30.9	23.1	8.7	132	150
	460	58.0	30.9	23.1	4.4	66	80
	575	47.0	30.9	23.1	3.5	54	60
ABDA-660	208	130.4	30.9	23.1	10	149	175
	230	116.0	30.9	23.1	8.7	132	150
	460	58.0	30.9	23.1	4.4	66	80
	575	47.0	30.9	23.1	3.5	54	60
ABDA-750	208	137.4	33.4	25.0	10	158	200
	230	122.0	33.4	25.0	8.7	140	175
	460	61.0	33.4	25.0	4.4	70	90
	575	49.0	33.4	25.0	3.5	56	70

Performance Data

SI Units

Table PD-7 – Performance Data at ARI Conditions

Model	Capacity (kW)	Coefficient of Performance (COP) HHV	Coefficient of Performance (COP) LHV	Cooling Duty Fuel Consumption (kCal/hr) HHV	Cooling Duty Fuel Consumption (kCal/hr) LHV	Heating Performance Fuel Consumption (kCal/hr) Capacity (kW)	Heating Performance Fuel Consumption (kCal/hr) HHV	Heating Performance Fuel Consumption (kCal/hr) LHV
ABDA-380	1378	1.03	1.14	1,149,120	1,036,830	1096	1,149,120	1,036,830
ABDA-440	1607	1.04	1.15	1,330,560	1,197,131	1269	1,330,560	1,197,131
ABDA-500	1828	1.04	1.15	1,512,000	1,362,162	1442	1,512,000	1,362,162
ABDA-575	2110	1.04	1.15	1,738,800	1,571,726	1658	1,738,800	1,571,726
ABDA-660	2433	1.05	1.17	1,995,840	1,795,459	1903	1,995,840	1,795,459
ABDA-750	2771	1.05	1.17	2,268,000	2,044,541	2162	2,268,000	2,044,541

Based on ARI Design Conditions
4.0 GPM/(Nominal Ton) Cooling Water
12.2-6.7°C Chilled Water, 29.4°C Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 60-82.2°C Hot Water Supply Temperature, std. fouling factors

Table PD-8– Performance Data at Trane Design Conditions

Model	Capacity (kW)	Coefficient of Performance (COP) HHV	Coefficient of Performance (COP) LHV	Cooling Duty Fuel Consumption (kCal/hr) HHV	Cooling Duty Fuel Consumption (kCal/hr) LHV	Heating Performance Fuel Consumption (kCal/hr) Capacity (kW)	Heating Performance Fuel Consumption (kCal/hr) HHV	Heating Performance Fuel Consumption (kCal/hr) LHV
ABDA-380	1315	1.01	1.12	1,117,368	1,008,809	1096	1,149,120	1,036,830
ABDA-440	1540	1.01	1.12	1,308,888	1,181,440	1269	1,330,560	1,197,131
ABDA-500	1751	1.01	1.12	1,486,296	1,343,281	1442	1,512,000	1,362,162
ABDA-575	2018	1.02	1.13	1,702,008	1,533,100	1658	1,738,800	1,571,726
ABDA-660	2331	1.02	1.13	1,956,780	1,770,811	1903	1,995,840	1,795,459
ABDA-750	2655	1.02	1.13	2,227,680	2,016,534	2162	2,268,000	2,044,541

Based on Trane Design Conditions
3.6 GPM/(Nominal Ton) Cooling Water
12.2-5.5°C Chilled Water, 29.4°C Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 60-82.2°C Hot Water Supply Temperature, std. fouling factors

Table PD-9 – Selection Data - Water Flow Rate at ARI Design Conditions

Model	Water Flow: Chilled Water Flow Rate (m^3/hr)	Chilled Water Pr. Drop (m H_2O)	Chilled Water # of Passes	Hot Water Flow Rate (m^3/hr)	Hot Water Pr. Drop (m H_2O)	Hot Water # of Passes	Cond/Abs.* Flow Rate (m^3/hr)	Cond/Abs.* Pr. Drop (m H_2O)	Cond/Abs.* # of Passes
ABDA-380	213	4.97	2	113.5	3.81	2	345	8.05	2
ABDA-440	247	5.09	2	113.5	4.02	2	400	9.30	2
ABDA-500	282	5.27	2	113.5	4.24	2	454	10.64	2
ABDA-575	326	9.60	2	158.9	6.68	2	522	5.88	2
ABDA-660	375	9.81	2	158.9	7.16	2	599	6.34	2
ABDA-750	428	10.18	2	158.9	7.65	2	681	6.95	2

Based on ARI Design Conditions
4.0 GPM/(Nominal Ton) Cooling Water
12.2-6.7°C Chilled Water, 29.4°C Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 60-82.2°C Hot Water Supply Temperature, std. fouling factors
* ABDA 380-500 ton units have 2 pass absorber and single pass condenser; ABDA575-750 have 2 pass absorber and 2 pass condenser

Table PD-10 – Selection Data Water Flow Rate at Trane Design Conditions

Model	Water Flow: Chilled Water Flow Rate (m^3/hr)	Chilled Water Pr. Drop (m H_2O)	Chilled Water # of Passes	Hot Water Flow Rate (m^3/hr)	Hot Water Pr. Drop (m H_2O)	Hot Water # of Passes	Cond/Abs.* Flow Rate (m^3/hr)	Cond/Abs.* Pr. Drop (m H_2O)	Cond/Abs.* # of Passes
ABDA-380	169	3.14	2	113.5	3.81	2	311	6.61	2
ABDA-440	198	3.29	2	113.5	4.02	2	360	7.62	2
ABDA-500	225	3.38	2	113.5	4.24	2	409	8.69	2
ABDA-575	260	5.94	2	158.9	6.68	2	470	4.85	2
ABDA-660	300	6.13	2	158.9	7.16	2	539	5.21	2
ABDA-750	341	6.34	2	158.9	7.65	2	613	5.70	2

Based on Trane Design Conditions
3.6 GPM/(Nominal Ton) Cooling Water
12.2-5.5°C Chilled Water, 29.4°C Cooling Water Supply Temperature, std. fouling factors
Heating Duty: 60-82.2°C Hot Water Supply Temperature, std. fouling factors
* ABDA 380-500 ton units have 2 pass absorber and single pass condenser; ABDA575-750 have 2 pass absorber and 2 pass condenser

Performance Data

SI Units

Table PD-11 - Selection Data - Air Flow and Flow Rate Limitations

	Air Flow*		Air Flow*		Flow Rate Limitations			
	ARI Condition		Trane Condition		Evaporator		Condenser/Absorber	
Model	Combustion Air (m^3/hr)	Exhaust Air (m^3/hr)	Combustion Air (m^3/hr)	Exhaust Air (m^3/hr)	Min (m^3/hr)	Max (m^3/hr)	Min (m^3/hr)	Max (m^3/hr)
ABDA-380	1499	2631	1457	2544	114	363	159	409
ABDA-440	1736	3037	1707	2978	136	409	182	477
ABDA-500	1972	3457	1939	3387	136	454	216	545
ABDA-575	2268	3852	2220	3757	136	454	238	613
ABDA-660	2603	4353	2552	4256	159	522	272	704
ABDA-750	2958	4891	2906	4793	182	590	318	726

*Results assume 20% excess air on burner.

Table PD-12 - Electrical Data - ABDA 380-750, 50 Cycle, 3 phase

Unit Size	Volts	FLA	Total Motor (HP)	Total Motor (kW)	Control CKT Amps	MCA	Max. Fuse Size
ABDA-380	190	76.1	19.9	20.1	10.5	92	100
	220	65.8	19.9	20.1	9.1	79	90
	380	38.0	19.9	20.1	5.3	46	50
	405	34.8	19.9	20.1	4.8	42	45
ABDA-440	190	76.1	19.9	20.1	10.5	92	100
	220	65.8	19.9	20.1	9.1	79	90
	380	38.0	19.9	20.1	5.3	46	50
	405	34.8	19.9	20.1	4.8	42	45
ABDA-500	190	85.1	21.9	21.5	10.5	101	125
	220	73.5	21.9	21.5	9.1	87	110
	380	42.5	21.9	21.5	5.3	50	60
	405	38.9	21.9	21.5	4.8	46	60
ABDA-575	190	110.0	27.9	20.8	10.5	128	150
	220	94.5	27.9	20.8	9.1	110	125
	380	55.0	27.9	20.8	5.3	64	70
	405	50.6	27.9	20.8	4.8	59	70
ABDA-660	190	110.0	27.9	20.8	10.5	128	150
	220	94.5	27.9	20.8	9.1	110	125
	380	55.0	27.9	20.8	5.3	64	70
	405	50.6	27.9	20.8	4.8	59	70
ABDA-750	190	118.1	30.4	22.7	10.5	138	175
	220	101.5	30.4	22.7	9.1	119	150
	380	59.0	30.4	22.7	5.3	69	90
	405	53.6	30.4	22.7	4.8	63	80

Performance Data

***Figure PD-1 — ABDA Capacity vs. Chilled Water* Supply Temperature at Various Cooling Water Supply Temperatures**

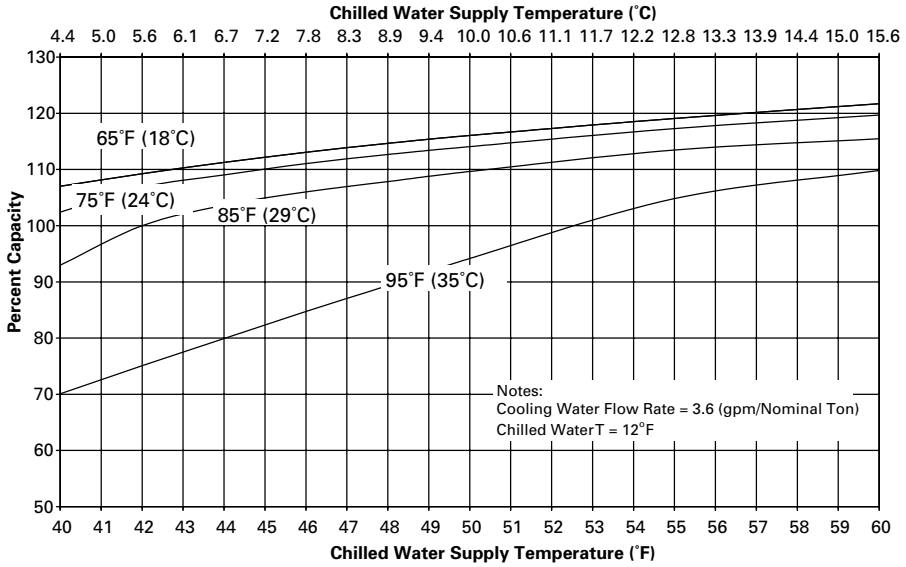


Figure PD-2 — ABDA Part Load Performance – Energy Input vs. Capacity at Various Cooling Water Supply Temperatures

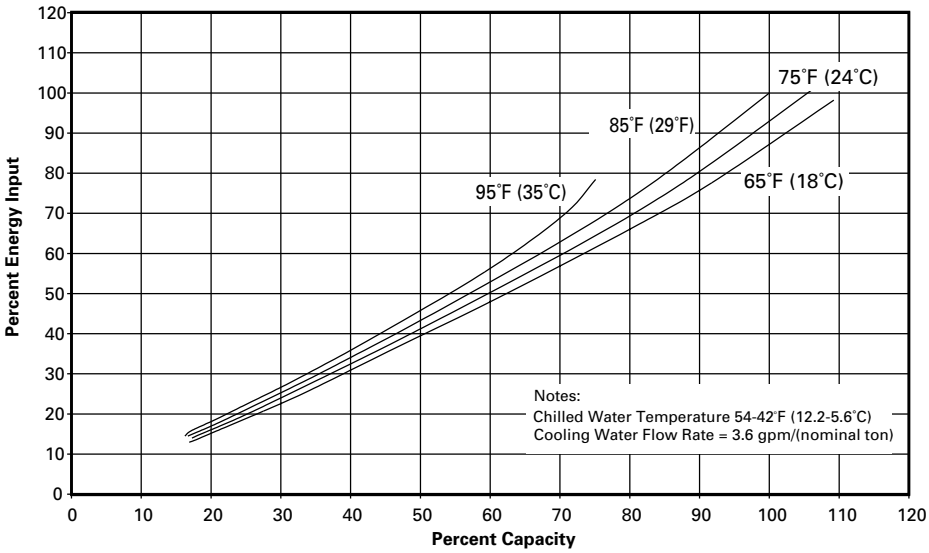


Figure PD-3 — Pressure Drop vs. Cooling Water Flow Rate – English and SI Units

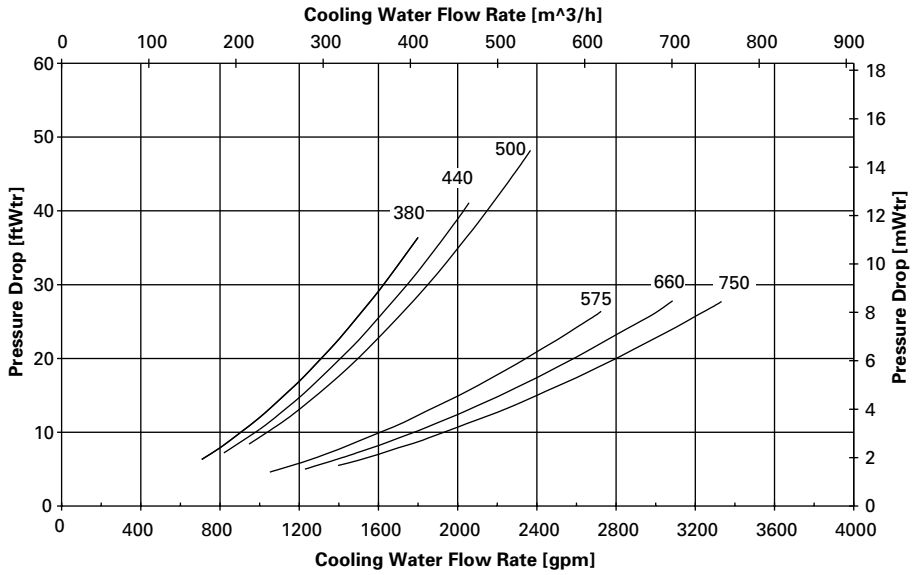
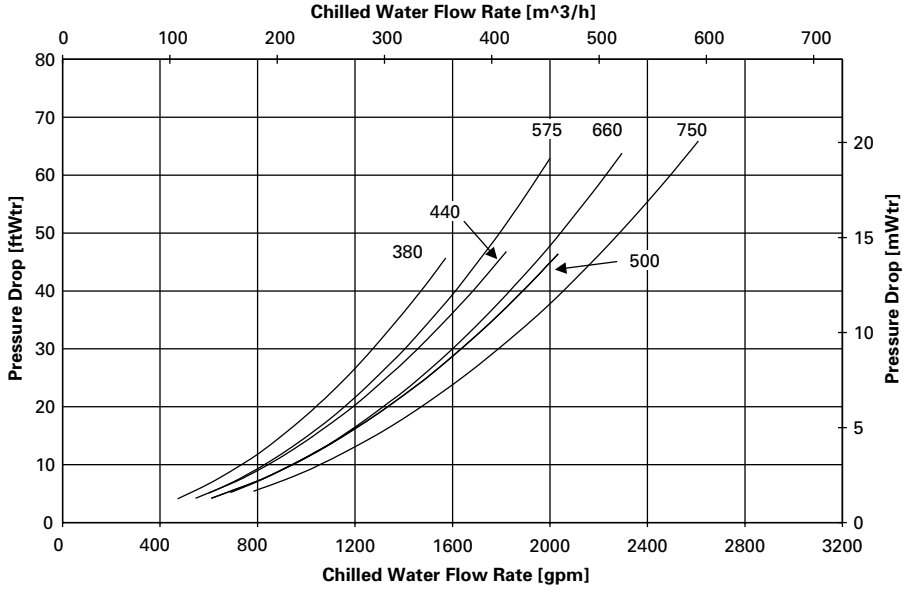
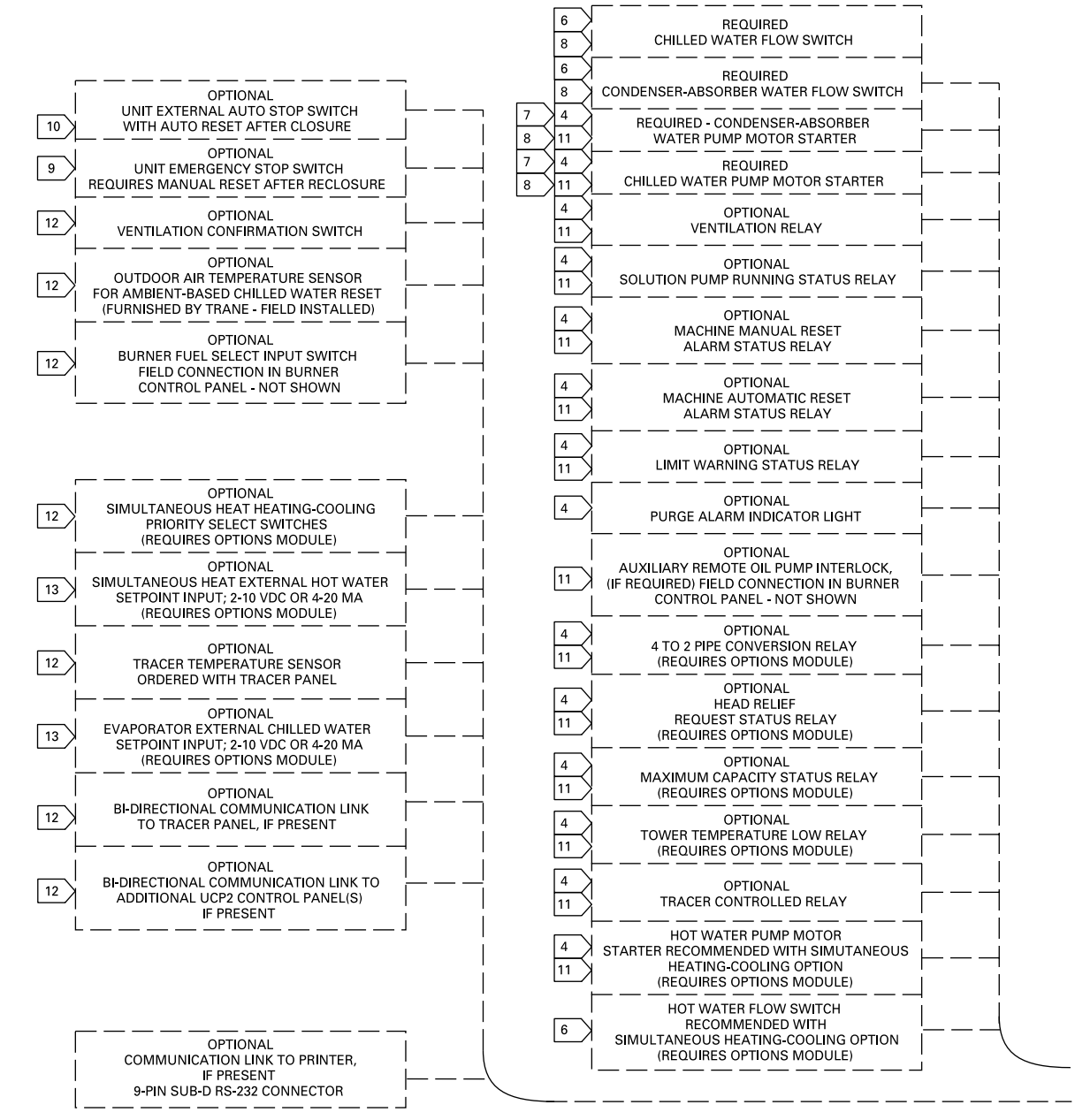


Figure PD-4 — Pressure Drop vs. Chilled Water Flow Rate – English and SI Units



⚠ WARNING	⚠ AVERTISSEMENT	⚠ CAUTION
HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.	VOLTAGE HASARDEUX! DECONNECTEZ TOUTES LES SOURCES ELECTRIQUES INCLUANT LES DISJONCTEURS SITUES A DISTANCE AVANT D'EFFECTUER L'ENTRETIEN. FAUTE DE DECONNECTER LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRETIEN PEUT ENTRAINER DES BLESSURES CORPORELLES SEVERES OU LA MORT.	USE COPPER CONDUCTORS ONLY! UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.



REFER TO NOTES AND DRAWING ON NEXT PAGE

Electrical Data

Wiring

GENERAL NOTES:

1. THIS DRAWING IS TO BE USED FOR THE PURPOSE OF ESTIMATING FIELD WIRING REQUIREMENTS. CHECK SALES ORDER TO DETERMINE WHICH OPTIONS ARE SPECIFIED AND REFER TO FIELD CONNECTION WIRING DIAGRAM FOR ACTUAL FIELD WIRING REQUIRED. DASHED LINES INDICATE DEVICES AND FIELD WIRING SUPPLIED BY CUSTOMER.

2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE OR STATE AND LOCAL REQUIREMENTS WHICH APPLY. ALL CUSTOMER CONTROL CIRCUIT WIRING MUST HAVE A MINIMUM RATING OF 150 VOLTS.

3. DO NOT ROUTE LOW VOLTAGE (30 VDC MAXIMUM) WIRING IN THE SAME CONDUIT AS CONTROL VOLTAGE (115 VAC) WIRING AND DO NOT POWER-UP UNIT UNTIL CHECK-OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.

4. THE MAIN UNIT CONTROL PANEL PROVIDES A CONTACT CLOSURE TO CONTROL THE INDICATED CUSTOMER CONNECTED DEVICE. CUSTOMER TO PROVIDE 115 VAC POWER TO EACH DEVICE. MAXIMUM FUSE SIZE IS 15 AMPS.

REQUIRED WIRING NOTES:

5. TRANE PROVIDES A TERMINAL BLOCK, FUSED OR NON-FUSED DISCONNECT SWITCH OR A CIRCUIT BREAKER IN THE MAIN UNIT CONTROL PANEL FOR LINE VOLTAGE CONNECTION WHICH REQUIRES THE USE OF COPPER CONDUCTORS ONLY. CHECK SALES ORDER TO DETERMINE WHICH OPTION IS SPECIFIED. WIRING SIZED PER NATIONAL ELECTRIC CODE BASED ON NAMEPLATE MINIMUM CIRCUIT AMPACITY RATING.

6. EVAPORATOR AND CONDENSER FLOW SWITCHES ARE TO BE INSTALLED AND WIRED TO THE MAIN UNIT CONTROL PANEL BY THE INSTALLING CONTRACTOR. THE PURCHASE OF FLOW SWITCHES FROM TRANE IS OPTIONAL. EACH FLOW SWITCH CIRCUIT REQUIRES TWO WIRES, 115 VAC. MINIMUM CONTACT RATING AT 115 VAC IS 4.8 MA.

7. CHILLED AND CONDENSER-ABSORBER WATER FLOW MUST BE PROVEN PRIOR TO CHILLER OPERATION. CONDENSER-ABSORBER WATER PUMP MUST BE CONTROLLED BY THE MAIN UNIT CONTROL PANEL FOR CHILLER SAFETY.

8. CIRCUIT REQUIRES TWO WIRES, 115 VAC. MAXIMUM MODULE CONTACT RATING AT 115 VAC OR 30 VDC IS 2.88 AMPS INDUCTIVE, 1/3 HP.

OPTIONAL WIRING NOTES:

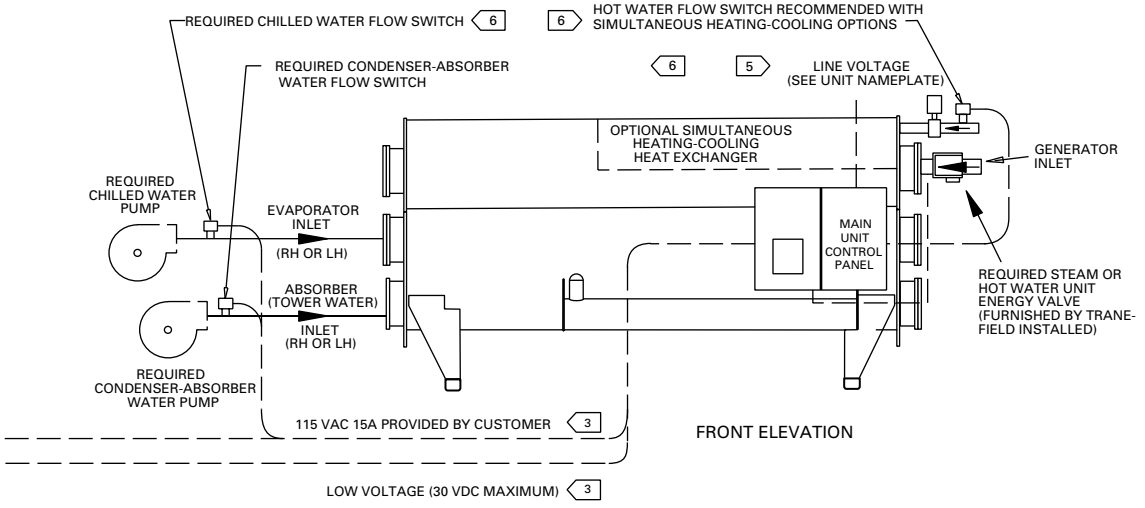
9. OPTIONAL CONTROL FOR A CUSTOMER SPECIFIED OR INSTALLED LATCHING TRIPOUT. THE CHILLER WILL RUN NORMALLY WHEN THE CONTACT IS CLOSED AND TRIP THE CHILLER OFF WITH A MANUALLY RESETTABLE DIAGNOSTIC WHEN THE CONTACT OPENS. MANUAL RESET IS ACCOMPLISHED WITH THE DIAGNOSTIC KEY ON THE FRONT OF THE MAIN UNIT CONTROL PANEL. CUSTOMER SUPPLIED SILVER CONTACTS ARE REQUIRED FOR 24 VDC, 12 MA RESISTIVE LOAD. CIRCUIT REQUIRES TWO WIRES, 30 VDC MAXIMUM. DO NOT ROUTE IN CONDUIT WITH HIGHER VOLTAGE CIRCUITS.

10. OPTIONAL CONTROL FOR A CUSTOMER SPECIFIED OR INSTALLED REMOTE AUTO-STOP FUNCTION. THE CHILLER WILL RUN NORMALLY WHEN THE CONTACT IS CLOSED AND STOP THE CHILLER WHEN THE CONTACT OPENS. RECLOSURE OF THE CONTACT WILL PERMIT THE CHILLER TO AUTOMATICALLY RETURN TO NORMAL OPERATION. CUSTOMER SUPPLIED SILVER CONTACTS ARE REQUIRED FOR 24 VDC, 12 MA RESISTIVE LOAD. CIRCUIT REQUIRES TWO WIRES, 30 VDC MAXIMUM. DO NOT ROUTE IN CONDUIT WITH HIGHER VOLTAGE CIRCUITS.

11. CIRCUIT REQUIRES TWO WIRES, 115 VAC. NORMALLY OPEN MAXIMUM MODULE CONTACT RATING AT 115 VAC OR 30 VDC IS 2.88 AMPS INDUCTIVE, 1/3 HP.

12. CIRCUIT REQUIRES SHIELDED WIRE PAIR, 30 VDC MAXIMUM. BELDON TYPE 8760 RECOMMENDED. MAXIMUM LENGTH OF 5000 FEET.

13. TRANE PROVIDES STEAM PRESSURE TRANSDUCER SHIELDED CABLE ASSEMBLIES FOR FIELD INSTALLATION BY CUSTOMER.



Controls Data

Setting The Standards
Trane set the standard for unit microprocessor controls in 1985 with the first generation of UCP. Associated with this standard have been:

- Proportional Integral Derivative (PID) control strategies which provide stable operation and high accuracy for better performance along with feed forward plus.
- Adaptive Control™ to keep the chiller "on line" and at the same time keep the chiller away from a major failure;
- Software based safeties that do not depend on electromechanical hardware – hardware that means questionable reliability and added cost;
- Operator interface that accesses chiller information and control adjustments at the front of the panel.

Trane Now Offers UCP2™
UCP2 adds more flexibility, more reliability and better system performance than even our most demanding customers expect.

Flexibility
Trane offers the ability to adapt to changes easily and effectively without adding prohibitive cost. To provide flexibility, the controller responds to a wide variety of needs for:

- **System Designs** including equipment, operating conditions, and controls variations that are either existing or being considered for new installations.

  Key to designing non-traditional systems is the ability to evaluate the cost and reliability issues of these systems in comparison to the more traditional systems. Trane recommends the use of C.D.S. Network Equipment Economics, the Trane Applications Manuals, and consultation with a Trane sales engineer for help in this analysis.

- **System Upgrades** including the ability to accommodate changes in the chilled water system design or equipment room requirements or to accommodate new technologies that become available.

Flexibility

- Modular structure or the UCP2 makes it possible for the designer to select the system controls and associated interfaces to Tracer® (or other building automation systems) that are required for the chiller plant design. With this modular concept, capability can be added or upgraded at any time — with only temporary interruption of chilled water production.
- The operator can quickly program a Custom Report — so that only what is considered to be the most frequently accessed/important reports are available — at any time, right at the front of the panel.
- With easy front panel programmability of Daily, Service Start-up and Machine Configuration settings and setpoints, the operator, serviceman, and system designer can customize the use of the micro controller to unique conditions of the chiller plant — whether the purpose of chilled water is for comfort cooling or for process cooling.
- All data that is necessary for the safe operation and easy serviceability of the chiller is provided as standard on all Horizon® absorption chillers. Options are available that provide additional controls/data that are required for: an industrial/process system design, applications outside of the typical chilled water system design, the need for redundant machine protection, or the desire for more system information.

Controls Data

Reliability
To most people, reliability means "dependable — giving the same result on successive trials." However, to our customers it has come to mean "keep chilled water flowing." In other words, "when I turn the switch on — cold water comes out." In order to do this, the micro controller must be aware of what is happening in the system. But more importantly, it must be able to make decisions and adjustments to keep the chiller running as long as possible even when non-standard conditions exist. Conditions such as bad power or bad water (flow, temperature, fouling) or system component failure. Also the Trane UCP2 panel continuously monitors for noncondensables and purges automatically.

- With Enhanced Adaptive Control™ the controller does everything it can to avoid taking the chiller off line.
  - — Senses potential overload, freeze and condenser overpressure conditions
  - — Displays a warning message about the potential condition/safety trip
  - — Take the following corrective action sequentially as the condition worsens:
    - limits loading
    - prevents further loading
    - unloads until condition improves
    - takes chiller off line
- With more diagnostics and diagnostic history that are time/date stamped and with help messages, the operator or serviceman can take faster and more effective corrective action.

System Performance
"Chilled Water System" encompasses many levels of control: Standalone Chiller, Chiller Plant, Applied System, Central Building Automation System. However, regardless of the system level being design, the unit controls become critical not just in making every level operate reliably but in facilitating optimal performance. UCP2 provides more capability and more intelligence to make this operation/optimization possible.

Panel Features:
The absorption chiller Unit Control Panel (UCP2) incorporates the following features and components:

Control Functions
- Smart dilution cycle duration based on system requirements
- Adaptive evaporator leaving fluid temperature control
- Low evaporator temperature limit
- High solution temperature limit
- Solution flow control via AFD
- Softloading
- Nuisance trip prevention via Adaptive Control
- Chilled water reset
- Optimum concentration control
- Crystallization recovery via SDR
- High temperature generator pressure limit

Safeties
- Smart shutdown sequence condenser/absorber loss of flow
- Low condenser/absorber water temperature
- High interstage pressure limit
- High pressure cutout
- Evaporator leaving fluid temperature cutout
- Motor current overload
- High motor winding temperature
- Over/under voltage (optional)
- Purge limit
- Sensor failure detection
- High flue gas limit and cutout

Controls Data

Monitored Points
Chiller information is available at the operator interface via a clear language display. Access to the information is through four dedicated report keys: Customer, Chiller, Cycle and Pump/ Purge.

Customer Report
User defined custom report (operator may choose up to 20 points — from a list of over 100 choices).

Chiller Report
Status, fluid temperatures, and setpoints:
- Operating mode (i.e. run status)
- Chilled water setpoint
- Evaporator entering/leaving water temperatures
- Absorber entering/leaving water temperatures
- Condenser leaving water temperature
- Outdoor air temperature
- Evaporator leaving water temperature
- Chilled water reset
- Heat and cooling priority (optional)
- Hot water reset (optional)
- Hot water entering/leaving temperatures (optional)

Burner Controls
- Firing rate mode selection, auto/ manual via UCP2
- Manual firing rate via UCP2
- Remote/manual fuel transfer via UCP2
- Call for operation indication
- Local/remote burner alarm indication
- Gas pressure normal indication
- Fuel "on" indication
- Ignition "on" indication
- Agency listed flame safeguard system
- Emergency "off" switch
- Audible alarm, with silencer switch

Cycle Report
Refrigerant temperatures and pressures:
- Solution temperature leaving high temperature generator
- Interstage vapor temperature
- Solution temperature entering level control
- Mixed solution temperature entering low temperature heat exchanger
- Solution temperature entering high temperature generator
- Interstage vapor pressure
- High temperature generator leaving concentration
- Low temperature generator leaving concentration
- High temperature generator cutout and monitor temperature
- Crystallization detection temperature
- Crystallization trip temperature
- Solution temperature leaving low temperature generator
- Saturated condenser refrigerant temperature
- Absorber entering concentration
- LiBr crystallization margin
- Solution temperature leaving absorber
- Absorber spray temperature
- Solution temperature leaving absorber
- Solution temperature entering low temperature generator
- Saturated evaporator refrigerant temperature
- Evaporator leaving water temperature
- Evaporator entering water temperature
- Absorber entering water temperature
- Absorber leaving water temperature
- Condenser leaving water temperature
- Solution pump auto/manual speed command
- Energy input auto/manual/slaved reported command
- Steam supply pressure
- Generator steam pressure
- Flue gas exhaust temperature

Controls Data

Pump/Purge Report
- Solution pump
  - — Starts and hours counters
  - — Motor phase currents
  - — Motor phase voltages (optional)
- Purge Pump
  - — Operating mode and status
  - — Refrigerant suction temperature
  - — Pumpout rate
  - — Total pumpout time
  - — Service log

Diagnostics
The absorption chiller Unit Control Panel (UCP2) provides over 70 active and historic diagnostics such as:
- Water and refrigerant/solution temperatures out of range
- Solution pressures out of range
- Loss of system water flows
- Sensor and switch faults
- Overload trips
- Over/under voltage (optional)
- Crystallization recovery
- High pressure cutout
- Emergency stop
- Loss of communication to other modules
- Motor abnormal

Operator Interface
The Trane Horizon® direct-fired absorption chiller control panel, UCP2, is easy to use, understand, access information, read, change setpoints, diagnose problems, maintain, and to reset after shutdown.

Convenience
Enunciation of all information is at the front panel display (including power, voltage, amps, purge pressures, and number of starts data). Messages displayed using clear language.

Readability
- Two line, 40 character display that is easy to read from within a 60 degree angle
- LCD backlight so that the display can be read in a variety of equipment room lighting
- Seven languages available
- Metric (SI) units available
- Complete character human interface available

Remote Operator Interface
With the addition of an optional remote interface panel, up to four chillers with UCP2 can be monitored and controlled. All data available at each chiller's local operator interface is available to the remote operator interface via a single twisted pair.

Ease of Use
- Keypad programmability — no manual switches or setpoint potentiometers
- Logically arranged report groups with report header and setpoint groups
- Selectable security
- Variable points updated every two seconds
- Messages that direct user to problem source via a menu item

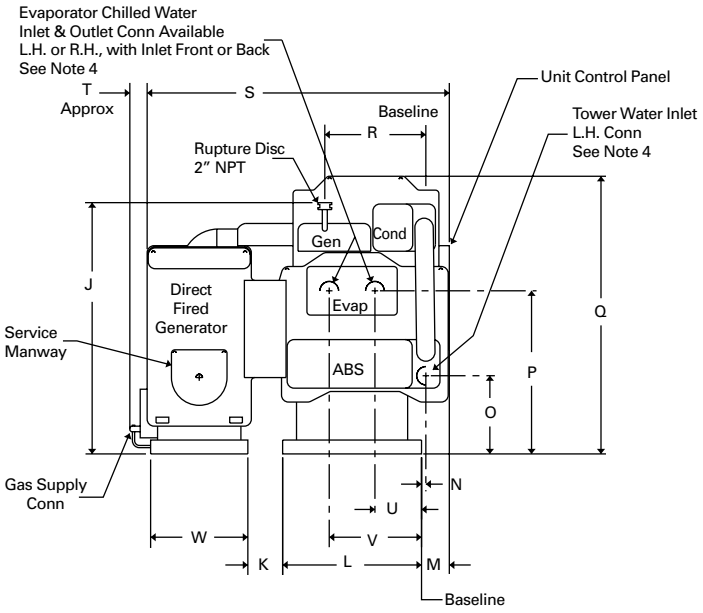
Trane ICS Compatibility
The Trane Absorption chiller control panel, UCP2, is 100 percent compatible with the Trane Integrated Comfort™ systems, ICS, UCP2 easily integrates into the Tracer® family of flexible chiller plant system controllers with a single twisted-wire pair communications cable.

For more information on the Trane absorption chiller unit control panel, please contact your local Trane sales engineer.

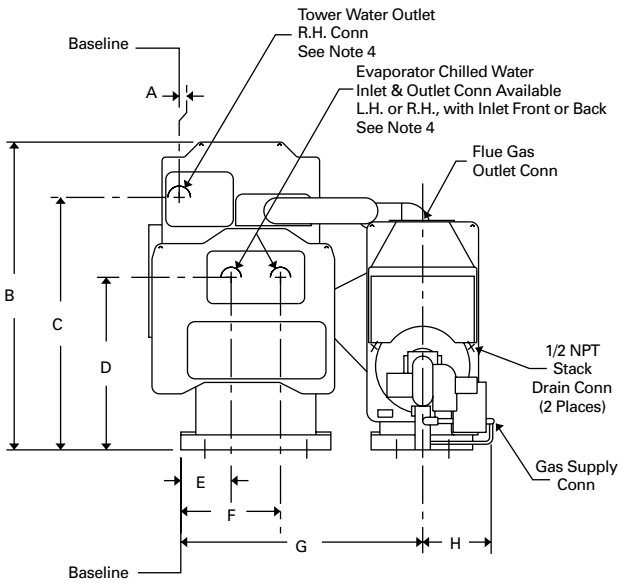
Dimensions and Weights

ABDA-380, 440, 500 Physical Dimensions English and SI Units

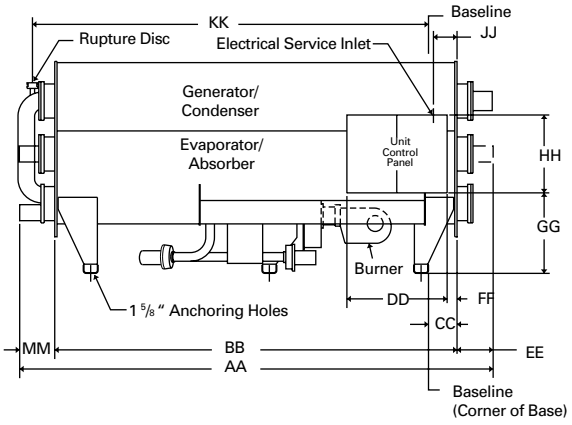
Left Hand Elevation - ABDA 380, 440, 500



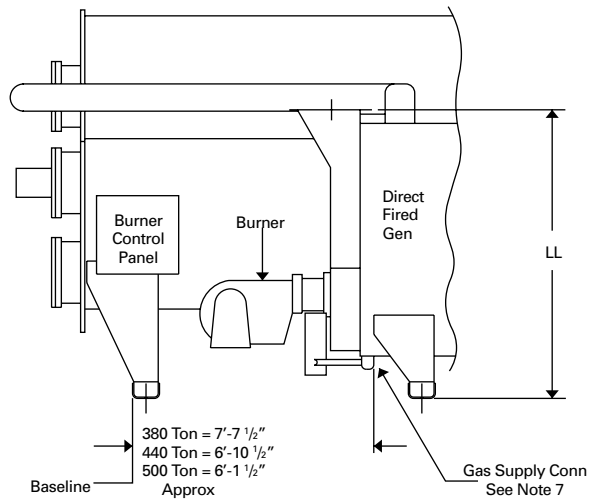
Right Hand Elevation - ABDA 380, 440, 500



Front Elevation - ABDA 380, 440, 500



Direct Fired Generator - ABDA 380, 440, 500



Dimensions and Weights

ABDA-380, 440, 500 Physical Dimensions English and SI Units

Table DW-1 – Unit Dimensions - English

Figure Reference	ABDA 380-440-500
A	3/8″
B	9′-6 7/8″
C	7′-9 5/8″
D	5′-4 1/8″
E	1′-8″
F	3′-1″
G	7′-5 3/4″
H	2′-2″
J	8′-6 3/8″
K	1′-1 3/4″
L	4′-9″
M	11 1/4″
N	2 3/4″
O	2′-8 1/4″
P	5′-4 1/8″
Q	9′-5 7/8″
R	3′-4 1/2″
S	10′-1 3/4″
T	7″ approx
U	1′-8″
V	3′-1″
W	3′-2″
AA	21′-2 1/4″
BB	17′-11 1/2″
CC	1′-1 5/8″
DD	4′-6″
EE	1′-7 3/8″
FF	5 1/4″
GG	3′-7 1/8″
HH	3′-6″
JJ	11 1/4″
KK	17′-10 1/4″
LL	7′-1 3/8″
MM	1′-7 3/8″

Table DW-2 – Unit Dimensions - (SI) - mm

Figure Reference	ABDA 380-440-500
A	9.525
B	2917.8
C	2378.1
D	1628.8
E	508.0
F	939.8
G	2279.7
H	660.4
J	2600.3
K	349.3
L	1447.8
M	285.8
N	69.9
O	819.2
P	1628.8
Q	2892.4
R	1028.7
S	3092.5
T	177.8 approx
U	508.0
V	939.8
W	965.2
AA	6457.9
BB	5473.7
CC	346.1
DD	1371.6
EE	492.1
FF	133.4
GG	1095.4
HH	1066.8
JJ	285.8
KK	5441.9
LL	2168.5
MM	492.1

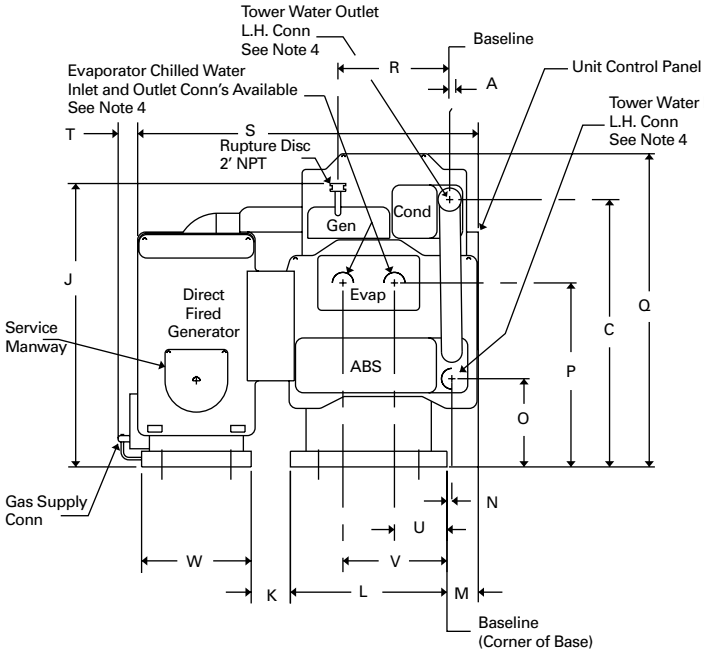
Customer Notes:

1. Front of unit is determined by facing unit control panel.
2. All vertical dimensions include 5/16″ thick isolation pads.
3. Dimensions shown are calculated values. Stack tolerance could be ± 1/2″ unless otherwise specified.
4. Evaporator, condenser and absorber water connections are for 8″ pipe. Available with 150# American Standard raised face flange. (Flanged bolt holes straddle vertical centerline.)
5. All water box vents are 1/4″ NPT and drains are 3/4″ NPT.
6. Flexible connection must be used for attachment to rupture disc. Do not apply more than 12 psi internal pressure on machine without removing rupture disc. Pipe rupture disc to floor vent or to the outside to meet local code.
7. Gas train ships assembled to unit. Gas supply connection size and location will vary per local codes and gas inlet pressure.
8. Field piping must be arranged and supported to avoid stress on the equipment. It is strongly recommended that the piping contractor refrain from pre-piping closer than 36″ minimum to the equipment. This will allow for proper connection upon arrival of the unit at the jobsite. Necessary adjustments can be made at that time.

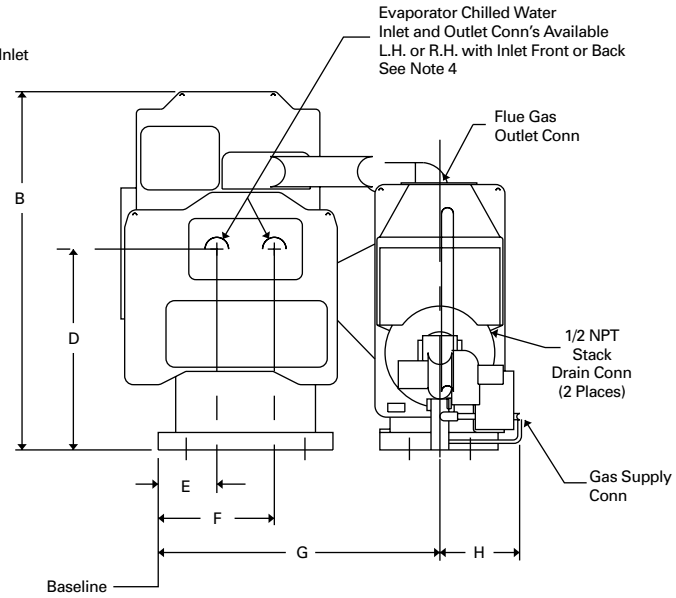
Dimensions and Weights

ABDA-575, 660, 750 Physical Dimensions English and SI Units

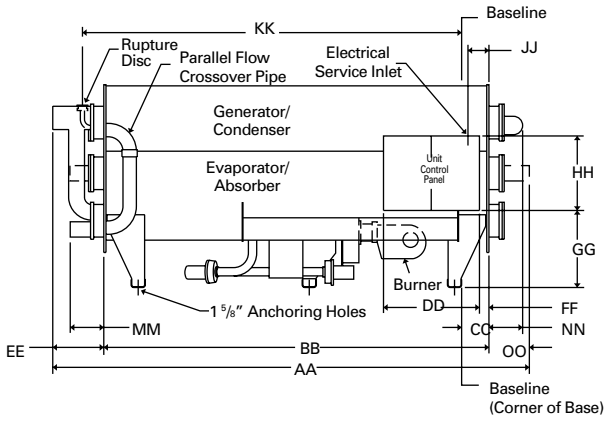
Left Hand Elevation - ABDA 575, 660, 750



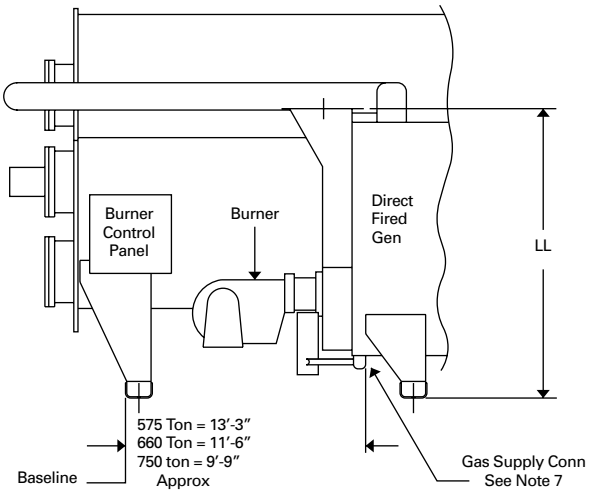
Right End Elevation - ABDA 575, 660, 750



Front End Elevation - ABDA 575, 660, 750



Direct Fired Generator - ABDA 575, 660, 750



Dimensions and Weights

ABDA-575, 660, 750 Physical Dimensions English and SI Units

Table DW-3 – Unit Dimensions - English

Figure Reference	ABDA 575-660-750
A	1/2″
B	9′-6 7/8″
C	7′-11 5/8″
D	5′-4 1/8″
E	1′-8″
F	3′-1″
G	7′-5 3/4″
H	2′-2″
J	8′-6 3/8″
K	1′-1 3/4″
L	4′-9″
M	11 1/4″
N	3 5/8″
O	2′-6 7/8″
P	5′-4 1/8″
Q	9′-5 7/8″
R	3′-4 1/2″
S	10′-1 3/4″
T	7″ approx
U	1′-8″
V	3′-1″
W	3′-2″
AA	30′-11 1/4″
BB	27′-0″
CC	1′-1 5/8″
DD	4′-6″
EE	1′-11 7/8″
FF	5 1/4″
GG	3′-7 1/8″
HH	3′-6″
JJ	11 1/4″
KK	26′-10 3/4″
LL	7′-1 3/8″
MM	1′-7 3/8″
NN	1′-4″
OO	1′-7 3/8″

Table DW-4 – Unit Dimensions - (SI) - mm

Figure Reference	ABDA 575, 660, 750
A	12.7
B	2917.8
C	2428.9
D	1628.8
E	508.0
F	939.8
G	2279.7
H	660.4
J	2600.3
K	349.3
L	1447.8
M	285.8
N	92.1
O	784.2
P	1628.8
Q	2892.4
R	1028.7
S	3092.5
T	177.8 approx
U	508.0
V	939.8
W	965.2
AA	9429.8
BB	8229.6
CC	346.1
DD	1371.6
EE	606.43
FF	133.4
GG	1095.4
HH	1066.8
JJ	285.8
KK	8197.8
LL	2168.5
MM	492.1
NN	406.4
OO	492.1

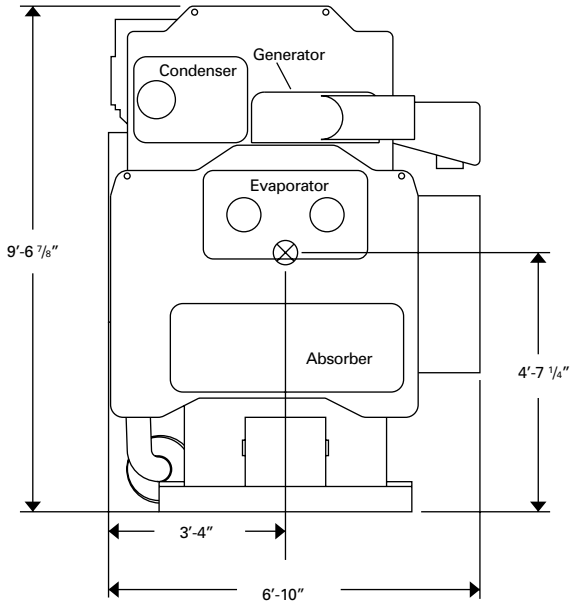
Customer Notes:

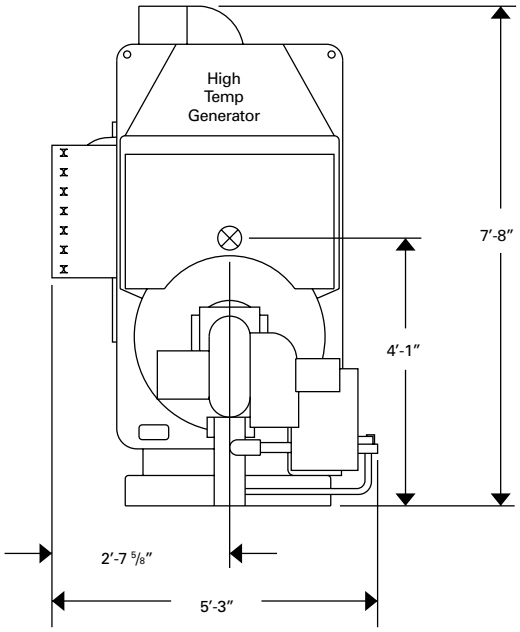
1. Front of unit is determined by facing unit control panel.
2. All vertical dimensions include 5/16″ thick isolation pads.
3. Dimensions shown are calculated values. Stack tolerance could be ± 1/2″ unless otherwise specified.
4. Evaporator water connections are for 8″ pipe. Condenser, and absorber water connections are for 10″ pipe. Available with 150# grooved connection for use with Style 77 Victaulic coupling. Also, available with 150# American Standard raised face flange. (Flanged bolt holes straddle vertical centerline.)
5. All water box vents are 1/4″ NPT and drains are 3/4″ NPT.
6. Flexible connection must be used for attachment to rupture disc. Do not apply more than 12 psi internal pressure on machine without removing rupture disc. Pipe rupture disc to floor vent or to the outside to meet local code.
7. Gas train ships assembled to unit. Gas supply connection size and location will vary per local codes and gas inlet pressure.
8. Field piping must be arranged and supported to avoid stress on the equipment. It is strongly recommended that the piping contractor refrain from pre-piping closer than 36″ minimum to the equipment. This will allow for proper connection upon arrival of the unit at the jobsite. Necessary adjustments can be made at that time.

Dimensions and Weights

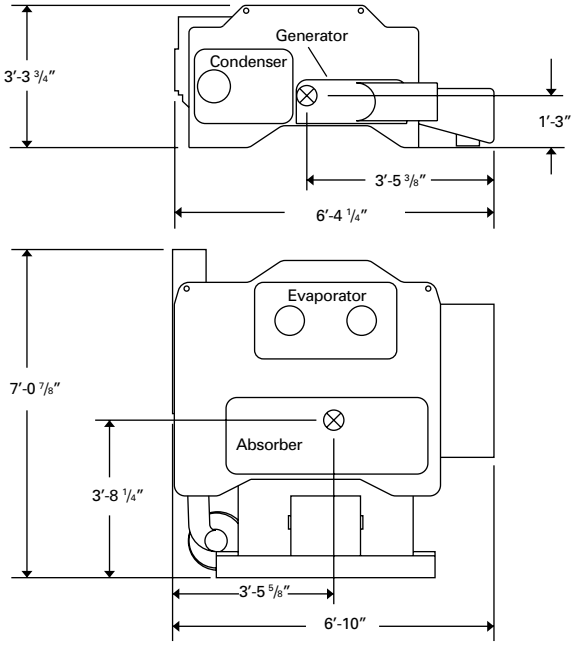
Disassembly Options

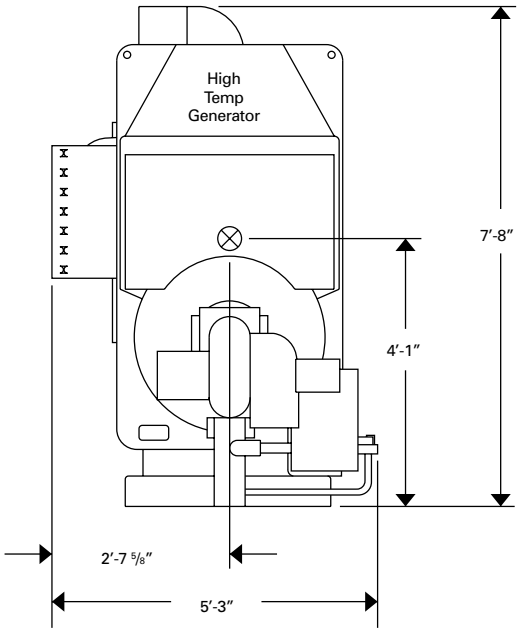
Break Apart and Center of Gravity – Two-Piece Disassembly





Three-Piece Disassembly

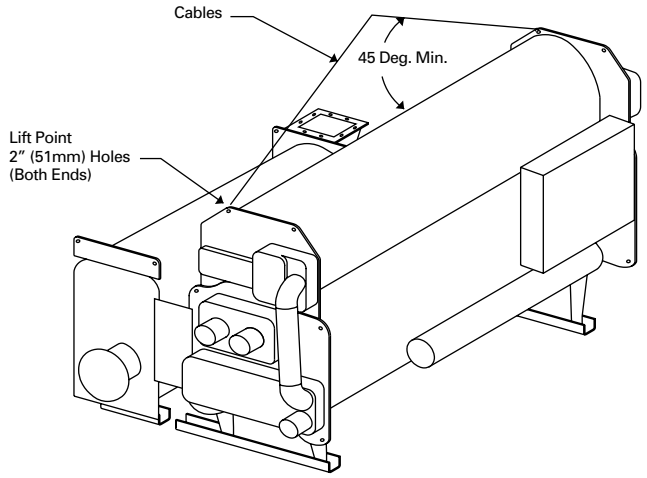




Dimensions and Weights

Rigging

Rigging Instructions



Space Requirements

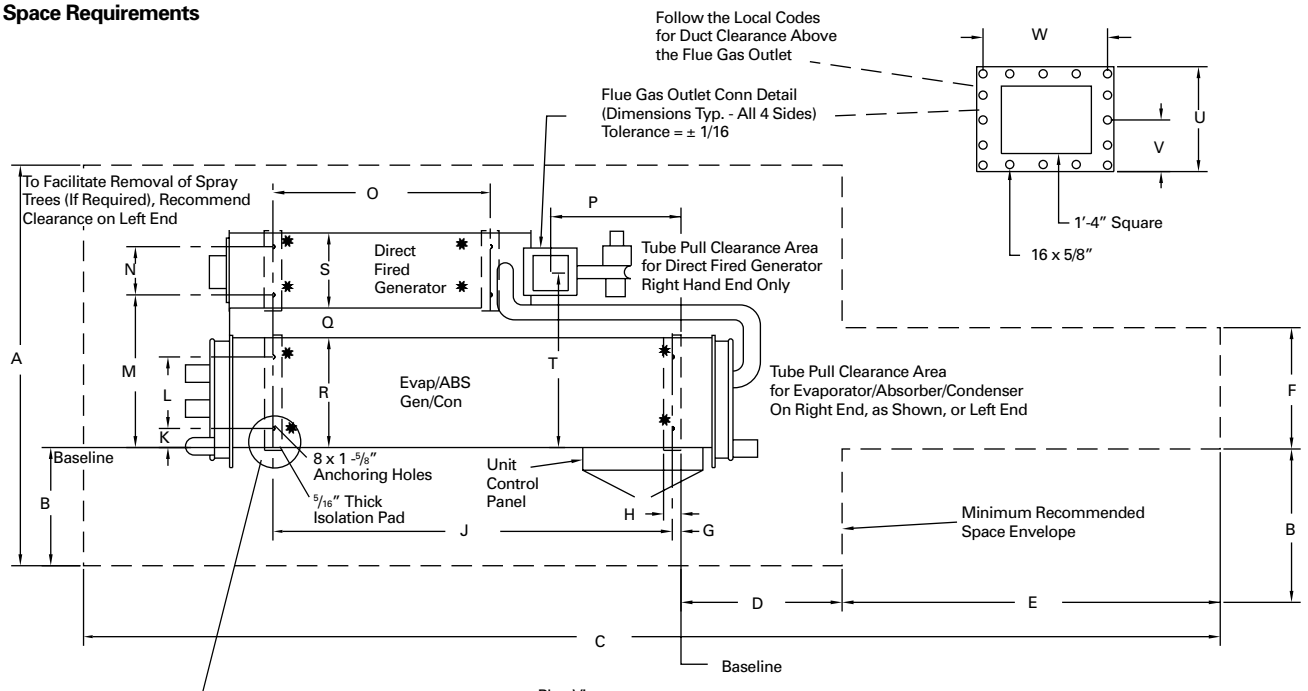


Table DW-5 – Service Clearances (English)

Figure Reference	ABDA 380, 440, 500	ABDA 575, 660, 750
A	18′-6″	18′-6″
B	5′-0″	5′-0″
C	41′-6″	59′-6″
D	6′-0″	6′-0″
E	13′-6″	22′-6″
F	5′-0″	5′-0″

Table DW-6 – Anchor and Flue Locations (English)

Figure Reference	ABDA-380	ABDA-440	ABDA-500	ABDA-575	ABDA-660	ABDA-750
G	5 3/8″	5 3/8″	5 3/8″	5 3/8″	5 3/8″	5 3/8″
H	10 3/4″	10 3/4″	10 3/4″	10 3/4″	10 3/4″	10 3/4″
J	14′-9 1/2″	14′-9 1/2″	14′-9 1/2″	23′-10″	23′-10″	23′-10″
K	10 1/2″	10 1/2″	10 1/2″	10 1/2″	10 1/2″	10 1/2″
L	3′-0″	3′-0″	3′-0″	3′-0″	3′-0″	3′-0″
M	6′-6 3/4″	6′-6 3/4″	6′-6 3/4″	6′-6 3/4″	6′-6 3/4″	6′-6 3/4″
N	1′-10″	1′-10″	1′-10″	1′-10″	1′-10″	1′-10″
O	6′-6″	7′-3″	8′-0″	9′-11″	11′-8″	13′-5″
P	6′-5 7/8″	5′-8 7/8″	4′-11 7/8″	12′-1 3/8″	10′-4 3/8″	8′-7 3/8″
Q	1′-1 3/4″	1′-1 3/4″	1′-1 3/4″	1′-1 3/4″	1′-1 3/4″	1′-1 3/4″
R	4′-9″	4′-9″	4′-9″	4′-9″	4′-9″	4′-9″
S	3′-2″	3′-2″	3′-2″	3′-2″	3′-2″	3′-2″
T	7′-5 3/4″	7′-5 3/4″	7′-5 3/4″	7′-5 3/4″	7′-5 3/4″	7′-5 3/4″
U	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″	2′-0″
V	1′-0″	1′-0″	1′-0″	1′-0″	1′-0″	1′-0″
W	1′-10″	1′-10″	1′-10″	1′-10″	1′-10″	1′-10″

Customer Notes:

1. Do not run wiring or piping across the front or panel side of the unit where most service is performed (the front is that side on which the main control panel is mounted).
2. Unit to be installed on level surface. Housekeeping pad recommended.
3. Use anchoring holes, as required, to meet local codes, anchoring hardware is provided by customer
4. Isolation pads are provided with the unit.
5. Recommended space envelope provides minimum 3 ft clearance at right end of unit, with 4 ft at front, back and left end (to direct-fired generator). Allow minimum of 1′-6″ clearance above unit.

Table DW-7 – Weights

	Weights		Unit Brine Charge		System Water Capacity	
Model	Shipping (Lbs)	Operating (Lbs)	Solution (Lbs)	Refrigerant (Gals)	Evaporator (Gals)	Cond/Abs. (Gals)
ABDA-380	32900	45800	9075	105	130	250
ABDA-440	34500	48300	9645	115	145	280
ABDA-500	36000	50500	10140	120	160	305
ABDA-575	42300	60700	12620	140	250	375
ABDA-660	44600	64500	13750	155	225	335
ABDA-750	46800	68300	14950	170	280	410

Table DW-8 – Service Clearances (SI) mm

Figure Reference	ABDA 380, 440, 500	ABDA 575, 660, 750
A	5638.8	5638.8
B	1524.0	1524.0
C	12649.2	18135.6
D	1828.8	1828.8
E	4114.8	6858.0
F	1524.0	1524.0

Table DW-9 – Anchor and Flue Locations (SI) mm

Figure Reference	ABDA-380	ABDA-440	ABDA-500	ABDA-575	ABDA-660	ABDA-750
G	136.5	136.5	136.5	136.5	136.5	136.5
H	273.1	273.1	273.1	273.1	273.1	273.1
J	4508.5	4508.5	4508.5	7264.4	7264.4	7264.4
K	266.7	266.7	266.7	266.7	266.7	266.7
L	914.4	914.4	914.4	914.4	914.4	914.4
M	2000.3	2000.3	2000.3	2000.3	2000.3	2000.3
N	558.8	558.8	558.8	558.8	558.8	558.8
O	1981.2	2209.8	2438.4	3022.6	3556	4089.4
P	1978.0	1749.4	1520.8	3692.5	3159.1	2625.7
Q	349.3	349.3	349.3	349.3	349.3	349.3
R	1447.8	1447.8	1447.8	1447.8	1447.8	1447.8
S	965.2	965.2	965.2	965.2	965.2	965.2
T	2279.7	2279.7	2279.7	2279.7	2279.7	2279.7
U	609.6	609.6	609.6	609.6	609.6	609.6
V	304.8	304.8	304.8	304.8	304.8	304.8
W	558.8	558.8	558.8	558.8	558.8	558.8

Customer Notes:

1. Do not run wiring or piping across the front or panel side of the unit where most service is performed (the front is that side on which the main control panel is mounted).
2. Unit to be installed on level surface. Housekeeping pad recommended.
3. Use anchoring holes, as required, to meet local codes, anchoring hardware is provided by customer
4. Isolation pads are provided with the unit.
5. Recommended space envelope provides minimum 3 ft clearance at right end of unit, with 4 ft at front, back and left end (to direct-fired generator). Allow minimum of 1′-6″ clearance above unit.

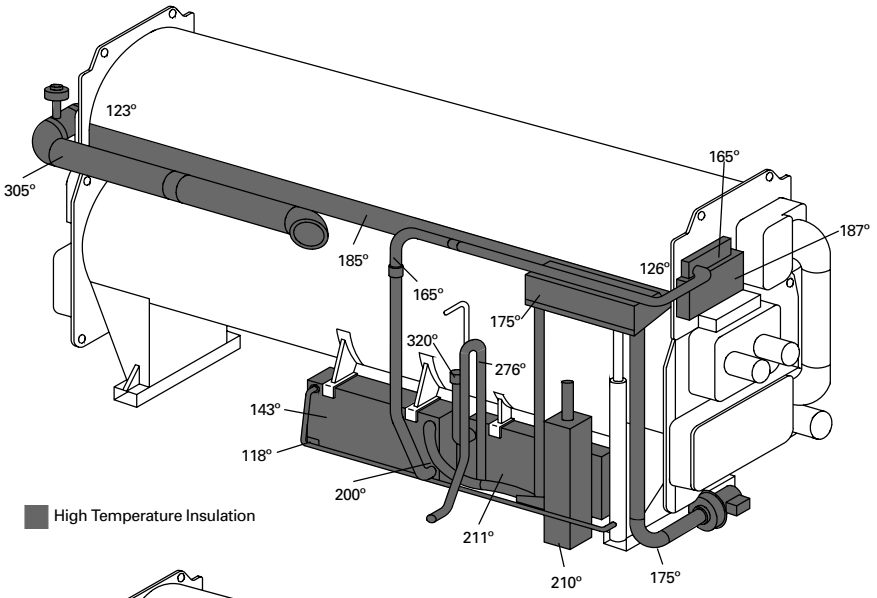
Table DW-10 – Weights

	Weights		Unit Brine Charge		System Water Capacity	
Model	Shipping (Kg)	Operating (Kg)	Solution (Kg)	Refrigerant (l)	Evaporator (l)	Cond/Abs. (l)
ABDA-380	14923	20775	4116	397	492	946
ABDA-440	15649	21909	4375	435	549	1060
ABDA-500	16330	22907	4600	454	606	1154
ABDA-575	19187	27534	5724	530	946	1419
ABDA-660	20231	29257	6237	587	852	1268
ABDA-750	21228	30987	6781	643	1060	1552

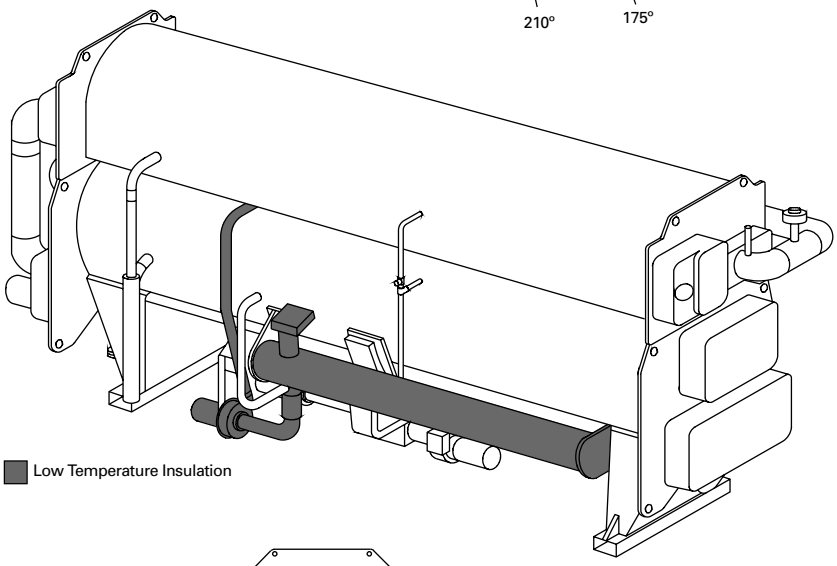
Dimensions and Weights

Cold and Hot Insulation

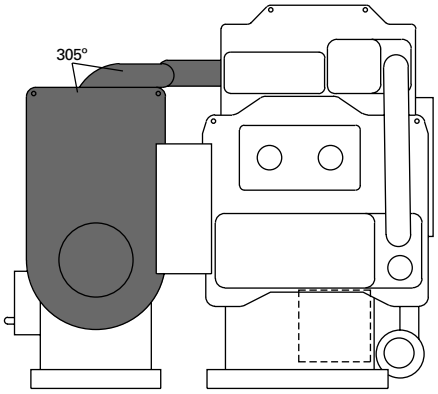
Unit Insulation



High Temperature Insulation



Low Temperature Insulation



High Temperature Insulation (Cover Entire Generators)

Table DW-11 — Low Temperature (Cold) Insulation (English)

Cold Insulation	ABDA-380,440,500	ABDA-575,660, 750
Evaporator Shell (Sq. Ft)	88	100
Evaporator water boxes and Refrigerant Storage Tank (Sq. Ft.)	70	115
4″ Pipe (Ln Ft)	3	3
2″ Pipe (Ln Ft)	6	5

Table DW-12 – High Temperature (Hot) Insulation (English)

Hot Insulation	ABDA-380	ABDA-440	ABDA-500	ABDA-575	ABDA-660	ABDA-750
Direct-Fired Generator (Sq. Ft.)	203	219	235	275	312	349
High Temp Heat Exchanger (Sq. Ft.)	23	23	23	26	26	26
Low Temp Heat Exchanger (Sq. Ft.)	28	28	28	31	31	31
8″ Pipe (Ln Ft)	13.5	12.75	12.0	10.0	8.33	6.58
4″ Pipe (Ln Ft)	7.75	7.75	7.75	7.75	7.75	7.75
3″ Pipe (Ln. Ft)	6	6	6	6	6	6
2 ½″ Pipe (Ln Ft)	3.4	3.4	3.4	3.4	3.4	3.4
2″ Pipe (Ln Ft)	13	13	13	13	13	13

Table DW-13 – Low Temperature (Cold) Insulation (SI)

Cold Insulation	ABDA-380,440,500	ABDA-575,660, 750
Evaporator Shell (Sq. M)	8.18	10.68
Evaporator water boxes and Refrigerant Storage Tank (Sq. Ft.)	6.5	10.68
4″ Pipe (Ln M)	1.07	1.07
2″ Pipe (Ln M)	2.15	2.15

Table DW-14 – High Temperature (Hot) Insulation (SI)

Hot Insulation	ABDA-380	ABDA-440	ABDA-500	ABDA-575	ABDA-660	ABDA-750
Direct-Fired Generator (Sq. M)	18.86	20.34	21.82	25.55	29.98	32.42
High Temp Heat Exchanger (Sq. M)	2.14	2.14	2.14	2.42	2.42	2.42
Low Temp Heat Exchanger (Sq. M)	2.6	2.6	2.6	2.88	2.88	2.88
8″ Pipe (Ln M)	4.8	4.6	4.3	3.6	3.0	2.4
4″ Pipe (Ln M)	2.77	2.77	2.77	2.77	2.77	2.77
3″ Pipe (Ln. M)	2.15	2.15	2.15	2.15	2.15	2.15
2 ½″ Pipe (Ln M)	1.22	1.22	1.22	1.22	1.22	1.22
2″ Pipe (Ln M)	4.65	4.65	4.65	4.65	4.65	4.65

Dimensions and Weights

Weights and Component Sizes

Table DW-15 – Component Dimensions - English

	Length Dimension					
	Machine Sizes					
Major Component	ABDA-380	ABDA-440	ABDA-500	ABDA-575	ABDA-660	ABDA-750
Gen/Cond		21′-2 1/4″			30′-7 7/8″	
Evap/Abs		21′-2 1/4″			30′-2 3/4″	
High Temp Generator	14′-6 1/8″	15′-3 1/8″	17′-4″	18′-6 7/8″	20′-4 5/8″	22′-1 5/8″
Gen/Cond-Evap/Abs		21′-2 1/4″			30′-11 1/4″	

Table DW-16 – Weights - English

Machine Size	High Temperature Direct-Fired Generator (Lbs)	Generator/Condenser (Lbs)	Evaporator/Absorber (Lbs)	Generator/Condenser Evaporator/Absorber (Lbs)	Total (Lbs)
ABDA-380	6200	7200	19600	26800	33000
ABDA-440	6700	7500	20400	27900	34600
ABDA-500	7200	7700	21200	28900	36100
ABDA-575	7300	10200	24900	35100	42400
ABDA-660	8400	10500	25700	36200	44600
ABDA-750	9500	10800	26500	37300	46800

Table DW-17 – Component Dimensions (SI) mm

	Length Dimension					
	Machine Sizes					
Major Component	ABDA-380	ABDA-440	ABDA-500	ABDA-575	ABDA-660	ABDA-750
Gen/Cond		6508.8			9344.0	
Evap/Abs		6508.8			9213.9	
High Temp Generator	4422.8	4651.4	5283.2	5664.0	6213.5	6746.9
Gen/Cond-Evap/Abs		6508.8			9429.8	

Table DW-18 – Weights (SI) Kg

Machine Size	High Temperature Direct-Fired Generator (Kg)	Generator/Condenser (Kg)	Evaporator/Absorber (Kg)	Generator/Condenser Evaporator/Absorber (Kg)	Total (Kg)
ABDA-380	2812	3266	8890	12156	14968
ABDA-440	3039	3402	9253	12655	15694
ABDA-500	3266	3493	9616	13109	16375
ABDA-575	3293	4627	11294	15921	19214
ABDA-660	3810	4763	11658	16420	20230
ABDA-750	4309	4899	12020	16919	21228

Mechanical Specifications

General
Unit shall be a complete double-effect direct-fired absorption chiller package built in an ISO 9001 environment. The chiller shall consist of a direct-fired generator, low temperature generator/ condenser section, evaporator/absorber section, controls, pumps, heat exchangers, burner assembly and fuel supply system. All units shall be of hermetic design, factory assembled and leak tested prior to shipment. The control panel, sensors, burner, burner controls and gas control system shall be factory installed. The unit shall be painted prior to shipping with two coats of water base air dry primer. The standard method of shipment shall be by truck from the USA.

Low Temperature Generator/ Condenser-Evaporator/Absorber
The shell material shall be carbon steel. The low temperature generator, evaporator and absorber tube material shall be 95/5 CuNi. Condenser tubes shall be copper. Tubes shall be mechanically rolled into the tubesheets and shall be replaceable from either end. Condenser, evaporator and absorber tube supports shall be fixed. The low temperature generator shall consist of fixed and floating tube supports to allow for even tube expansion. Spray systems shall be replaceable from end of unit without sacrificing the hermetic integrity of the unit.

The standard design working pressure for the waterboxes shall be 150 psig. All tube bundles shall be tested at 150 percent of design working pressure. All waterboxes except low temperature generator shall have gasketed removable covers for access. Marine-type waterboxes shall be provided with either Victaulic™ or raised face flanged connections.

Heat Exchangers
Two welded plate solution heat exchangers shall be provided to improve unit performance. Heat exchanger surfaces shall be 300 series stainless steel.

Pumps
Solution and refrigerant shall be circulated by means of four hermetic, single stage centrifugal pumps. The pump impeller shall be cast iron with a steel shaft. The motor bearings shall be lubricated and the motor shall be cooled by the fluid that is pumped. Adjustable frequency drives shall be provided on the low temperature generator pump and the absorber spray pump to provide solution flow control.

Purge
The purge system shall include a collection chamber in the absorber section, an eductor for moving non-condensables to the condenser, Purifier™ purge shall be supplied to collect the non-condensables in an external storage tank, and a vacuum pump provided for removal of the non-condensables. The purge shall operate automatically to remove non-condensables from the unit during periods of chiller operation and shutdown. Logging of the purge information shall be provided via the unit control panel.

Direct-Fired Generator
An ob-round shell shall be fabricated of carbon steel containing a horizontal fire/ flue tube generator. Fire tube, gas turn box, tube sheets and all generator tubes shall be constructed of stainless steel. Generator tubes shall be 1-⅛ inches .055" wall, 409 stainless steel and shall be individually rolled and welded into tubesheets. Unit direct-fired generator shall include rupture disk, located on the low temperature generator outlet box and shall be sized to meet ANSI/ASHRAE B-15. Other items which shall be included are: refractory lined burner mounting plate, flue gas access door, integral exhaust gas recirculation system when required for emissions control, condensate collection system for flue gas and sight glass for observation of the flame.

Burner
The burner shall be completely assembled, installed and wired prior to shipment. The burner shall meet maximum NOx requirements of 30 ppm when firing on natural gas. The burner shall support 8 to 1 turndown with natural gas. The flue gas recirculation parts, when needed, shall be shipped lose and provided for field installation.

Exhaust Gas Duct and Flue Stack
The exhaust gas duct and flue stack shall be provided and installed by others. The flue exhaust duct and flue stack must be designed of material in compliance with municipal, state and federal regulations. The duct and stack must be heat-resistant to accept temperatures up to 675 degrees F. Flue stack should be sized to provide and exhaust gas pressure at the unit of 0 to ± 0.2" water.

Unit Options
Simultaneous hot water heat exchanger shall provide simultaneous heating and cooling or heating and cooling . A three-way valve assembly shall be provided for hot water flow control. Dual fuel using gas/propane or gas/oil combinations shall be available. Industrial package shall include special tubing and an option for a factory mounted lithium bromide filter. The disassembled unit shall provide for easy disassembly and reassembly of major components at the jobsite.

Power Panel
A factory wired and mounted power panel shall include: main power connection, control transformer and 115 volt single phase control circuit. Unit shall be available for operation on 200, 230, 460 or 575 volts, 3-phase, 60 hertz power or 190, 220, 380 or 415 volts, 3-phase, 50 hertz power.

Mechanical Specifications

Control Panel
The factory mounted unit control panel (UCP2) is a microprocessor-based chiller control system that provides complete stand alone operation. The UCP2 shall provide the following items:

Control Function
- Chilled water temperature control
- Concentration control
- Simultaneous heating and cooling (optional)

System Functions
- User interface with a 40 character, 2 line display and a 16 key keypad, capable of displaying 7 languages in SI or English units.
- Passwords for protection of unit setup and configuration
- Chilled water pump control
- Absorber/condenser pump control
- Automatic and manual purge system
- Chilled water reset
- Simultaneous heating: cooling only, heating only, cooling priority and heating priority (optional)
- Simultaneous heating water pump control (optional)
- Minimum turndown of 8 to 1 with natural gas
- Minimum turn-down of 3 to 1 with oil (optional)
- Start/stop and reset of flame safeguard at UCP2
- Combustion confirmation and alarm status at UCP2
- Fuel selection and automatic fuel changeover (optional)
- Remote clear language display panel - capable of monitoring 1-4 chillers per panel (optional)

Adaptive Limits
- Evaporator water temperature limit
- High interstage pressure limit
- High exhaust gas temperature limit
- High interstage temperature limit
- Low absorber/condenser limit
- Soft-loading control

System Protection
- Evaporator freeze protection
- Chilled water flow confirmation
- Cooling water flow confirmation
- Simultaneous hot water flow confirmation (optional)
- High interstage pressure cutout to prevent excessive pressure
- Phase loss, phase reversal and under/over voltage detection
- Emergency stop/shutdown of burner

Monitor and Displays
- Chilled water temperature entering and leaving
- Absorber/condenser water temperature entering and leaving
- Evaporator water flow (optional)
- Cooling water flow (optional)
- Solution concentrations
- Solution temperatures
- Interstage pressure
- Total motor current
- Unit voltage
- Chiller run time and starts
- Purge operation and run time

Interfaces to UCP2™
- Interface to Tracer 100 or Tracer Summit®
- External machine manual reset alarm indication output
- External machine auto reset warning indication output
- External limit warning indication output
- External burner fire rate output
- External combustion indication output
- Interstage pressure relief request output
- Maximum capacity indication output
- External auto-stop/emergency shutdown of unit
- External selection of heating/cooling priority (opt)
- External fuel type selection (opt)
- External chilled water setpoint (opt)
- External heated water setpoint (opt)
- Tracer temperature sensor (opt)
- Tracer controlled relay (opt)
- Printer interface (opt)
- Remote Clear Language Interface

Standard Conversion Table

To Convert From:	To:	Multiply By:
Length		
Feet (ft)	meters (m)	.30481
Inches (In)	millimeters (mm)	25.4
Area		
Square Feet (ft^2)	square meters (m^2)	.093
Square Inches (In^2)	square millimeters (mm^2)	645.2
Volume		
Cubic Feet (ft^3)	Cubic meters (m^3)	.0283
Cubic Inches (In^3)	Cubic mm (mm^3)	16387
Gallons (gal)	litres (l)	3.785
Gallons (gal)	cubic meters (m^3)	.003785
Flow		
Cubic feet/min (cfm)	cubic meters/second (m^3/s)	.000472
Cubic feet/min (cfm)	cubic meters/hr (m^3/hr)	1.69884
Gallons/minute (GPM)	cubic meters/hr (m^3/hr)	.2271
Gallons/minute (GPM)	litres/second (l/s)	.06308
Velocity		
Feet per minute (ft/m)	meters per second (m/s)	.00508
Feet per second (ft/s)	meters per second (m/s)	.3048

To Convert From:	To:	Multiply By:
Energy and Power and Capacity		
British Thermal Units (BTUH)	Kilowatt (kW)	.000293
British Thermal Units (BTU)	KCalorie (Kcal)	.252
Tons (refrig. effect)	Kilowatt (refrig. effect)	3.516
Tons (refrig. effect)	Kilocalories per hour (Kcal/hr)	3024
Horsepower	Kilowatt (kW)	.7457
Pressure		
Feet of water (ftH_2O)	Pascals (PA)	2990
Inches of water (inH_2O)	Pascals (PA)	249
Pounds per square inch (PSI)	Pascals (PA)	6895
PSI	Bar or KG/CM^2	6.895×10^{-2}
Weight		
Ounces (oz)	Kilograms (kg)	.02835
Pounds (lbs)	Kilograms (Kg)	.4536
Fouling factors for heat exchangers		
.00075 ft^2 °F hr/BTU	= .132 m^2° K/kW	
.00025 ft^2 °F hr/BTU	= .044 m^2° K/kW	

Temperature — Centrigrade (°C) Versus Fahrenheit (°F)

Note: The center columns of numbers, referred to as BASE TEMP., is the temperature in either degrees Fahrenheit (°F) or Centigrade (°C), whichever is desired to convert into the other. If degrees Centigrade is given, read degrees Fahrenheit to the right. If degrees Fahrenheit is given, read degrees Centigrade to the left.

Temperature		
°C	C or F	°F
−40.0	**−40**	−40.0
−39.4	**−39**	−38.2
−38.9	**−38**	−36.4
−38.3	**−37**	−34.6
−37.8	**−36**	−32.8
−37.2	**−35**	−31.0
−36.7	**−34**	−29.2
−36.1	**−33**	−27.4
−35.6	**−32**	−25.6
−35.0	**−31**	−23.8
−34.4	**−30**	−22.0
−33.9	**−29**	−20.2
−33.3	**−28**	−18.4
−32.8	**−27**	−16.6
−32.2	**−26**	−14.8
−31.7	**−25**	−13.0
−31.1	**−24**	−11.2
−30.6	**−23**	−9.4
−30.0	**−22**	−7.6
−29.4	**−21**	−5.8
−28.9	**−20**	−4.0
−28.3	**−19**	−2.2
−27.8	**−18**	−0.4
−27.2	**−17**	+1.4
−26.7	**−16**	+3.2
−26.1	**−15**	+5.0
−25.6	**−14**	+6.8
−25.0	**−13**	+8.6
−24.4	**−12**	+10.4
−23.9	**−11**	+12.2
−23.3	**−10**	+14.0
−22.8	**−9**	+15.8
−22.2	**−8**	+17.6
−21.7	**−7**	+19.4
−21.1	**−6**	+21.2
−20.6	**−5**	+23.0
−20.0	**−4**	+24.8
−19.4	**−3**	+26.6
−18.9	**−2**	+28.4
−18.3	**−1**	+30.2
−17.8	**0**	+32.0
−17.2	**+1**	+33.8
−16.7	**+2**	+35.6
−16.1	**+3**	+37.4
−15.6	**+4**	+39.2

Temperature		
°C	C or F	°F
−15.0	**+5**	+41.0
−14.4	**+6**	+42.8
−13.9	**+7**	+44.6
−13.3	**+8**	+46.4
−12.8	**+9**	+48.2
−12.2	**+10**	+50.0
−11.7	**+11**	+51.8
−11.1	**+12**	+53.6
−10.6	**+13**	+55.4
−10.0	**+14**	+57.2
−9.4	**+15**	+59.0
−8.9	**+16**	+60.8
−8.3	**+17**	+62.6
−7.8	**+18**	+64.4
−7.2	**+19**	+66.2
−6.7	**+20**	+68.0
−6.1	**+21**	+69.8
−5.5	**+22**	+71.6
−5.0	**+23**	+73.4
−4.4	**+24**	+75.2
−3.9	**+25**	+77.0
−3.3	**+26**	+78.8
−2.8	**+27**	+80.6
−2.2	**+28**	+82.4
−1.7	**+29**	+84.2
−1.1	**+30**	+86.0
−0.6	**+31**	+87.8
.0	**+32**	+89.6
+0.6	**+33**	+91.4
+1.1	**+34**	+93.2
+1.7	**+35**	+95.0
+2.2	**+36**	+96.8
+2.8	**+37**	+98.6
+3.3	**+38**	+100.4
+3.9	**+39**	+102.2
+4.4	**+40**	+104.0
+5.0	**+41**	+105.8
+5.5	**+42**	+107.6
+6.1	**+43**	+109.4
+6.7	**+44**	+111.2
+7.2	**+45**	+113.0
+7.8	**+46**	+114.8
+8.3	**+47**	+116.6
+8.9	**+48**	+118.4
+9.4	**+49**	+120.2

Temperature		
°C	C or F	°F
+10.0	**+50**	+122.0
+10.6	**+51**	+123.8
+11.1	**+52**	+125.6
+11.7	**+53**	+127.4
+12.2	**+54**	+129.2
+12.8	**+55**	+131.0
+13.3	**+56**	+132.8
+13.9	**+57**	+134.6
+14.4	**+58**	+136.4
+15.0	**+59**	+138.2
+15.6	**+60**	+140.0
+16.1	**+61**	+141.8
+16.7	**+62**	+143.6
+17.2	**+63**	+145.4
+17.8	**+64**	+147.2
+18.3	**+65**	+149.0
+18.9	**+66**	+150.8
+19.4	**+67**	+152.6
+20.0	**+68**	+154.4
+20.6	**+69**	+156.2
+21.1	**+70**	+158.0
+21.7	**+71**	+159.8
+22.2	**+72**	+161.6
+22.8	**+73**	+163.4
+23.3	**+74**	+165.2
+23.9	**+75**	+167.0
+24.4	**+76**	+168.8
+25.0	**+77**	+170.6
+25.6	**+78**	+172.4
+26.1	**+79**	+174.2
+26.7	**+80**	+176.0
+27.2	**+81**	+177.8
+27.8	**+82**	+179.6
+28.3	**+83**	+181.4
+28.9	**+84**	+183.2
+29.4	**+85**	+185.0
+30.0	**+86**	+186.8
+30.6	**+87**	+188.6
+31.1	**+88**	+199.4
+31.7	**+89**	+192.2
+32.2	**+90**	+194.0
+32.8	**+91**	+195.8
+33.3	**+92**	+197.6
+33.9	**+93**	+199.4
+34.4	**+94**	+201.2

Temperature		
°C	C or F	°F
+35.0	**+95**	+203.0
+35.6	**+96**	+204.8
+36.1	**+97**	+206.6
+36.7	**+98**	+208.4
+37.2	**+99**	+210.2
+37.8	**+100**	+212.0
+38.3	**+101**	+213.8
+38.9	**+102**	+215.6
+39.4	**+103**	+217.4
+40.0	**+104**	+219.2
+40.6	**+105**	+221.0
+41.1	**+106**	+222.8
+41.7	**+107**	+224.6
+42.2	**+108**	+226.4
+42.8	**+109**	+228.2
+43.3	**+110**	+230.0
+43.9	**+111**	+231.8
+44.4	**+112**	+233.6
+45.0	**+113**	+235.4
+45.6	**+114**	+237.2
+46.1	**+115**	+239.0
+46.7	**+116**	+240.8
+47.2	**+117**	+242.6
+47.8	**+118**	+244.4
+48.3	**+119**	+246.2
+48.9	**+120**	+248.0
+49.4	**+121**	+249.8
+50.0	**+122**	+251.6
+50.6	**+123**	+253.4
+51.1	**+124**	+255.2
+51.7	**+125**	+257.0
+52.2	**+126**	+258.8
+52.8	**+127**	+260.6
+53.3	**+128**	+262.4
+53.9	**+129**	+264.2
+54.4	**+130**	+266.0
+55.0	**+131**	+267.8
+55.6	**+132**	+269.6
+56.1	**+133**	+271.4
+56.7	**+134**	+273.2
+57.2	**+135**	+275.0
+57.8	**+136**	+276.8
+58.3	**+137**	+278.6
+58.9	**+138**	+280.4
+59.4	**+139**	+282.2

Temperature		
°C	C or F	°F
+60.0	**+140**	+284.0
+60.6	**+141**	+285.8
+61.1	**+142**	+287.6
+61.7	**+143**	+289.4
+62.2	**+144**	+291.2
+62.8	**+145**	+293.0
+63.3	**+146**	+294.8
+63.9	**+147**	+296.6
+64.4	**+148**	+298.4
+65.0	**+149**	+300.2
+65.6	**+150**	+302.0
+66.1	**+151**	+303.8
+66.7	**+152**	+305.6
+67.2	**+153**	+307.4
+67.8	**+154**	+309.2
+68.3	**+155**	+311.0
+68.9	**+156**	+312.8
+69.4	**+157**	+314.6
+70.0	**+158**	+316.4
+70.6	**+159**	+318.2
+71.1	**+160**	+320.0
+71.7	**+161**	+321.8
+72.2	**+162**	+323.6
+72.8	**+163**	+325.4
+73.3	**+164**	+327.2
+73.9	**+165**	+329.0
+74.4	**+166**	+330.8
+75.0	**+167**	+332.6
+75.6	**+168**	+334.4
+76.1	**+169**	+336.2
+76.7	**+170**	+338.0
+77.2	**+171**	+339.8
+77.8	**+172**	+341.6
+78.3	**+173**	+343.4
+78.9	**+174**	+345.2
+79.4	**+175**	+347.0
+80.0	**+176**	+348.8
+80.6	**+177**	+350.6
+81.1	**+178**	+352.4
+81.7	**+179**	+354.2
+82.2	**+180**	+356.0
+82.8	**+181**	+357.8
+83.3	**+182**	+359.6
+83.9	**+183**	+361.4
+84.4	**+184**	+363.2

FOR INTERPOLATION IN THE ABOVE TABLE USE:

BASE TEMPERATURE (°F or °C):	1	2	3	4	5	6	7	8	9	10
DEGREES CENTIGRADE:	0.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.56
DEGREES FAHRENHEIT:	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4	16.2	18.0

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Literature Order Number	ABS-PRC002-EN
File Number	PL-RF-ABS-PRC002-EN-1100
Supersedes	New
Stocking Location	La Crosse