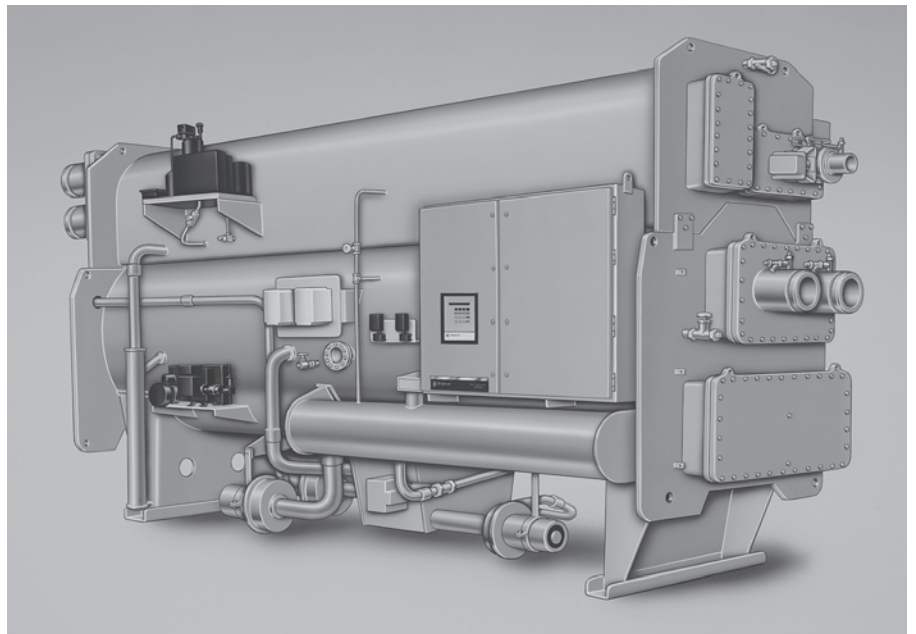




Trane Horizon™ Absorption Series

**Two-Stage Steam-Fired or Hot Water
Absorption Water Chillers
380-1650 Tons – 50-60 Hz**

Built for Industrial and Commercial Applications



Introduction



History of Trane Absorption Chillers

Trane has been the leader 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.

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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 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.
- Can operate with tower water temperatures as low as 55 F.
- **Includes** factory installed **crossover pipe, lithium bromide filter, 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.

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Features and Benefits

General

Better By Design

From the outside most chilled water systems may look comparable, yet if one understands the differences, the benefit of the Horizon™ chiller becomes apparent. The Trane Horizon design set a new performance standard for today's absorption chillers, earning a reputation as a viable alternative to today's electric powered chiller.

UCP2™ Intelligent Controls

Chiller controls are key to optimal chiller performance. Like the Trane CenTraVac™ centrifugal water chiller, the Horizon absorption chiller line uses UCP2 control panel intelligence for the highest performance possible

Energy Efficient For Life Cycle Cost Savings

The UCP2 “reverse series cycle” can be as much as 5-15 percent more efficient at full load than other cycles.

Chilled water temperatures as low as 40 F allows for lower system component costs and reduced operating costs.

Fully Automatic Purge System

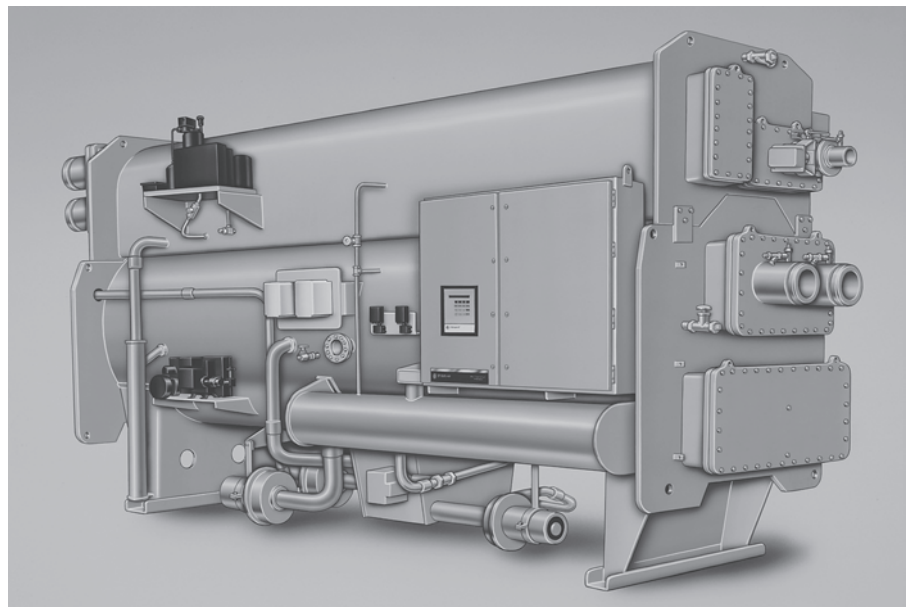
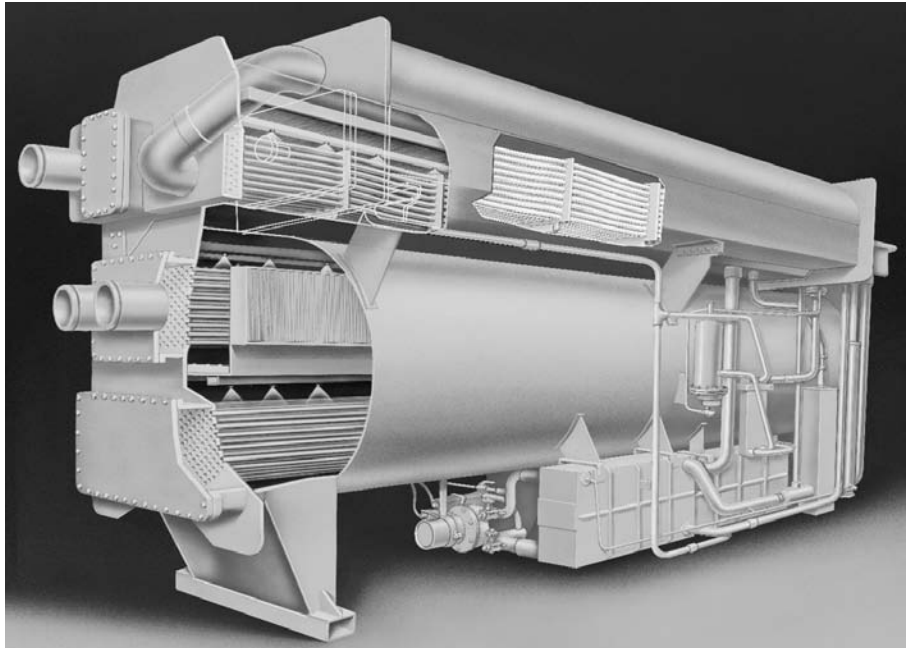
Trane's new purge system removes non-condensables from the machine continuously and automatically while logging purge information through the UCP2. This helps prevent damage to the chiller while maintaining the peak performance.

Automatic, Energy Efficient Crystallization Protection

Crystallization – the solidifying of the refrigerant/ lithium bromide solution into salt crystals – occurs when temperature margins are not maintained during chiller operation. The Horizon chiller accurately controls the solution during chiller operation, while at the same time adjusting the energy input for optimum energy efficiency.

UCP2 Sensing, Detecting, and Recovery (SDR) Safety

The SDR safety is an automatic corrective action process that provides a secondary line of defense against crystallization. If cycle temperature points become close to the point of crystallization, SDR executes a recovery cycle that in worst cases, will shut down the machine safely.



Industrial-Grade Construction

Trane performed extensive laboratory testing to ensure the major components used in the Horizon (tubes, shells, water boxes, heat exchangers and pumps) are based upon a 20 year minimum design life.

Features and Benefits

General

Factory Installed Crossover Pipe Included As Standard

The Horizon chiller has a number of available features that can save chiller owners thousands of dollars in installed costs. For example, unlike other absorption chiller manufacturers, Trane includes as standard on the Horizon, the cooling water cross over pipe between the absorber and condenser. This saves customers the additional cost of a crossover pipe and the added cost for installing it at the job site.

Modular, Break Apart Option For Easier Installation

For easy access into buildings with limited space, the Horizon can be ordered in a two or three-piece modular design for easy disassembly and reassembly of the modules at the job site.

Dedicated Support

Professional engineering expertise is available from Trane at local sales offices worldwide. Trane headquarters applications and engineering field office support gives you access to refrigeration, air conditioning and facility control system applications.

Designed With Easy Servicing in Mind

Removable spray trees, individually replaceable tubes, marine style waterboxes are a few of the Horizon chiller features that can be appreciated when chiller maintenance is performed. To further assist in this area, Trane also offers service training for the chiller maintenance staff and/or local post warranty service from trained technicians and extended warranty plans that can be customized for specific warranty related needs.

Environmentally Friendly

The Trane Horizon™ two-stage steam absorption chillers contain no CFC's making them completely ozone friendly. Nonhazardous lithium molybdate is used as the corrosion inhibitor for Horizon chillers, further enhancing its positive influence for the preservation of the environment.

Controls Data

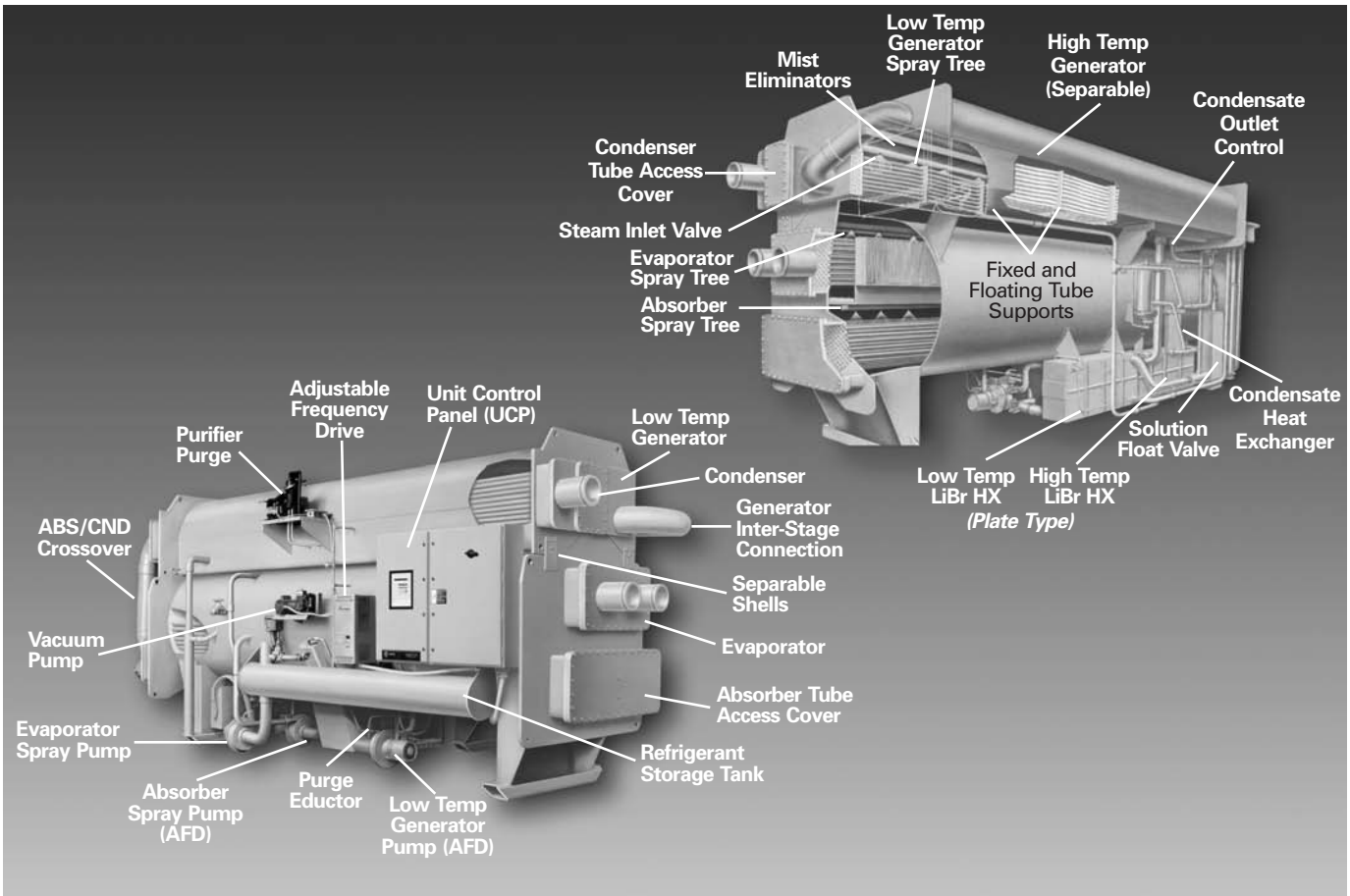
Control integration with Tracer™ chiller plant system controllers with a single twisted-wire pair cable. UCP2 control includes these features/benefits:

- Proportional Integral Derivative (PID) control strategies for increased operating stability and optimal chilled water temperature accuracy.
- Adaptive Control™ for keeping the chiller "on line" and safe.
- Microprocessor based safeties for pump motor protection, low refrigerant water temperature cutout, low leaving water temperature cutout and high interstage pressure cutout.
- Clear language interface in multiple different languages
- Standard and custom reports
- Over 200 diagnostics
- Cost-effective adaptation to system upgrades
- Compatible with Trane Integrated Comfort™ systems (ICS)

Features and Benefits

Component Identification

Horizon™ Two-Stage Fired or Hot Water Absorption Water Chiller Component Identification



Features and Benefits

Refrigeration Cycle

Absorption Refrigeration Cycle

Figure FB-1 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 is 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 high temperature generator where the refrigerant water vapor is separated from the solution via the energy source inside the tube bundle (steam or hot water). The refrigerant vapor travels to the low temperature generator. The now concentrated solution returns to the absorber through the high and low temperature heat exchangers.

Solution 300 F (149 C), Refrigerant Vapor 300 F (149 C), Tube Bundle 115 PSIG steam or 346 F (174 C)

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.

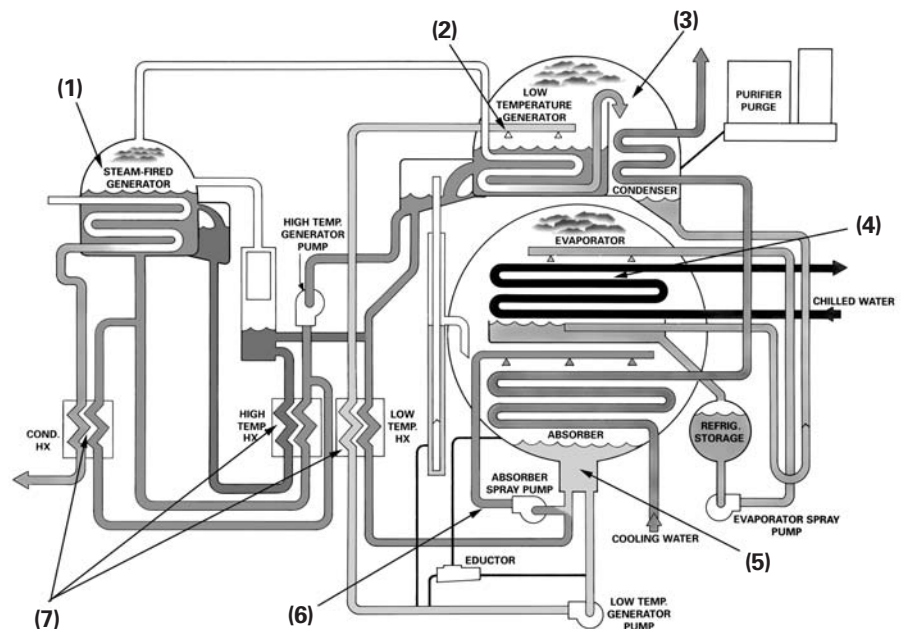
Solution 180 F (82 C), Vapor 190 F (88 C)

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.

Refrigerant 100 F (38 C), Entering/Leaving Cooling Water 93 F/97 F (34 C/36 C)

Figure FB-1 – Absorption Refrigeration Cycle



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.

Entering/Leaving System Water 54 F/44 F (12 C/7 C), Evaporator Pump Refrigerant 42 F (6 C)

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. Heat (acquired in the evaporator) is rejected via the cooling water inside the tube bundle.

Leaving Solution 95 F (35 C), Entering / Leaving Cooling Water 85 F/93 F (29 C/34 C)

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.

Entering Solution 112 F (44 C)

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.



Application Considerations

General

General

The Horizon two-stage steam-fired or hot water absorption chiller is designed to provide 40 F to 60 F (+4.4 C - +15.6 C) chilled water for comfort or process cooling applications within all three market segments – commercial, industrial and institutional. The primary advantage of the absorption chiller over other chiller options, is its ability to use steam or hot water to provide energy-saving cooling.

Operating Limits

Trane two-stage absorption chillers operate with nominal 120 PSIG steam or nominal 370 F hot water. In all applications, superheat should be limited so steam temperature does not exceed 400 F. Hot water machines can use up to 370 F hot water.

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 two-stage steam 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 taken into consideration 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
- Generator hot water application

Cooling Tower Water Flow

The ARI standard gpm/ton for absorption chillers is 4.0 but lower flow through the condenser and absorber section will present an opportunity for a smaller tower and smaller condenser pump. 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.

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 revision, 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 two-stage 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 – 0.1320

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™ Absorption Selection Program. For applications higher 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 provided¹:
 - 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 loop².

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.



Selection Procedure

Model Number Description

Selection

Product Coding Description

The coding block precisely identifies all characteristics of a any Horizon™ Two-Stage Steam-Fired or Hot Water Absorption Chiller.

Table S-1 — Product Coding Description

MODL - Absorption Unit Model

ABTF Horizon Two-Stage

DSEQ - Unit Design Sequence

E0 Design Sequence

NTON - Unit Nominal Tonnage

380	380 Tons
440	440 Tons
500	500 Tons
575	575 Tons
660	660 Tons
750	750 Tons
850	850 Tons
950	950 Tons
1050	1050 Tons
1150	1150 Tons
1200	1200 Tons
1350	1350 Tons
1500	1500 Tons
1650	1650 Tons

VOLT - Unit Voltage

190	190/50/3
200	200/60/3
220	220/50/3
230	230/60/3
380	380/50/3
415	415/50/3
460	460/60/3
575	575/60/3

ENSR - Unit Energy Source

HOTW Hot Water
STM Steam

ENPR - Unit Energy Pressure

115 115 Psig Steam
400 400 Psig Hot Water

PVCN - Pressure Vessel Construction

ASME ASME Evp-Abs-Cds
ISPL Ispepl Evp-Abs-Cds
LMIN Les-Mines Evp-Abs-Cds
TUV Tuv Evp-Abs-Cds
STD Standard

LGTM - Low-Temp Generator Tube Material/Surface

SB01 .028 Wall 95-5 CuNi Smooth
SB04 .028 Wall 90-10 CuNi Smooth
SB05 .035 Wall 90-10 CuNi Smooth
SB06 .049 Wall 90-10 CuNi Smooth

HGTM - High-Temp Generator Tube Material/Surface

SB16 .028 Wall 409 Sstl Smooth

EVTM - Evaporator Tube Material/Surface

ES01 .028 Wall 95-5 CuNi Enhanced
ES11 .025 Wall 90-10 CuNi Enhanced
ES05 .035 Wall 90-10 CuNi Enhanced
ES09 .028 Wall Copper Enhanced
ES12 .025 Wall Copper Enhanced

CDTM - Condenser Tube Material

SB04 .028 Wall 90-10 CuNi Smooth
SB05 .035 Wall 90-10 CuNi Smooth
SB06 .049 Wall 90-10 CuNi Smooth
SB09 .028 Wall Copper Smooth
SB10 .035 Wall Copper Smooth

ABTM - Absorber Tube Material/Surface

SB00 .022 Wall 95-5 CuNi Smooth
SB01 .028 Wall 95-5 CuNi Smooth
SB02 .035 Wall 95-5 CuNi Smooth
SB03 .049 Wall 95-5 CuNi Smooth
SB04 .028 Wall 90-10 CuNi Smooth
SB05 .035 Wall 90-10 CuNi Smooth
SB06 .049 Wall 90-10 CuNi Smooth

GNWA - Generator Water Box Arrangement

GN02 1-Pass 150 PSI Non-Marine RF Flange
GN04 2-Pass 150 PSI Non-Marine RF Flange

CAWA - Condenser and Absorber Water Box Arrangement

CA01 1-Pass Cond, 2-Pass Abs 150 PSI Marine Victaulic
CA02 1-Pass Cond, 2-Pass Abs 150 PSI Marine RF Flange
CA05 2-Pass Cond, 2-Pass Abs 150 PSI Marine Victaulic
CA06 2-Pass Cond, 2-Pass Abs 150 PSI Marine RF Flange

EVWA - Evaporator Water Box Arrangement

EV01 2-Pass 150 Psi Non-Marine Victaulic
EV02 2-Pass 150 Psi Non-Marine RF Flange

CAWC - Condenser and Absorber Water Connections

LELE In LH End - Out LH End
LERE In LH End - Out RH End
RERE In RH End - Out RH End

EVWC - Evaporator Water Connections

LEBK Inlet Connection Left Back
LEFR Inlet Connection Left Front
REBK Inlet Connection Right Back
REFR Inlet Connection Right Front
LEND Inlet LH End
REND Inlet RH End

CAFT - Condenser and Absorber Water Box Fluid Type

WTR Water
EGLY Ethylene Glycol Solution
PGLY Propylene Glycol Solution

EVFT - Evaporator Water Box Fluid Type

WTR Water
EGLY Ethylene Glycol Solution
PGLY Propylene Glycol Solution

Selection Procedure

Model Number Description

EVLV - Unit Energy Valve

VB01 2-Way 2.00" 150# Wafer V-Ball
 VB02 2-Way 3.00" 150# Wafer V-Ball
 VB03 2-Way 4.00" 150# Wafer V-Ball
 VB11 2-Way 2.00" 300# Wafer V-Ball
 VB12 2-Way 3.00" 300# Wafer V-Ball
 VB13 2-Way 4.00" 300# Wafer V-Ball
 VB14 2-Way 6.00" 300# Wafer V-Ball
 VB41 2-Way 2.00" 150# Flanged V-Ball
 VB42 2-Way 3.00" 150# Flanged V-Ball
 VB43 2-Way 4.00" 150# Flanged V-Ball
 VB44 2-Way 6.00" 150# Flanged V-Ball

EVIN - Unit Energy Valve Installation

FLD Field Installed
 FACT Factory Installed

UPNT - Unit Paint

SFPT Standard Factory Paint

EVPN - Evaporator Pan Construction

STD Steel evaporator pan
 SSTL Stainless steel evap pan

WCNM - Water Chiller Nameplate

SNMP Standard Plastic Nameplate
 BNMP Decorative Brass Nameplate

SPKG - Unit Shipping Package

DAU Domestic - Assembled Unit
 DDU Domestic - 3 Pc Disassembled Unit
 DDG Domestic - 2 Pc Disassembled Unit
 DAUF Domestic - Assembled - 3 Pc Field Disassembly
 DAGF Domestic - Assembled - 2 Pc Field Disassembly

EAU Export - Assembled Unit
 EDU Export - 3 Pc Disassembled Unit
 EDG Export - 2 Pc Disassembled Unit
 EAUF Export - Assembled - 3 Pc Field Disassembly
 EAGF Export - Assembled - 2 Pc Field Disassembly

ELPP - Electrical Protection Package

SELP Standard

PPCO - Control Panel Power Connection

CB Circuit Breaker
 FDS Fused Disconnect Switch
 NFDS Non-Fused Disconnect Switch
 TB Terminal Block

LCLD - Local Clear Language Display

CLDC Complex Character
 CLDO Standard

TRIM - Tracer Interface Control Module

TRMI Tracer 100 (COM3)
 TRMS Tracer Summit™ (COM4)

PRIM - Printer Interface Control Module

YES Printer Interface Module

ACWR - Ambient Chilled Water Reset

YES Ambient Chilled Water Reset

WVUO - Under/Over Phase Voltage Protection

YES Under-Over Voltage Protection

CTWF - Chilled/Tower Water Flow Display

YES Differential Water Pressure Transducers

OPTM - Options Control Module

YES Options Module

FLSW - Flow Switches

2FS1 150 PSI NEMA 1 Switch Qty 2
 3FS1 150 PSI NEMA 1 Switch Qty 3
 2FS2 300 PSI NEMA 1 Switch Qty 2
 3FS2 300 PSI NEMA 1 Switch Qty 3
 2FS3 150 PSI NEMA 4X Switch Qty 2
 3FS3 150 PSI NEMA 4X Switch Qty 3
 2FS4 300 PSI NEMA 4X Switch Qty 2
 3FS4 300 PSI NEMA 4X Switch Qty 3
 1FS1 150 PSI NEMA 1 Switch Qty 1
 1FS2 300 PSI NEMA 1 Switch Qty 1
 1FS3 150 PSI NEMA 4X Switch Qty 1
 1FS4 300 PSI NEMA 4X Switch Qty 1

LBMF - Lithium Bromide Filter

YES Lithium Bromide Filter

SOPT - Special Unit Options

Special Unit Options As Defined On Sales Order Basis. Contact Sales Order Group For Current Listing

UINS - Unit Insulation

HINS Hot Unit Insulation Only
 CINS Cold Unit Insulation
 HCIN Hot and Cold Unit Insulation

UNIT - Parts Warranty - Whole Unit

M2 Two Months
 M4 Four Months
 M6 Six Months
 M8 Eight Months
 Y2 Second Year
 Y3 Second Thru Third Year
 Y4 Second Thru Fourth Year
 Y5 Second Thru Fifth Year

LB01 - Labor Warranty - First Year

Y1 First Year

LB02 - Labor Warranty - Beyond First Year

Y2 Second Year Only
 Y3 Second Thru Third Year
 Y4 Second Thru Fourth Year
 Y5 Second Thru Fifth Year

BRM1 - Bromide Warranty - First Year

Y1 First Year

BRM2 - Bromide Warranty - Beyond First Year

Y2 Second Year Only
 Y3 Second Thru Third Year
 Y4 Second Thru Fourth Year
 Y5 Second Thru Fifth Year



Performance Data

Table PD-1 — Performance Data at ARI Conditions

English Units*							
Model	Capacity (Tons)	Coefficient of Performance	Steam Rate (lbm/ton/hr)	Chilled Water		Cond/Abs Water	
				Flow Rate (gpm)	Press. Drop (ft Wtr)	Flow Rate (gpm)	Pr. Drop (ft Wtr)
ABTF-380	360	1.21	9.73	861	13.7	1520	26.5
ABTF-440	426	1.21	9.69	1018	14.6	1760	30.5
ABTF-500	493	1.22	9.65	1178	15.6	2000	34.9
ABTF-575	558	1.21	9.65	1333	26.9	2300	19.4
ABTF-660	659	1.22	9.62	1576	29.1	2640	20.9
ABTF-750	765	1.22	9.63	1833	31.6	3000	22.9
ABTF-850	915	1.24	9.51	2187	13.7	3400	13.3
ABTF-950	1030	1.24	9.51	2462	19.1	3800	17.5
ABTF-1050	1145	1.24	9.49	2736	25.8	4200	22.5
ABTF-1150	1259	1.24	9.48	3010	33.9	4600	28.3
ABTF-1200	1264	1.19	9.83	3022	13.2	4800	16.0
ABTF-1350	1419	1.19	9.84	3391	18.2	5400	21.2
ABTF-1500	1573	1.19	9.84	3759	24.4	6000	27.2
ABTF-1650	1721	1.20	9.77	4113	31.7	6600	34.1

SI Units**							
Model	Capacity (kW)	Coefficient of Performance	Steam Rate (kg/kw-hr)	Chilled Water		Cond/Abs Water	
				Flow Rate (m ³ /hr)	Press. Drop (m wg)	Flow Rate (m ³ /hr)	Pr. Drop (m wg)
ABTF-380	1266	1.20	1.25	196	4.5	345	8.7
ABTF-440	1498	1.21	1.25	231	4.8	400	10.0
ABTF-500	1734	1.21	1.24	268	5.1	454	11.5
ABTF-575	1963	1.21	1.24	303	8.8	522	6.4
ABTF-660	2318	1.22	1.24	358	9.5	600	6.9
ABTF-750	2691	1.21	1.24	416	10.4	681	7.5
ABTF-850	3218	1.23	1.23	497	4.5	772	4.4
ABTF-950	3623	1.23	1.23	559	6.3	863	5.7
ABTF-1050	4027	1.24	1.22	621	8.5	954	7.4
ABTF-1150	4428	1.24	1.22	684	11.1	1045	9.3
ABTF-1200	4446	1.19	1.27	686	4.3	1090	5.2
ABTF-1350	4991	1.19	1.27	770	6.0	1226	7.0
ABTF-1500	5533	1.19	1.27	854	8.0	1363	8.9
ABTF-1650	6053	1.20	1.26	934	10.4	1499	11.2

*English:

4.0 gpm/nominal ton, P_{stm} = 120 psig, T_{ctwS} = 85 F, T_{cwS} = 44 F, T_{cwR} = 54 F, 0.0001 Evaporator fouling and 0.00025 Absorber/Condenser fouling.

**Metric:

.26 m³/kWh, P_{stm} = 120 psig, T_{ctwS} = 29.44 C, T_{cwS} = 6.67 C, T_{cwR} = 12.2 C, 0.0001 Evaporator fouling and 0.00025 Absorber/Condenser fouling.

Performance Data

Table PD-2 — Performance Data at Trane Rated Conditions

English Units*							
Model	Capacity (Tons)	Coefficient of Performance	Steam Rate (lbm/ton/hr)	Chilled Water		Cond/Abs Water	
				Flow Rate (gpm)	Press. Drop (ft Wtr)	Flow Rate (gpm)	Pr. Drop (ft Wtr)
ABTF-380	334	1.18	9.98	665	8.2	1368	21.7
ABTF-440	395	1.18	9.93	787	8.7	1584	25.0
ABTF-500	457	1.19	9.9	909	9.3	1800	28.5
ABTF-575	517	1.19	9.9	1029	15.7	2070	16.0
ABTF-660	611	1.19	9.86	1216	16.9	2376	17.2
ABTF-750	710	1.19	9.88	1413	18.3	2700	18.8
ABTF-850	843	1.21	9.76	1679	7.9	3060	11.0
ABTF-950	951	1.21	9.74	1893	11.0	3420	14.5
ABTF-1050	1058	1.21	9.73	2106	14.9	3780	18.6
ABTF-1150	1165	1.21	9.71	2319	19.6	4140	23.4
ABTF-1200	1167	1.16	10.09	2324	7.6	4320	13.2
ABTF-1350	1311	1.16	10.09	2611	10.5	4860	17.4
ABTF-1500	1455	1.16	10.09	2897	14.1	5400	22.4
ABTF-1650	1595	1.17	10.01	3175	18.4	5940	28.1

SI Units**							
Model	Capacity (kW)	Coefficient of Performance	Steam Rate (kg/kw-hr)	Chilled Water		Cond/Abs Water	
				Flow Rate (m ³ /hr)	Press. Drop (m wg)	Flow Rate (m ³ /hr)	Pr. Drop (m wg)
ABTF-380	1175	1.17	1.29	151	2.7	311	7.1
ABTF-440	1389	1.18	1.28	179	2.9	360	8.2
ABTF-500	1607	1.18	1.28	206	3.1	409	9.4
ABTF-575	1819	1.18	1.28	234	5.2	470	5.2
ABTF-660	2149	1.19	1.27	276	5.5	540	5.6
ABTF-750	2497	1.19	1.27	321	6.0	613	6.2
ABTF-850	2965	1.20	1.26	381	2.6	695	3.6
ABTF-950	3345	1.20	1.26	430	3.6	777	4.8
ABTF-1050	3721	1.21	1.25	478	4.9	858	6.1
ABTF-1150	4098	1.21	1.25	527	6.4	940	7.7
ABTF-1200	4105	1.16	1.30	528	2.5	981	4.3
ABTF-1350	4611	1.16	1.30	593	3.4	1104	5.7
ABTF-1500	5118	1.16	1.30	658	4.6	1226	7.3
ABTF-1650	5610	1.17	1.29	721	6.0	1349	9.2

*English:

4.0 gpm/nominal ton, Pstm = 120 psig, TctwS = 85 F, TcwS = 44 F, TcwR = 54 F, 0.0001 Evaporator fouling and 0.00025 Absorber/Condenser fouling.

**Metric:

.26 m³/kWh, Pstm = 120 psig, TctwS = 29.44 C, TcwS = 6.67 C, TcwR = 12.2 C, 0.0001 Evaporator fouling and 0.00025 Absorber/Condenser fouling.

Performance Data

Figure PD-1 – ABTF Capacity vs. Chilled Water Supply Temperature at Various Cooling Water Supply Temperatures

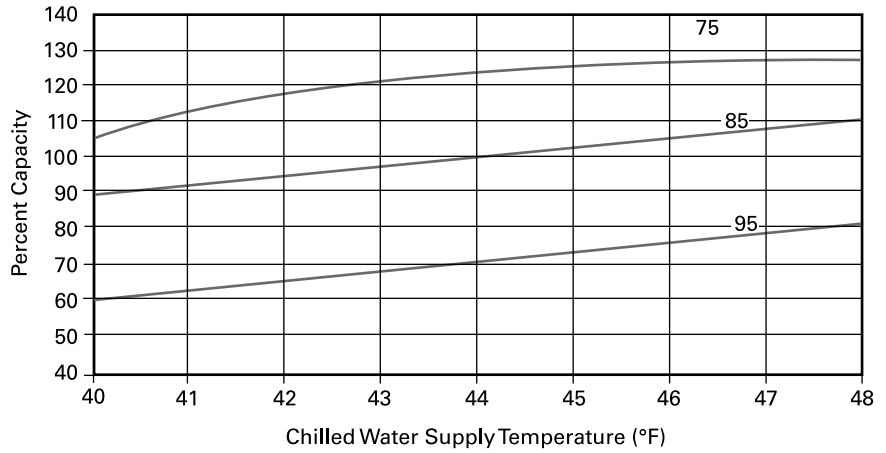
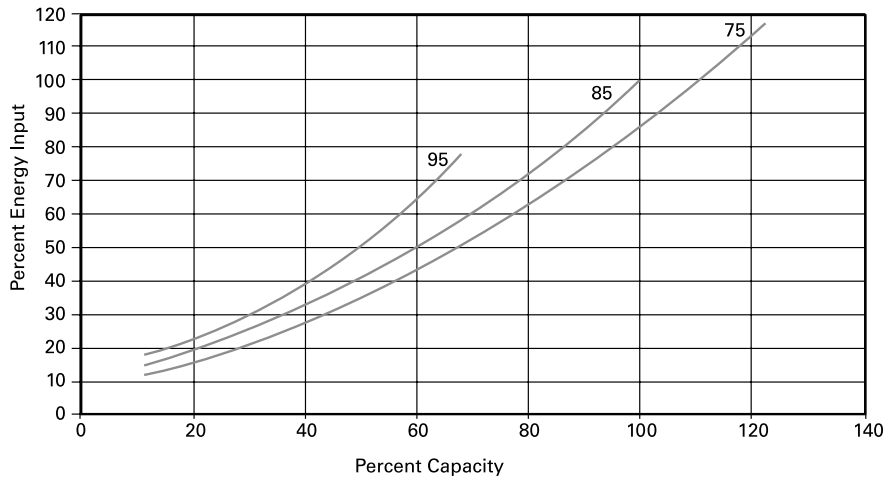


Figure PD-2 – ABTF Part Load Performance – Energy Input vs. Capacity at Various Cooling Water Supply Temperatures – Chilled Water Supply Temperature = 44 F



Performance Data

Pressure Drop vs. Water Flow Rate

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

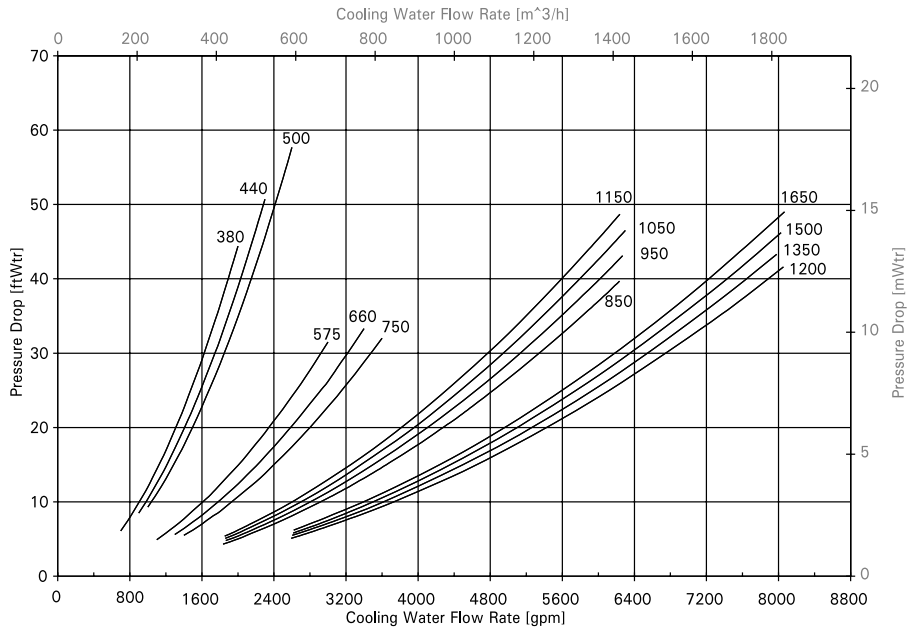
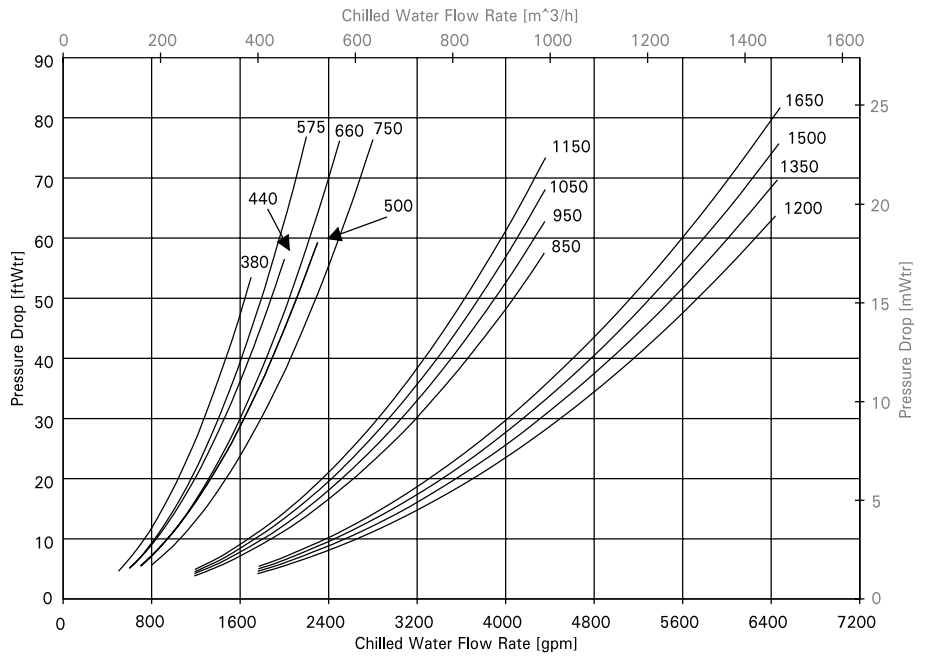


Figure PD-4 – Pressure Drop vs. Chilled Water Flow Rate – English and SI Units





Electrical Data

Electrical Data

Factory wired and mounted power control includes main power connections. Total kW includes solution and refrigerant pump, motors, purge pump motor and control panel. Units may be supplied for operation on 230,460 or 575 volt, 3 phase, 60 hertz power. 190, 220, 380, 415, 3 phase, 50 hertz power is also available.

Table ED-1 — Electrical Data

60 Cycle, 3-Phase							
Model	Supply Voltage	FLA	Total Motor HP	Total Motor kW	Control Circuit Amps	MCA	Max Fuse Size Amps
380 thru 440	208	60	14	10.6	10.0	75	90
	230	56.0	14	10.6	8.7	70	90
	460	28.0	14	10.6	4.4	35	45
	575	23.0	14	10.6	3.5	29	35
500	208	68	16	12.0	10.0	83	100
	230	64	16	12.0	8.7	78	100
	460	32	16	12.0	4.4	39	50
	575	26	16	12.0	3.5	32	40
575 thru 660	208	103	20.5	15.3	10.0	122	150
	230	90	20.5	15.3	8.7	106	125
	460	45	20.5	15.3	4.4	53	60
	575	37	20.5	15.3	3.5	44	50
750	208	110	23.0	17.2	10.0	130	150
	230	96	23.0	17.2	8.7	114	150
	460	48	23.0	17.2	4.4	57	70
	575	39	23.0	17.2	3.5	46	60
850 thru 1150	208	131.0	30.0	22.4	10.0	151	175
	230	116.0	30.0	22.4	8.7	134	150
	460	58.0	30.0	22.4	4.4	67	70
	575	46.0	30.0	22.4	3.5	53	60
1200 thru 1650	208	144.0	32.5	24.3	10.0	164	200
	230	126.0	32.5	24.3	8.7	144	175
	460	63.0	32.5	24.3	4.4	72	95
	575	50.0	32.5	24.3	3.5	57	80
50 Cycle, 3 Phase							
Model	Supply Voltage	FLA	Total Motor HP	Total Motor kW	Control Circuit Amps	MCA	Max Fuse Size Amps
380 thru 440	190	57	14	10.6	10.5	73	90
	220	49.3	14	10.6	9.1	63	80
	380	28.5	14	10.6	5.3	36	45
	415	26.1	14	10.6	4.8	33	40
500	190	66	16	12.0	10.5	82	100
	220	57	16	12.0	9.1	71	90
	380	33	16	12.0	5.3	41	50
	415	30.2	16	12.0	4.8	37	45
575 thru 660	190	88	20.5	15.3	10.5	106	125
	220	75.5	20.5	15.3	9.1	91	110
	380	43.5	20.5	15.3	5.3	53	60
	415	40.1	20.5	15.3	4.8	48	60
750	190	96.0	23.0	17.2	10.5	116	150
	220	82.5	23.0	17.2	9.1	100	125
	380	47.5	23.0	17.2	5.3	58	70
	415	43.1	23.0	17.2	4.8	52	60
850 thru 1150	190	118.0	30.0	22.4	10.5	138	175
	220	102.2	30.0	22.4	9.1	120	150
	380	59.0	30.0	22.4	5.3	69	70
	415	53.2	30.0	22.4	4.8	62	60
1200 thru 1650	190	125.0	32.5	24.3	10.5	145	175
	220	108.1	32.5	24.3	9.1	125	150
	380	62.5	32.5	24.3	5.3	73	90
	415	56.6	32.5	24.3	4.8	66	80

Electrical Data

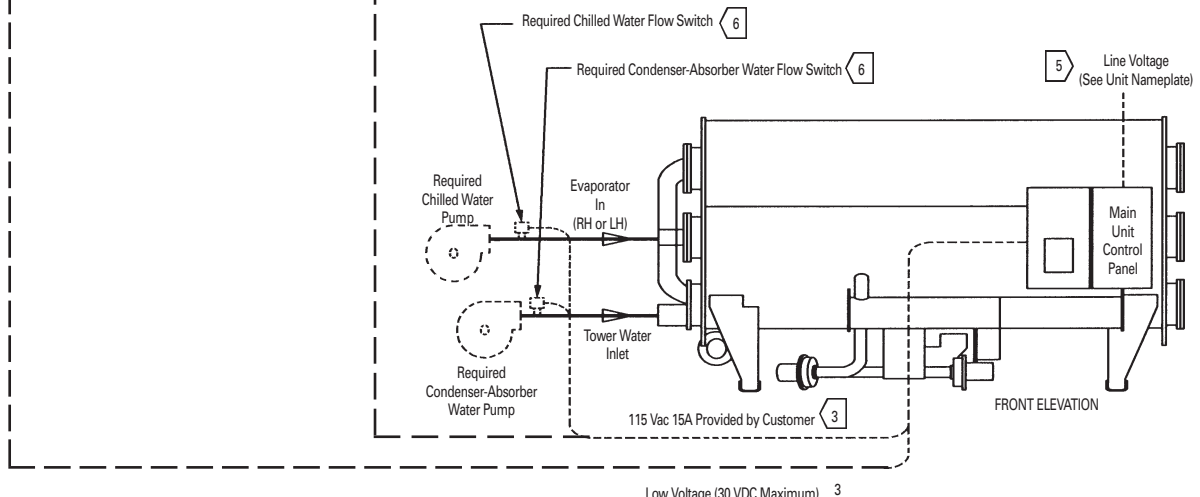
Wiring

11	Optional External Auto Stop Switch With Auto Reset After Closure
10	Optional Emergency Stop Switch Requires Manual Reset After Reclosure
13	Optional Outdoor Air Temperature Sensor For Ambient-Based Chilled Water Reset (Furnished by Trane - Field Installed)
13	Optional Energy Valve Monitor Output; 2-10 VDC (Requires Options Module)
13	Optional Tracer Temperature Sensor Ordered with Tracer Panel (Requires Options Module)
13	Optional Evaporator External Chilled Water Setpoint Input; 2-10 VDC or 4-20 MA (Requires Options Module)
13	Optional Bi-Directional Communication Link To Tracer Panel, If Present (Requires Tracer Communication Module)
13	Optional Bi-Directional Communication Link To Additional UCP2 Control Panel(s), If Present (Requires Tracer Communication Module)
13	Optional Bi-Directional Communication Link To Remote Clear Language Display Panel, If Present (Requires IPC Buffer Module)
14	Optional Communication Link to Printer, If Present 9-Pin Sub-D RS-232 Connector (Requires Printer Module)

Required Chilled Water Flow Switch	6 8
Required Condenser-Absorber Water Flow Switch	6 8
Required Condenser-Absorber Water Pump Relay	4 12 7 8
Recommended Chilled Water Pump Relay	4 12 7 8
Optional Hot Water Pump	4 12
Optional Machine Manual Reset Alarm Status Relay	4 12
Optional Machine Automatic Reset Alarm Status Relay	4 12
Optional Limit Warning Status Relay	4 12
Optional Purge Alarm Indicator Light	4
Optional Interstage Pressure Relief Request Status Relay (Requires Options Module)	4 12
Optional Maximum Capacity Status Relay (Requires Options Module)	4 12
Optional Tracer Controlled Relay (Requires Options Module)	4 12
Optional Tower Temperature Low Relay (Requires Options Module)	4 12

<p>⚠ WARNING HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERAL PERSONAL INJURY OR DEATH.</p>	<p>⚠ AVERTISSEMENT 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.</p>	<p>⚠ CAUTION 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.</p>
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- GENERAL NOTES:
- 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.
 - 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.
 - 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.
 - 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:
- 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.
 - EVAPORATOR, CONDENSER AND 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.
 - 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.
 - 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:
- OPTIONAL CONTROL FOR A CUSTOMER SPECIFIED OR INSTALLED LATCHING TRIP-OUT. 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.
 - 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.
 - 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
 - CIRCUIT REQUIRES SHIELDED WIRE PAIR, 30 VDC MAXIMUM BELDON TYPE 8760 RECOMMENDED. MAXIMUM LENGTH OF 5000 FEET.
 - OPTIONAL REMOTE CLEAR LANGUAGE DISPLAY PANEL REQUIRES SEPARATE CUSTOMER PROVIDED 24 VAC POWER SOURCE.



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 of 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.

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

Controls Data

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

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

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

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™ steam-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

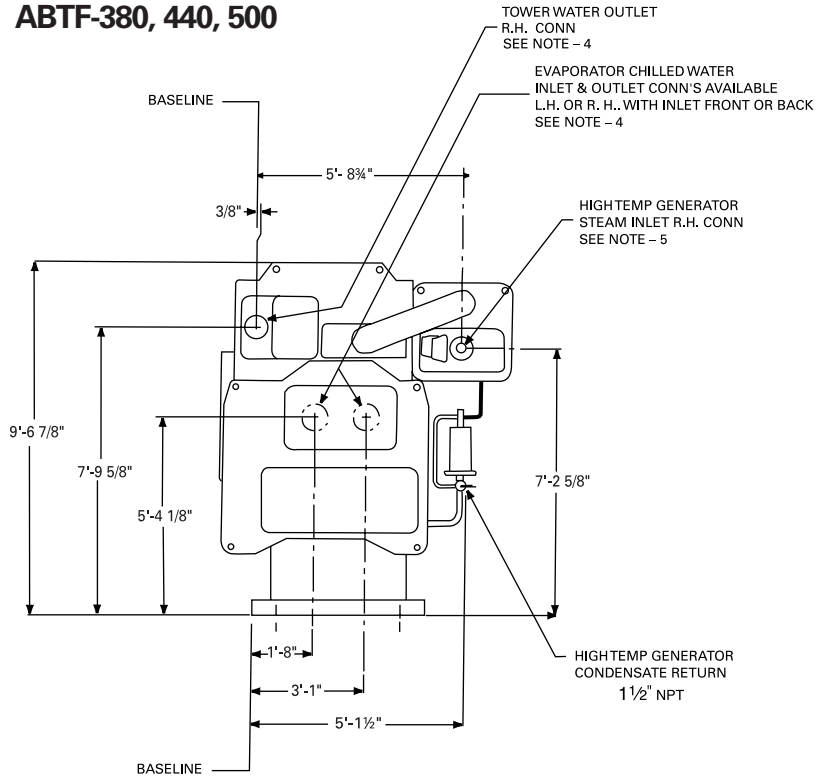
Physical Dimensions

Customer Notes:

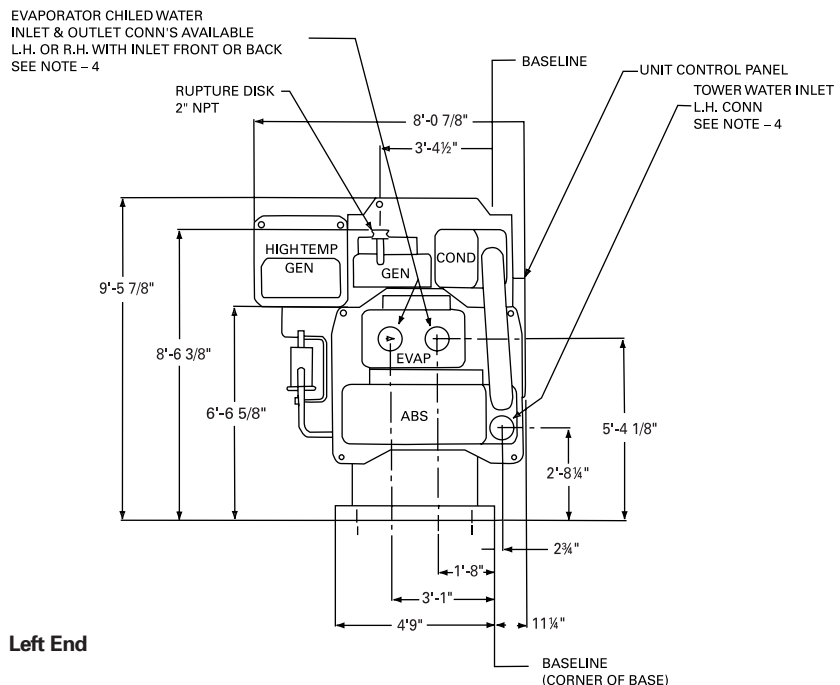
1. Front of unit is determined by facing unit control panel
2. All vertical dimensions include $\frac{5}{16}$ " (7.99 mm) thick isolation pads.
3. Dimensions shown are calculated values.
4. Evaporator, condenser, and absorber water connections are for 8" (203 mm) pipe. Available with 150# grooved connection for use with style 77 Victaulic coupling. Also, available with 150# American Standard raised face flange (flange bolt holes straddle vertical centerline).
5. High temperature generator steam inlet connection is for 2" (55 mm) pipe. Provided with 150# American raised face flange (flange bolt holes straddle vertical centerline).
6. All water box vents are $\frac{1}{4}$ " (6 mm) NPT and drains are $\frac{3}{4}$ " (19 mm) NPT.
7. Flexible connection must be used for attachment to rupture disk. 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.
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" (914 mm) minimum to the equipment. This will allow for proper connection upon arrival of the unit at the job site. Necessary adjustments can be made at that time.

All catalog dimensional drawings are subject to change. Current submittal drawings should be referred to for detailed dimensional information. Contact the local Trane sales office for submittal and template information.

ABTF-380, 440, 500



Right End



Left End

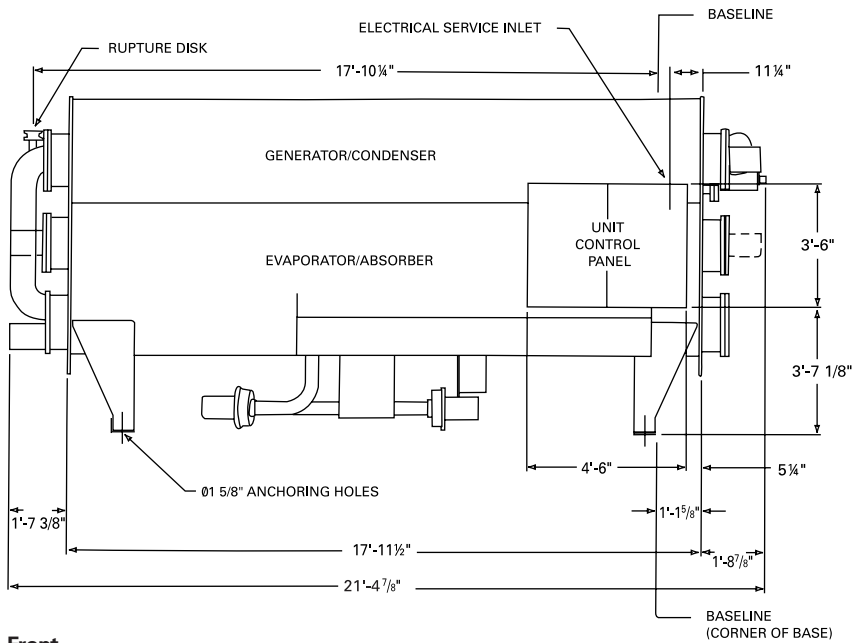
Dimensions and Weights

Physical Dimensions

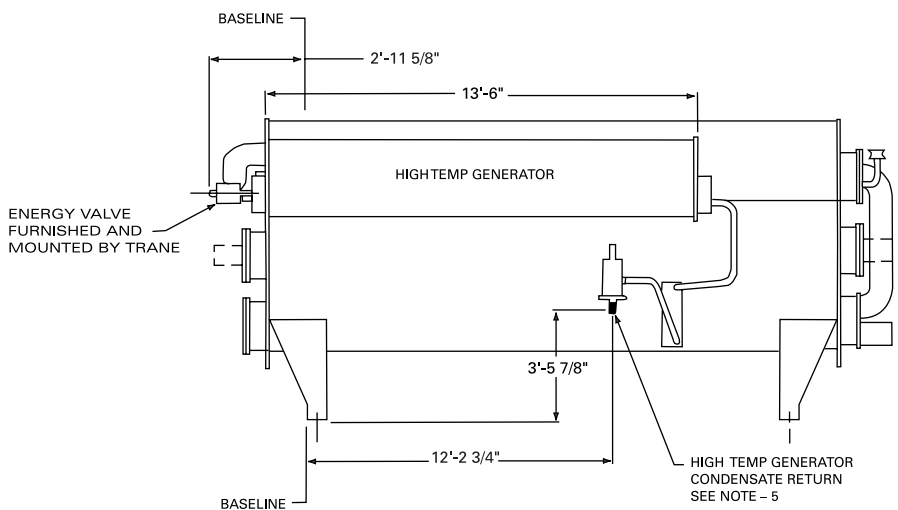
Table DW-1 – English to SI Units Cross Reference Conversion Chart (Ft. to mm)

English Units	SI Units
3/8"	10
2 3/4"	70
5 1/4"	133
11 1/4"	286
1' 1 5/8"	346
1' 7 3/8"	492
1' 8"	508
1' 8 7/8"	530
2' 8 1/4"	819
2' 11 5/8"	903
3' 1"	940
3' 4 1/2"	1022
3' 5 7/8"	1064
3' 6"	1067
3' 7 1/8"	1095
4' 6"	1372
4' 9"	1448
5' 1 1/2"	1562
5' 4 1/8"	1629
5' 8 3/4"	1749
6' 6 5/8"	1997
7' 2 5/8"	2200
7' 9 5/8"	2378
8' 7 7/8"	2461
8' 6 3/8"	2600
9' 5 7/8"	2892
9' 6 7/8"	2918
12' 2 3/4"	3727
13' 6"	4115
17' 10 1/4"	5442
17' 11 1/2"	5474
21' 4 7/8"	6525

ABTF-380, 440, 500



Front



Back

Dimensions and Weights

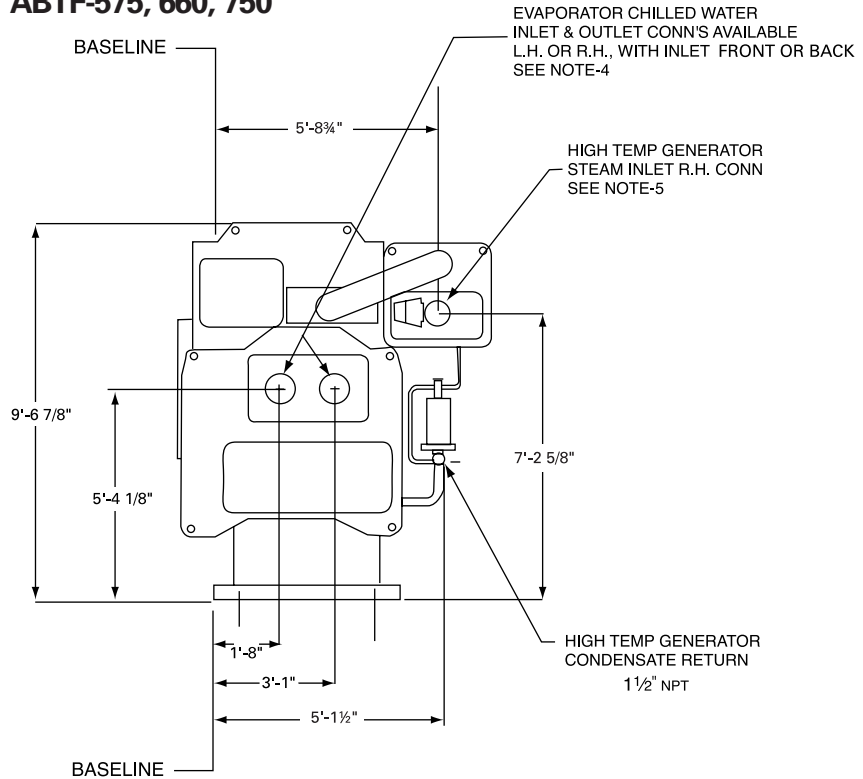
ABTF-575, 660, 750 Physical Dimensions English and SI Units

Customer Notes:

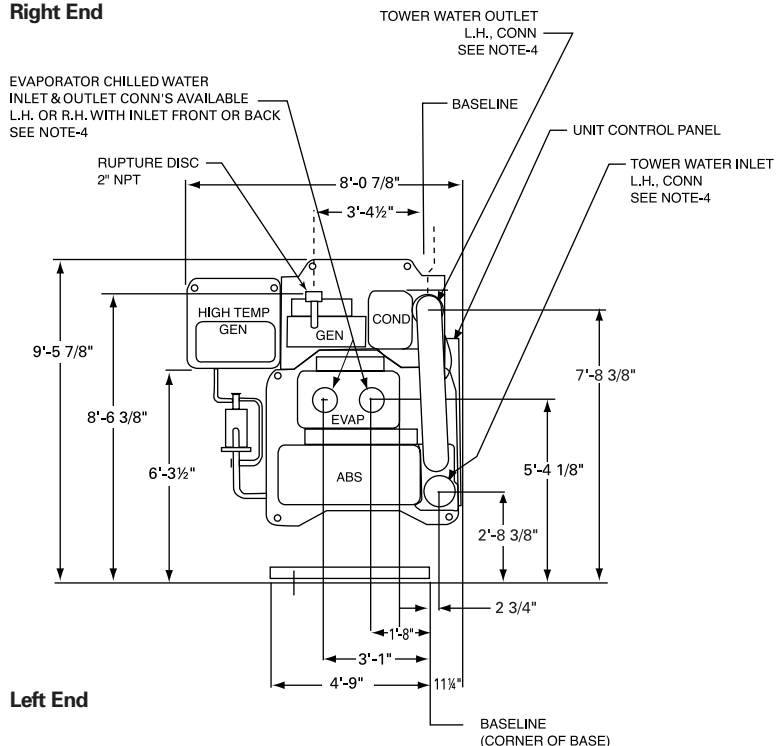
1. Front of unit is determined by facing unit control panel
2. All vertical dimensions include $\frac{5}{16}$ " (7.99 mm) thick isolation pads.
3. Dimensions shown are calculated values.
4. Evaporator, condenser, and absorber water connections are for 8" (203 mm) pipe. Available with 150# grooved connection for use with style 77 Victaulic coupling. Also, available with 150# American Standard raised face flange (flange bolt holes straddle vertical centerline).
5. High temperature generator steam inlet connection is for 2" (55 mm) pipe. Provided with 150# American raised face flange (flange bolt holes straddle vertical centerline).
6. All water box vents are $\frac{1}{4}$ " (6 mm) NPT and drains are $\frac{3}{4}$ " (19 mm) NPT.
7. Flexible connection must be used for attachment to rupture disk. 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.
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" (914 mm) minimum to the equipment. This will allow for proper connection upon arrival of the unit at the job site. Necessary adjustments can be made at that time.

All catalog dimensional drawings are subject to change. Current submittal drawings should be referred to for detailed dimensional information. Contact the local Trane sales office for submittal and template information.

ABTF-575, 660, 750



Right End



Left End

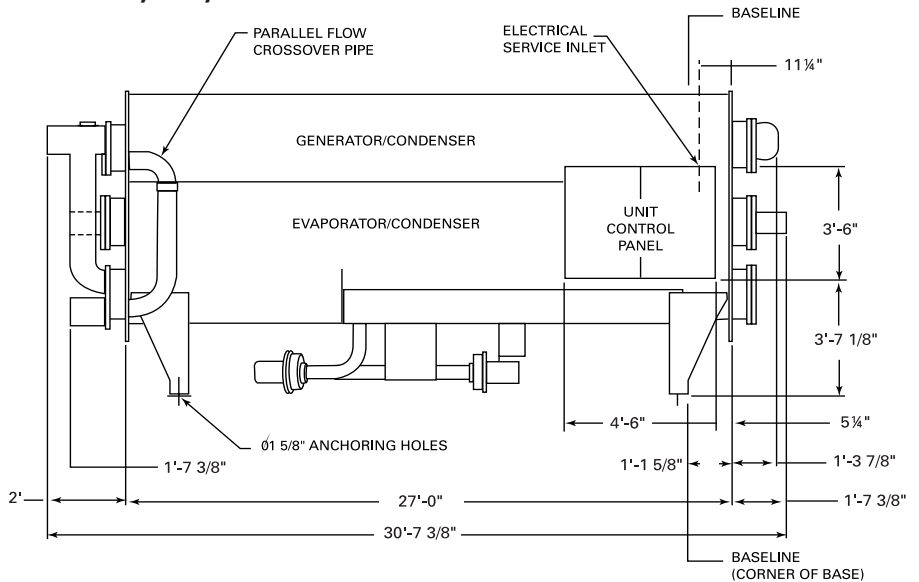
Dimensions and Weights

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

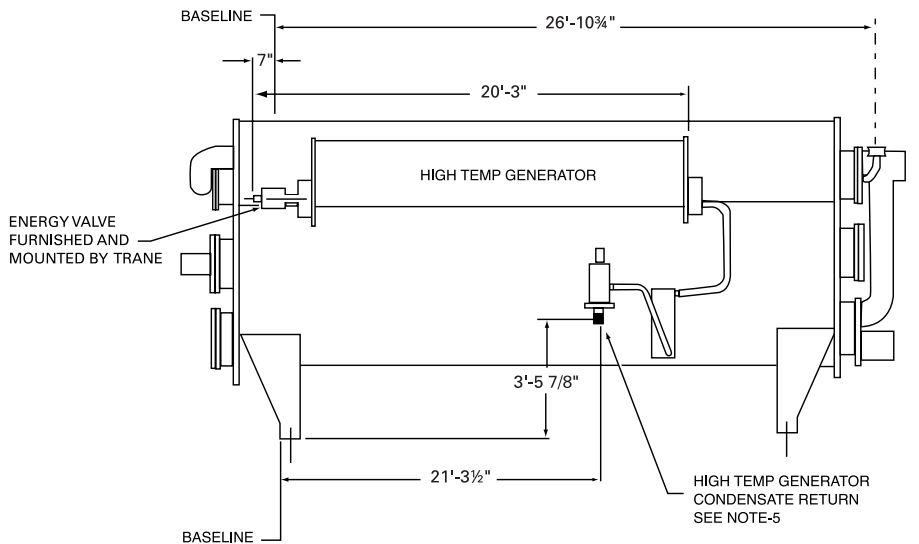
Table DW-2 – English to SI Units
Cross Reference

Conversion Chart (Ft. to mm)	
English Units	SI Units
3/4"	19
2 3/4"	70
5 1/4"	133
7"	178
11 1/4"	286
1' 1 5/8"	346
1' 3 7/8"	406
1' 7 3/8"	492
1' 8"	508
2'	610
2' 6 7/8"	784
2' 8 3/8"	822
3' 1"	940
3' 4 1/2"	1022
3' 5 7/8"	1064
3' 6"	1067
3' 7 1/8"	1096
4' 6"	1372
4' 9"	1448
5' 1 1/2"	1562
5' 4 1/8"	1629
5' 8 3/4"	1749
6' 3 1/2"	1918
7' 2 5/8"	2200
7' 8 3/8"	2346
8' 7/8"	2461
8' 6 3/8"	2600
9' 5 7/8"	2892
9' 6 7/8"	2918
20' 3"	6172
21' 3 1/2"	6488
26' 10 3/4"	8198
27'	8230
30' 7 3/8"	9330

ABTF-575, 660, 750



Front



Back

Dimensions and Weights

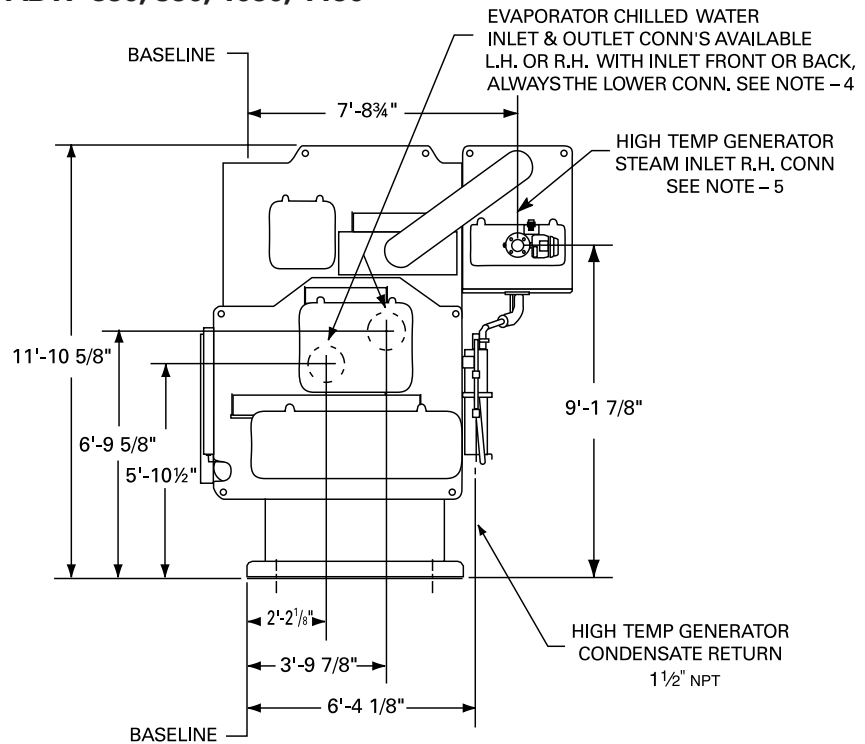
ABTF-850,950,1050,1150 Physical Dimensions English and SI Units

Customer Notes:

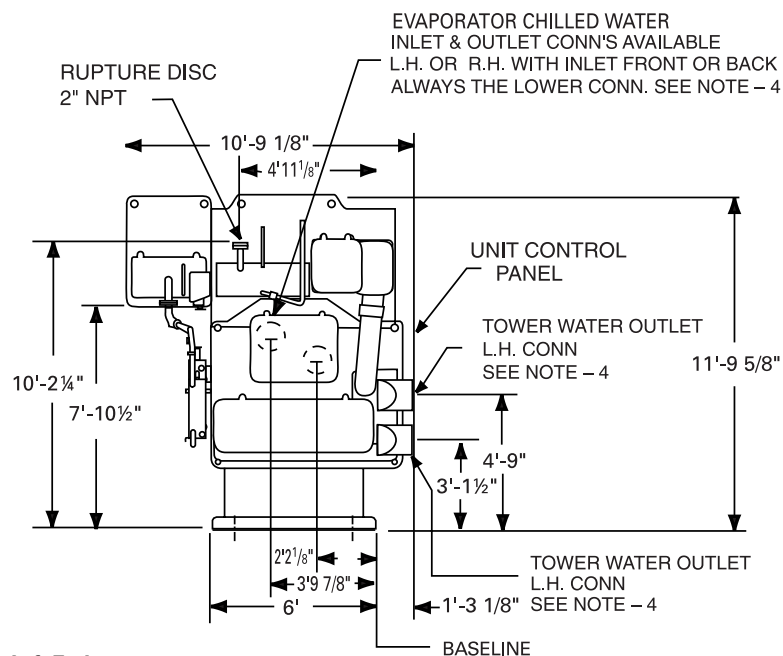
1. Front of unit is determined by facing unit control panel
2. All vertical dimensions include $\frac{5}{16}$ " (8 mm) thick isolation pads.
3. Dimensions shown are calculated values.
4. Evaporator and absorber connections are for 12" (305 mm) pipe. Available with 150# (10 kg/cm²) grooved connection for use with style 77 Victaulic coupling. Also, available with 150# American Standard raised face flange (flange bolt holes straddle vertical centerline).
5. High temperature generator steam inlet connection is for 2" (55 mm) pipe. Provided with 150# American Standard raised face flange (flange bolt holes straddle vertical centerline). Condensate return connection is for 1½" NPS. Both connections are to be welded.
6. All water box vents are ¼" (6 mm) NPT and drains are ¾" (19 mm) NPT.
7. Flexible connection must be used for attachment to rupture disk. Do not apply more than 12 PSI (.8 kg/cm²) internal pressure on machine without removing rupture disc. Pipe rupture disc to floor vent or to the outside to meet local code.
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" (914 mm) minimum to the equipment. This will allow for proper connection upon arrival of the unit at the job site. Necessary adjustments can be made at that time.

All catalog dimensional drawings are subject to change. Current submittal drawings should be referred to for detailed dimensional information. Contact the local Trane sales office for submittal and template information.

ABTF-850, 950, 1050, 1150



Right End



Left End

Dimensions and Weights

ABTF-850,950,1050,1150 Physical Dimensions English and SI Units

Table DW-3 – ABTF 850-1150 Dimensions

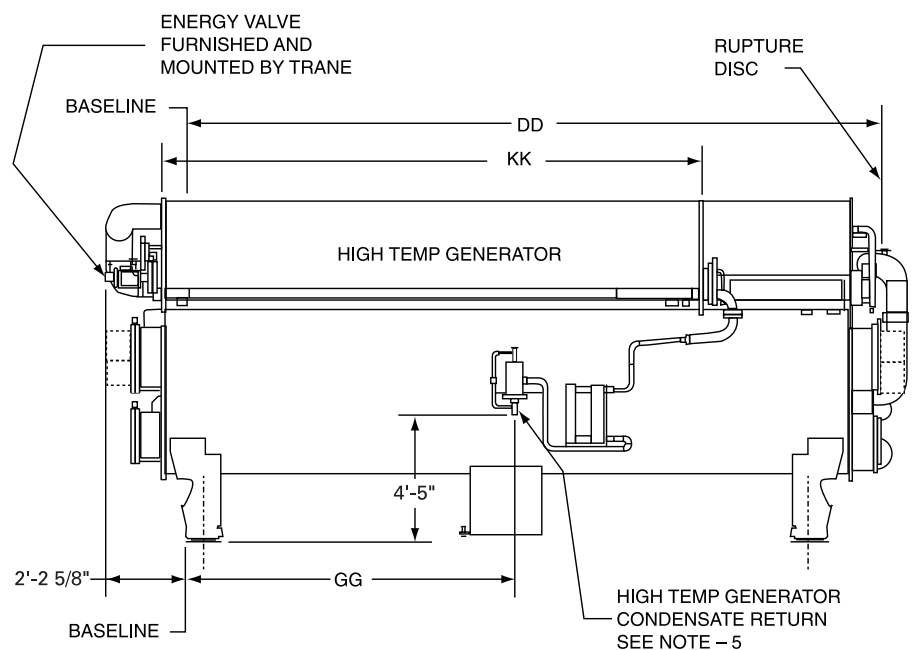
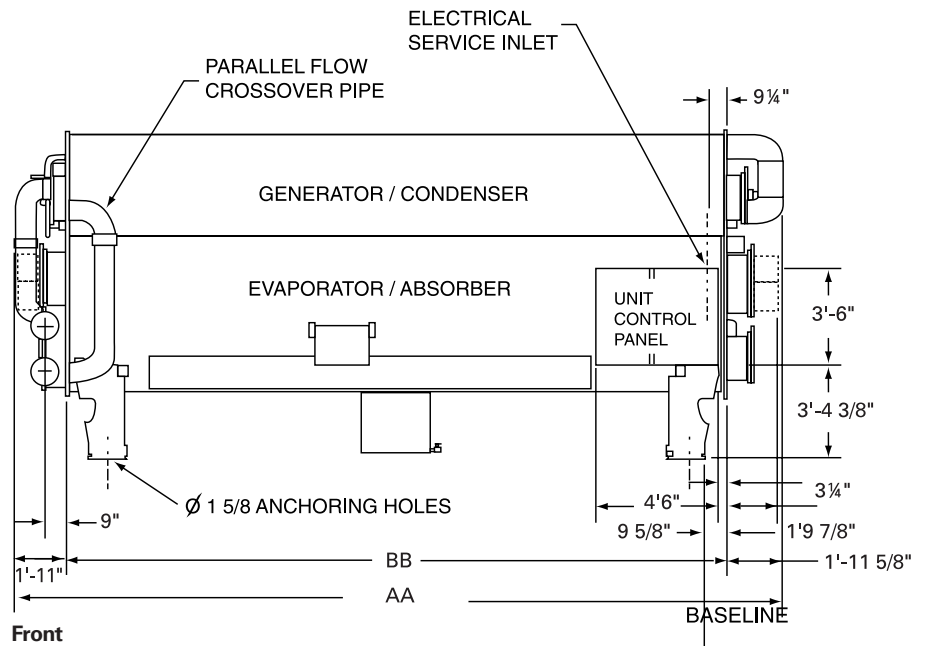
English Units					
Machine Size	AA	BB	DD	GG	KK
850	23'-10 1/4"	20'	20'-3 1/4"	10'-3 1/4"	14'-10"
950	25'-10 1/4"	22'	22'-3 1/4"	12'-3 1/4"	16'-10"
1050	27'-10 1/4"	24'	24'-3 1/4"	14'-3 1/4"	18'-10"
1150	29'-10 1/4"	26'	26'-3 1/4"	16'-3 1/4"	20'-10"

SI Units					
Machine Size	AA	BB	DD	GG	KK
850	7271	6096	6179	3131	4521
950	7880	6706	6788	3741	5131
1050	8490	7315	7398	4350	5740
1150	9100	7925	8007	4959	6350

**Table DW-4 – English to SI Units
Cross Reference**

Conversion Chart (Ft. to mm)	
English Units	SI Units
3 1/4"	83
9"	229
9 1/4"	235
9 5/8"	244
1' 3 1/8"	384
1' 9 7/8"	556
1' 11"	584
1' 11 5/8"	600
2' 2 1/8"	664
2' 2 5/8"	675
3' 1 1/2"	953
3' 4 3/8"	1026
3' 6"	1067
3' 9 7/8"	1165
4' 5"	1346
4' 6"	1372
4' 9"	1448
4' 11 1/8"	1502
5' 10 1/2"	1791
6"	1829
6' 4 1/8"	1934
6' 9 5/8"	2073
7' 8 3/4"	2356
7' 10 1/2"	2400
9' 1 7/8"	2791
10' 2 1/4"	3105
10' 3 1/4"	3131
10' 9 1/8"	3280
11' 9 5/8"	3597
11' 10 5/8"	3623
12' 3 1/4"	3741
14' 3 1/4"	4350
16' 3 1/4"	4959
23' 10 1/4"	7271
25' 10 1/4"	7880
27' 10 1/4"	8490
20' 10 1/4"	9100

ABTF-850, 950, 1050, 1150



Back

Dimensions and Weights

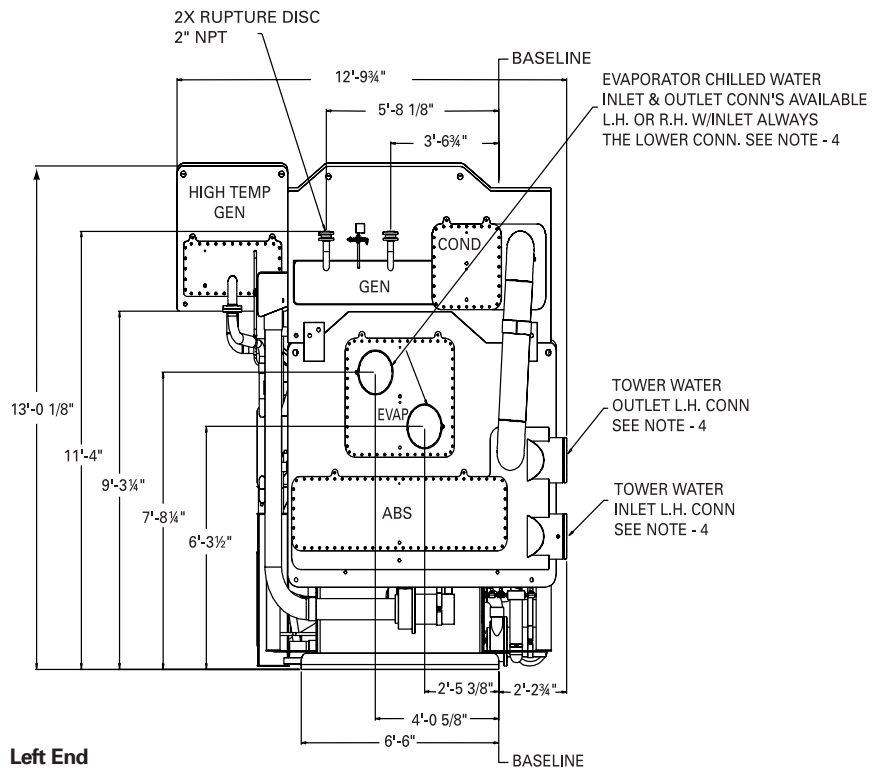
ABTF 1200-1650 Physical Dimensions English and SI Units

Customer Notes:

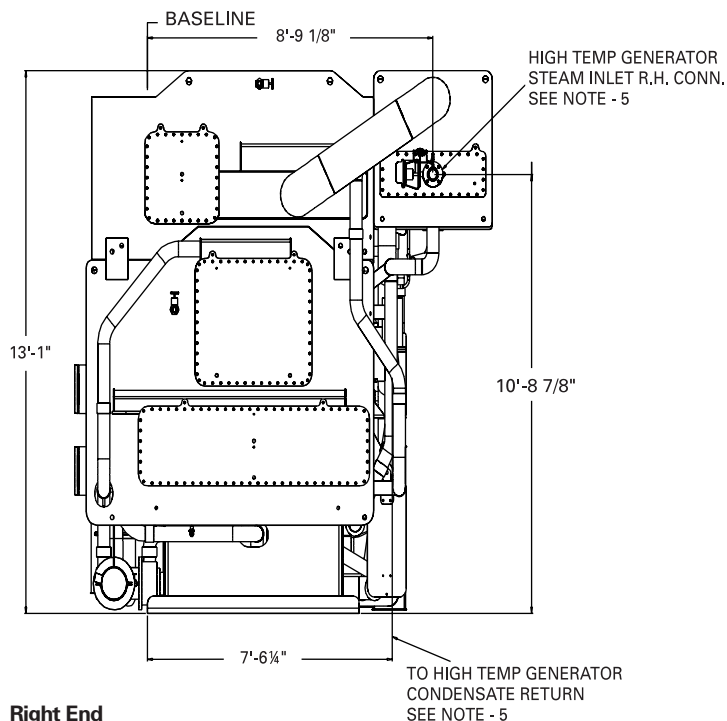
1. Front of unit is determined by facing unit control panel
2. All vertical dimensions include $\frac{5}{16}$ " (7.99 mm) thick isolation pads.
3. Dimensions shown are calculated values.
4. Evaporator, condenser, and absorber water connections are for 14" (356 mm) pipe. Available with 150# grooved connection for use with style 77 Victaulic coupling. Also, available with 150# American Standard raised face flange (flange bolt holes straddle vertical centerline).
5. High temperature generator steam inlet connection is for 3" (76 mm) pipe. Provided is a valve with pipe stub. Condensate return connection is for $\frac{1}{2}$ " (38 mm) NPT.
6. All water box vents are $\frac{1}{4}$ " (6 mm) NPT and drains are $\frac{3}{4}$ " (19 mm) NPT.
7. 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.
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" (194 mm) minimum to the equipment. This will allow for proper connection upon arrival of the unit at the job site. Necessary adjustments can be made at that time.
9. ABTF 1200-1650 units ship disassembled in 2 or 3 pieces as standard.

All catalog dimensional drawings are subject to change. Current submittal drawings should be referred to for detailed dimensional information. Contact the local Trane sales office for submittal and template information.

ABTF 1200-1650



Left End



Right End

Dimensions and Weights

ABTF 1200-1650 Physical Dimensions English and SI Units

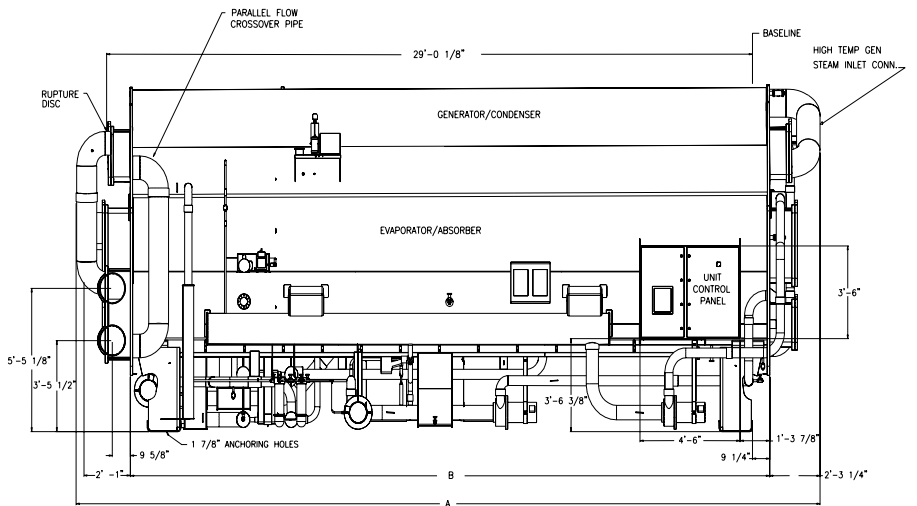
Table DW-5 – ABTF 1200-1650 Dimensions

English Units		
Machine Size	A	B
1200	26' – 11"	22' – 2 1/2"
1350	29' – 1"	24' – 4 1/2"
1500	31' – 3"	26' – 6 1/2"
1650	33' – 5"	28' – 8 1/2"
SI Units		
Machine Size	A	B
1200	8204	6769
1350	8865	7430
1500	7525	8090
1650	10,185	8750

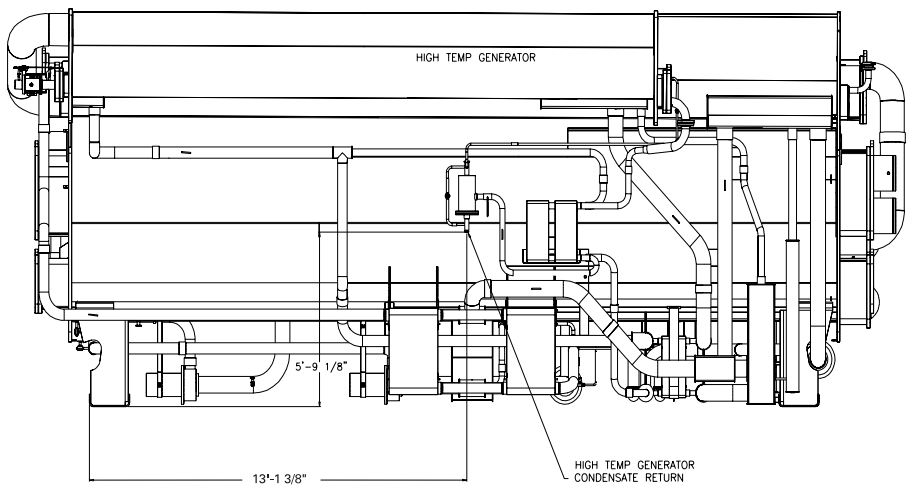
**Table DW-6 – English to SI Units
Cross Reference
Conversion Chart
(Ft. to mm)**

English Units	SI Units
9 1/4"	235
9 5/8"	244
1' 3 7/8"	403
2' 1"	635
2' 2 3/4"	679
2' 3 1/4"	692
2' 5 3/8"	746
3' 5 1/2"	1054
3' 6"	1067
3' 6 3/8"	1076
3' 6 3/4"	1086
4' 5/8"	1235
4' 6"	1372
5' 5 1/8"	1654
5' 8 1/8"	1730
5' 9 1/8"	1756
6' 3 1/2"	1918
6' 6"	1981
7' 6 1/4"	2292
7' 8 1/4"	2343
8' 9 1/8"	2670
9' 3 1/4"	2826
10' 8 7/8"	3273
11' 4"	3454
12' 9 3/4"	3905
13' 1/8"	3965
13' 1"	3988
13' 1 3/8"	3997
29' 1/8"	8842

ABTF 1200-1650



Front



Back

Dimensions and Weights

Disassembly Options

Separated Machine Sections

Disassembled machines can ship to the job site in two or three main sections. The three-piece option ships as an evaporator/absorber section, the high temperature generator section and the low temperature generator/condenser section. The two piece option will ship the evaporator/absorber as a section and the low temperature generator/condenser and high temperature generator as a separate piece. Contact the local Trane sales office for current submittal information.

Figure DW-1 – Disassembly Options – Right End View

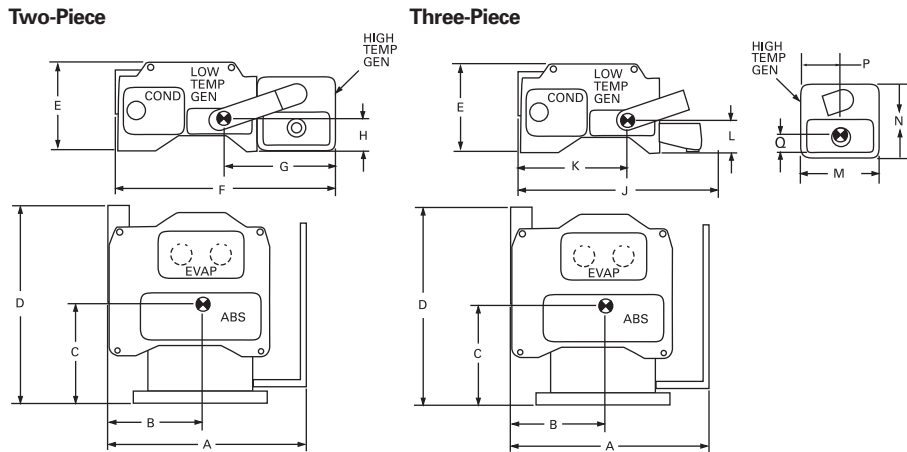


Table DW-7 – Disassembly and Center of Gravity Dimensions

English			
Unit Size	380-750	850-1150	1200-1650
A	7' - 1"	9' - 2 1/2"	10' - 2"
B	3' - 4 5/8"	4' - 3 1/8"	5' - 4 3/8"
C	3' - 6 1/4"	4' - 4 3/8"	5' - 3 1/4"
D	7' - 7/8"	9' - 3/4"	9' - 2 5/8"
E	3' - 2 5/8"	4' - 5 1/8"	4' - 6 1/2"
F	7' - 8 3/8"	10' - 1 3/4"	12' - 3 5/8"
G	3' - 11 1/2"	5' - 0 3/8"	6' - 1 7/8"
H	1' - 2 1/8"	1' - 8 3/4"	2' - 2 3/8"
J	6' - 0 7/8"	7' - 5 1/8"	9' - 7 7/8"
K	2' - 8 1/8"	3' - 9 3/4"	4' - 10 3/8"
L	1' - 3 1/8"	2' - 0 5/8"	2' - 2 3/8"
M	2' - 9 1/2"	3' - 6 1/2"	3' - 7 3/4"
N	2' - 8 3/4"	3' - 11 1/4"	3' - 9"
P	1' - 4 5/8"	1' - 9"	1' 8 1/8"
Q	1' - 0"	1' - 10 3/4"	2' 2 1/2"

SI (mm)			
Unit Size	380-750	850-1150	1200-1650
A	2159	2806	3099
B	1032	1299	1635
C	1073	1330	1606
D	2156	2762	2810
E	981	1349	1384
F	2346	3092	3750
G	1207	1534	1876
H	359	527	670
J	1851	2264	2943
K	816	1162	1483
L	384	625	670
M	851	1080	1111
N	832	1200	1143
P	422	533	511
Q	305	578	673

Table DW-8 – Horizon 2-Stage Steam Absorption Subassembly Weights

English Units					
Tons	High Temp. Gen.	Low Temp Gen. and Cond.	Low and High Temp. Gen. and Cond.	Evap. and Abs.	Low Temp. Gen. and Cond. and Abs.
380	3527	7159	10686	19523	26682
440	3574	7418	10992	20398	27816
500	3621	7665	11286	21185	28850
575	4480	10175	14655	24835	35010
660	4550	10500	15050	25700	36200
750	4625	10800	15425	26500	37300
850	5084	14404	19488	33264	47668
950	5522	15493	21015	35427	50920
1050	4953	16546	21499	37260	53806
1150	6376	17606	23982	39205	56811
1200	7206	25825	33031	48131	73956
1350	6714	22512	29226	50928	73440
1500	7219	24029	31248	53729	77758
1650	7722	25603	33325	56514	82117

SI Units					
Tons	High Temp. Gen.	Low Temp Gen. and Cond.	Low and High Temp. Gen. and Cond.	Evap. and Abs.	Low Temp. Gen. and Cond. and Abs.
380	1600	3247	4847	8856	12103
440	1621	3365	4986	9253	12617
500	1642	3477	5119	9610	13086
575	2032	4615	6648	11265	15881
660	2064	4763	6827	11658	16420
750	2098	4899	6997	12020	16919
850	2306	6534	8840	15089	21622
950	2505	7028	9532	16070	23097
1050	2247	7505	9752	16901	24406
1150	2892	7986	10878	17783	25769
1200	3269	11714	14983	21832	33546
1350	3045	10211	13257	23101	33312
1500	3275	10900	14174	24371	35271
1650	3503	11614	15116	25635	37248

Dimensions and Weights

Rigging

Foundation Support

The foundation must be level, smooth, and capable of supporting the machine weight. The machine legs should be positioned over isolation pads. A housekeeping pad or support rail is recommended to elevate the machine for maintenance. Any foundation pad should provide adequate structural support and keep the installed machine level within $\frac{1}{16}$ -inch by length and width for reliable operation. Leveling marks on the evaporator and absorber tube sheet can be used to check the machine after it is positioned on the pad.

Chiller Isolation

Isolation pads are provided with each unit. The purpose of the isolation pad is to distribute the machine weight and minimize sound and vibration transmission through the building structure.

Figure DW-2 – Typical Machine Rigging Points

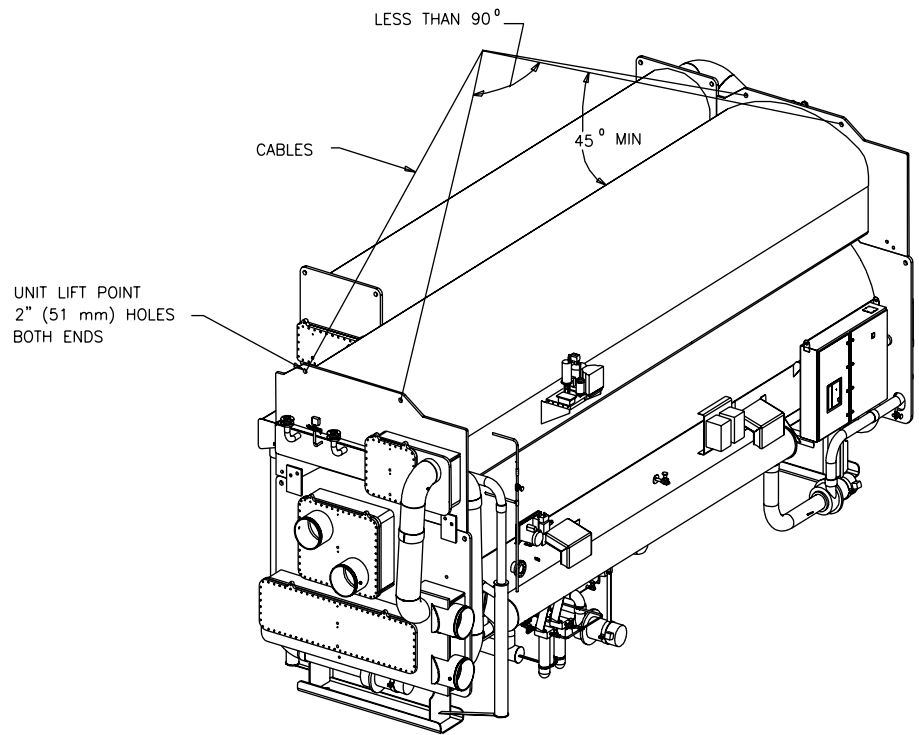
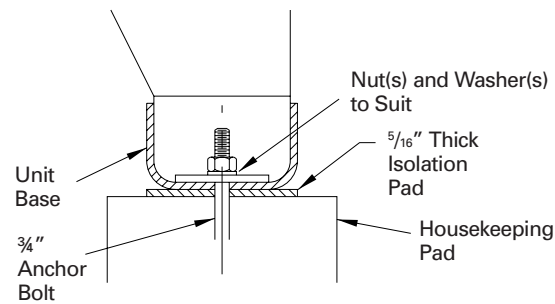


Figure DW-3 – Unit Anchoring Detail – All Sizes



Dimensions and Weights

Service Clearances

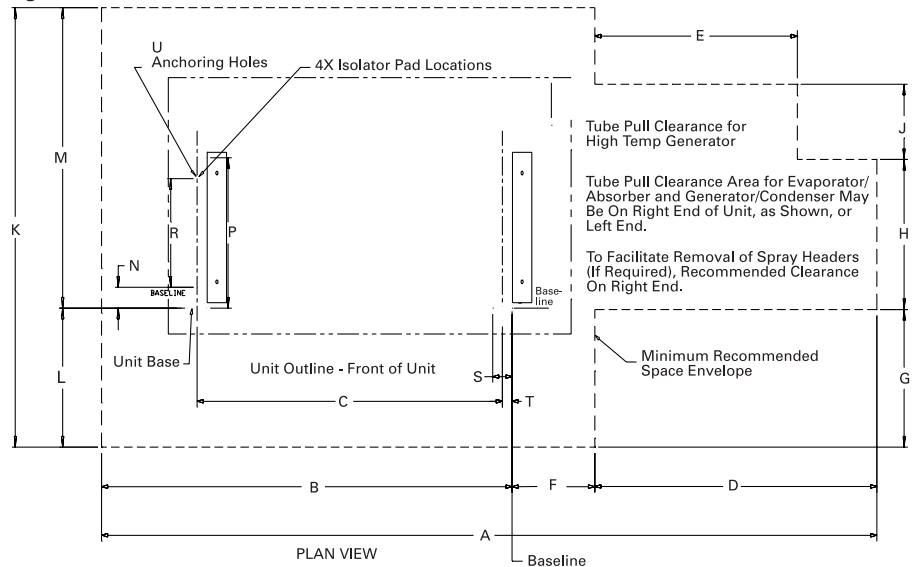
Rigging and Service Clearances

Service clearance is required on all sides of the machine. Pay particular attention to the control panel door clearance and the clearance at one end, for tube service.

Figure DW-4 and Table DW-8 illustrate the recommended clearances for normal service and tube replacement. When a sufficient overhead clearance exists, we recommend placing a 6-8 inch extension underneath the machine legs for additional access under the chiller.

Overhead lift is the recommended method when moving a machine. Before lifting the machine, determine the approximate location of the center of gravity.

Figure DW-4 – Service Clearances



¹Tube pull clearances for the high temperature generator for 380 through 1150 tonnage sizes must be on the right end of the unit. For the 1200-1650 tonnage sizes, the tube pull clearances for the high temperature generator may be on the left or right end of the unit.

Table DW-9 – Service Clearances

	Unit Size										
	380/440/500	575/660/750	850	950	1050	1150	1200	1350	1500	1650	
English Units											
A	41' 6"	59' 6"	45' 6"	49' 6"	53' 6"	57' 6"	52'-2"	56'-6"	60'-10"	65'-2"	
B	22' 0"	31' 0"	24' 4"	26' 4"	28' 4"	30' 4"	26'-11"	29'-1"	31'-3"	33'-5"	
C	14' 9 1/2"	23' 10"	17' 1"	19' 1"	21' 1"	23' 1"	19'-2"	21'-4"	23'-6"	25'-8"	
D	13' 6"	22' 6"	15' 6"	17' 6"	19' 6"	21' 6"	17' 4"	19' 6"	21' 8"	23' 10"	
E	9' 0"	16' 0"	10' 0"	12' 0"	14' 0"	16' 0"	10'-9"	12'-11"	15'-1"	17'-3"	
F	6' 0"	6' 0"	5' 8"	5' 8"	5' 8"	5' 8"	6' 1"	6' 1"	6' 1"	6' 1"	
G	5' 0"	5' 0"	5' 6"	5' 6"	5' 6"	5' 6"	6' 2"	6' 2"	6' 2"	6' 2"	
H	5' 0"	5' 0"	6' 0"	6' 0"	6' 0"	6' 0"	6' 9"	6' 9"	6' 9"	6' 9"	
J	2' 0"	2' 0"	3' 6"	3' 6"	3' 6"	3' 6"	3' 6"	3' 6"	3' 6"	3' 6"	
K	15' 0"	15' 0"	18' 0"	18' 0"	18' 0"	18' 0"	19' 10"	19' 10"	19' 10"	19' 10"	
L	5' 0"	5' 0"	5' 6"	5' 6"	5' 6"	5' 6"	6' 3"	6' 3"	6' 3"	6' 3"	
M	10' 0"	10' 0"	12' 6"	12' 6"	12' 6"	12' 6"	13' 7"	13' 7"	13' 7"	13' 7"	
N	10' 1/2"	10' 1/2"	10' 0"	10' 0"	10' 0"	10' 0"	10' 0"	10' 0"	10' 0"	10' 0"	
P	4' 9"	4' 9"	6' 0"	6' 0"	6' 0"	6' 0"	6' 6"	6' 6"	6' 6"	6' 6"	
R	3' 0"	3' 0"	4' 4"	4' 4"	4' 4"	4' 4"	4' 10"	4' 10"	4' 10"	4' 10"	
S	10 3/4"	10 3/4"	1' 4"	1' 4"	1' 4"	1' 4"	1' 6"	1' 6"	1' 6"	1' 6"	
T	5 7/8"	5 3/8"	8"	8"	8"	8"	9"	9"	9"	9"	
U	4X 01 5/8"		4X 01 7/8"				4X 01 7/8"				
SI Units (mm)											
A	12649	18136	13868	15088	16307	17526	15900	17221	18542	19853	
B	6706	9449	7417	8026	8636	9246	8204	8864	9525	9576	
C	4509	7264	5207	5817	6426	7036	5842	6451	7163	7823	
D	4119	6858	4724	5334	5944	6553	5283	5944	6604	7264	
E	2743	4877	3048	3658	4267	4877	3277	3937	4597	5258	
F	1829	1829	1725	1725	1725	1725	1854	1854	1854	1854	
G	1524	1524	1676	1676	1676	1676	1879	1879	1879	1879	
H	1524	1524	1829	1829	1829	1829	2057	2057	2057	2057	
J	610	610	1067	1067	1067	1067	1067	1067	1067	1067	
K	4572	4572	5486	5486	5486	5486	6045	6045	6045	6045	
L	1524	1524	1676	1676	1676	1676	1905	1905	1905	1905	
M	3048	3048	3810	3810	3810	3810	4140	4140	4140	4140	
N	3200	3200	3048	3048	3048	3048	3048	3048	3048	3048	
P	1448	1448	1829	1829	1829	1829	1981	1981	1981	1981	
R	914	914	1321	1321	1321	1321	1473	1473	1473	1473	
S	273	273	406	406	406	406	457	457	457	457	
T	136	136	203	203	203	203	229	229	229	229	
U	4X 41.275		4X 47.625				4X 47.625				

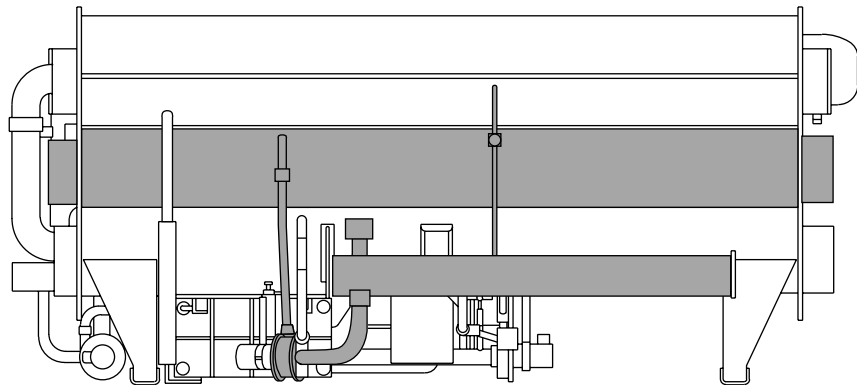
Dimensions and Weights

Cold Insulation

Low Temperature Cold Insulation

Cold insulation can be ordered as a factory installed option. The quantity and the areas to be covered are illustrated in Table DW-9 and Figure DW-5.

Figure DW-5 – Cold Insulation



■ Factory Provided, Factory Installed Option

Table DW-10 – Cold Insulation Area and Length

Unit Size	Refrigerant Storage Tank Sq. Ft.	Evaporator Section Sq. Ft.	6" Pipe Ln. Ft.	4" Pipe Ln. Ft.	3.5" Pipe Ln. Ft.	3.0" Pipe Ln. Ft.	2" Pipe Ln. Ft.	1/2" Pipe Ln. Ft.
English Units								
380-440-500	70	170	N/A	3	N/A	N/A	6	N/A
575-660-750	70	234	3	N/A	N/A	N/A	6	N/A
850	81	195	6	5	5	5	10	8
950	88	215	6	5	5	5	10	8
1050	95	230	6	5	5	5	10	8
1150	102	250	6	5	5	5	10	8
1200	80	335	6	15	N/A	5	10	11
1350	90	360	6	15	N/A	5	10	11
1500	100	385	6	15	N/A	5	10	11
1650	110	410	6	15	N/A	5	10	11
SI Units								
Unit Size	Sq. Mtrs. (m ²)	Sq. Mtrs. (m ²)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)
380-440-500	6.51	15.81	N/A	.91443	N/A	N/A	1.83	N/A
575-660-750	6.51	21.76	.91443	N/A	N/A	N/A	1.83	N/A
850	7.5	18.13	1.83	1.52	1.52	1.52	3.05	2.45
950	8.18	19.99	1.83	1.52	1.52	1.52	3.05	2.45
1050	8.83	21.39	1.83	1.52	1.52	1.52	3.05	2.45
1150	9.49	23.25	1.83	1.52	1.52	1.52	3.05	2.45
1200	7.44	31.15	1.83	4.57	N/A	1.52	3.05	3.35
1350	8.37	33.48	1.83	4.57	N/A	1.52	3.05	3.35
1500	9.3	35.80	1.83	4.57	N/A	1.52	3.05	3.35
1650	10.23	38.13	1.83	4.57	N/A	1.52	3.05	3.35

Dimensions and Weights

Hot Insulation

High Temperature Hot Insulation

To minimize heat released to the equipment room, insulation is recommended in the following areas on the unit. "Factory Option" insulation illustrated in Table DW-10 and Figure DW-6 can be ordered from Trane as an option. If additional insulation is desired, the dimensions/location of "Field Supplied" are also provided.

Figure DW-6 – Hot Insulation

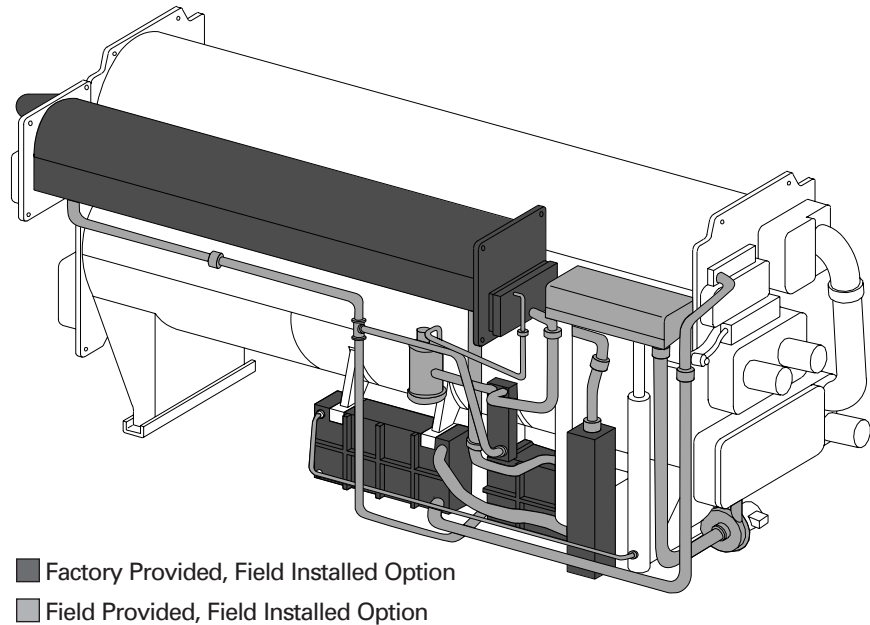


Table DW-11 – Hot Insulation Area and Length

Unit Size	Factory Option						Field Addition If Desired									
	High Temp Gen. Sq. Ft.	Low Temp HX Sq. Ft.	High Temp HX Sq. Ft.	Condensate HX Sq. Ft.	Float Chamber Sq. Ft.		12" Pipe Ln. Ft.	10" Pipe Ln. Ft.	8" Pipe Ln. Ft.	6" Pipe Ln. Ft.	4" Pipe Ln. Ft.	3" Pipe Ln. Ft.	2½" Pipe Ln. Ft.	2" Pipe Ln. Ft.	1.5" Pipe Ln. Ft.	½" Pipe Ln. Ft.
English Units																
380-440-500	107	28	23	4.5	14	NA	NA	3	NA	8	NA	18	29	10	NA	
575-660-750	160	31	26	5	14	NA	NA	3	NA	8	NA	18	38	10	NA	
850	265	23	15	6	19	NA	9	NA	12	27	46	2	9	5	13	
950	295	25	19	7	19	NA	9	NA	12	27	46	2	9	5	13	
1050	320	27	20	9	19	NA	9	NA	12	27	46	2	9	5	13	
1150	345	29	21	9	19	NA	9	NA	12	27	46	2	9	5	13	
1200	270	37	22	12	19	8	NA	NA	56	67	4	21	14	7	17	
1350	300	40	26	12	19	8	NA	NA	56	67	4	21	14	7	17	
1500	330	42	28	13	19	8	NA	NA	56	67	4	21	14	7	17	
1650	355	43	29	14	19	8	NA	NA	56	67	4	21	14	7	17	
SI Units																
Unit Size	Sq. Mtrs. (m ²)	Sq. Mtrs. (m ²)	Sq. Mtrs. (m ²)	Sq. Mtrs. (m ²)	Sq. Mtrs. (m ²)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)	Meters (m)
380-440-500	9.95	2.60	2.14	.42	1.30	NA	NA	.914	NA	2.44	NA	5.49	8.84	3.05	NA	
575-660-750	14.88	2.88	2.42	.46	1.30	NA	NA	.914	NA	2.44	NA	5.49	11.58	3.05	NA	
850	24.65	2.14	1.40	.56	1.77	NA	2.74	NA	3.66	8.23	14.02	.61	2.74	1.52	3.96	
950	27.44	2.32	1.77	.65	1.77	NA	2.74	NA	3.66	8.23	14.02	.61	2.74	1.52	3.96	
1050	29.76	2.51	1.86	.84	1.77	NA	2.74	NA	3.66	8.23	14.02	.61	2.74	1.52	3.96	
1150	32.08	2.70	1.95	.84	1.77	NA	2.74	NA	3.66	8.23	14.02	.61	2.74	1.52	3.96	
1200	25.11	3.44	2.05	1.12	1.77	2.438	NA	NA	17.07	20.42	1.22	6.40	4.26	2.13	5.18	
1350	27.9	3.72	2.42	1.12	1.77	2.438	NA	NA	17.07	20.42	1.22	6.40	4.26	2.13	5.18	
1500	30.69	3.90	2.60	1.21	1.77	2.438	NA	NA	17.07	20.42	1.22	6.40	4.26	2.13	5.18	
1650	33.01	4.0	2.70	1.30	1.77	2.438	NA	NA	17.07	20.42	1.22	6.40	4.26	2.13	5.18	

Dimensions and Weights

Weights and Connection Sizes

Table DW-12 – Weights and Connection Sizes

English Units						
Model	Weights		Connection Sizes		Unit Charging	
	Shipping [lbm]	Operating [lbm]	Evap [in]	Cond/Abs [in]	54.7% Brine [lbm]	Refrigerant [gal]
ABTF-380	30300	41400	8	8	6512	180
ABTF-440	31400	43300	8	8	6919	175
ABTF-500	32500	44700	8	8	6919	175
ABTF-575	39500	55200	8	10	8954	250
ABTF-660	40800	57000	8	10	8954	245
ABTF-750	42000	59000	8	10	9361	245
ABTF-850	52800	74500	10	12	11803	235
ABTF-950	56500	79800	10	12	12617	270
ABTF-1050	59800	84700	10	12	13431	295
ABTF-1150	63200	90200	10	12	14652	325
ABTF-1200*	75200	104400	14	14	14652	145
ABTF-1350*	80200	112000	14	14	15873	155
ABTF-1500*	85000	119000	14	14	17501	160
ABTF-1650*	89900	126100	14	14	18722	170

SI Units						
Model	Weights		Connection Sizes		Unit Charging	
	Shipping [kg]	Operating [kg]	Evap [mm]	Cond/Abs [mm]	54.7% Brine [kg]	Refrigerant [l]
ABTF-380	13744	18779	203	203	2954	681
ABTF-440	14243	19641	203	203	3138	662
ABTF-500	14742	20276	203	203	3138	662
ABTF-575	17917	25039	203	254	4062	946
ABTF-660	18507	25855	203	254	4062	927
ABTF-750	19051	26762	203	254	4246	927
ABTF-850	23950	33793	254	305	5354	889
ABTF-950	25628	36197	254	305	5723	1022
ABTF-1050	27125	38420	254	305	6092	1117
ABTF-1150	28668	40915	254	305	6646	1230
ABTF-1200*	34111	47356	356	356	6646	549
ABTF-1350*	36379	50803	356	356	7200	587
ABTF-1500*	38556	53978	356	356	7938	606
ABTF-1650*	40779	57199	356	356	8492	643

Note: The weight information provided here should be used for general information purposes only. Trane does not recommend using this weight information for considerations relative to chiller handling. The large number of variances between chiller selections drives variances in chiller weights that are not recognized in this table.

*Assembled weight. Units leave factory disassembled.

Jobsite Connections

Steam Supply Piping

Steam Supply

Figure JC-1 illustrates a typical steam supply piping illustration that includes the appropriate hardware.

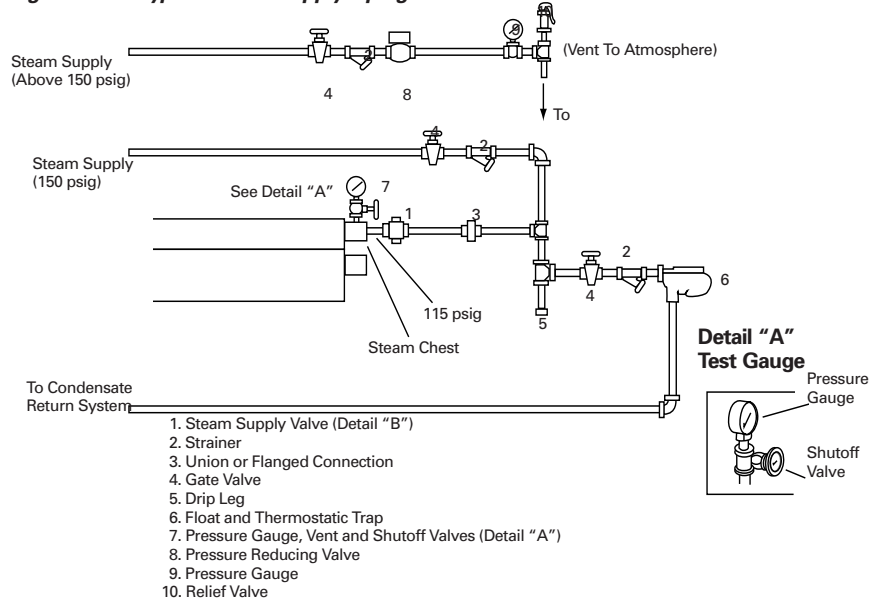
The steam supply piping should be designed in accordance with good design practice, providing strainers, unions and gate valves for ease of operation and maintenance. A properly sized steam modulating valve, based on design flow and pressure drop requirements, is provided factory mounted by The Trane Company.

A hand valve in the steam supply piping is recommended when the machine will be out of operation for an extended period. The modulating steam valve may experience a small amount of leakage during shutdown. This leakage may result in heating of the equipment room unless the machine is properly valved off with a hand valve.

In all applications, it is recommended that the steam supply pressure to the control valve inlet not exceed design to assure proper valve close off. If steam supply pressures exceed design, a pressure reducing station should be used to control the steam pressure to the valve.

The unit control has adjustable features which minimize steam draw on start-up. The adjustable steam control feature allows the user to adapt the machine to the available steam source capability.

Figure JC-1 – Typical Steam Supply Piping



Note: Nominal steam valve is selected for a pressure drop of 5 to 10 psig @ full load. If steam supply pressure exceeds the selected valve pressure drop, a pressure reducing valve (Item 8) may be needed.

Detail "B" - Steam Supply Valve

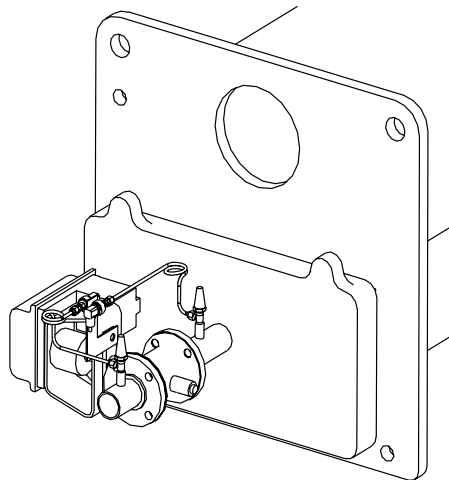


Table JC-1 – Steam Supply Piping Responsibilities

Item	Material Provided By		Installed By	
	Trane	Other	Trane	Other
Steam Control Valve	X		X	
T-Type Strainer, Flanged connections, gate valve, drip leg w/dirt pocket, float and thermostatic trap, pressure gauge vent and valve, pressure reducing valve, pressure gauge, relief valve.		X		X

Jobsite Connections

Hot Water Piping

Hot Water Piping

Expansion of the tubes in the generator is a normal condition due to the water temperatures reached in the tube bundle. All Trane absorption units use a combination of fixed and floating tube supports to control the direction of generator tube expansion. Normally, this expansion is uniformly distributed throughout the bundle. However, during shutdown, when very small amounts of hot water may leak through the valve, the first tube pass reaches the temperature of the hot water while the remaining passes are cold.

Consequently, it is recommended that the supply and return piping include a circulating pump, check valve and cold legs to protect the generator tubes from the unequal expansion should the control valve leak during unit shutdown. This system is designed to eliminate hot water flow through the generator during unit shutdown.

Figure JC-2 illustrates the recommended method for applying up to 370 F (+187.8 C) hot water to the generator section. This generator design is rated to 400 psig. The piping includes a circulating pump and secondary hot water loop and should be designed in accordance with good design practice providing strainers, unions and gate valves for ease of operation and maintenance. The pump circulates water through the generator at a constant rate and the temperature within the loop is controlled by mixing recirculated water with hot water from the supply main. A properly sized modulating two-way positive shutoff valve controls the amount of water leaving the loop and therefore, determines the temperature of mixed water entering the generator. This valve is provided by The Trane Company. This valve is also selected based on design flow and pressure drop requirements submitted by the consulting engineer.

The hot water inlet must always be connected to the right side of the machine. Right hand is determined by standing in front of the unit facing the control panels.

Figure JC-2 – Hot Water Supply Temperature Piping

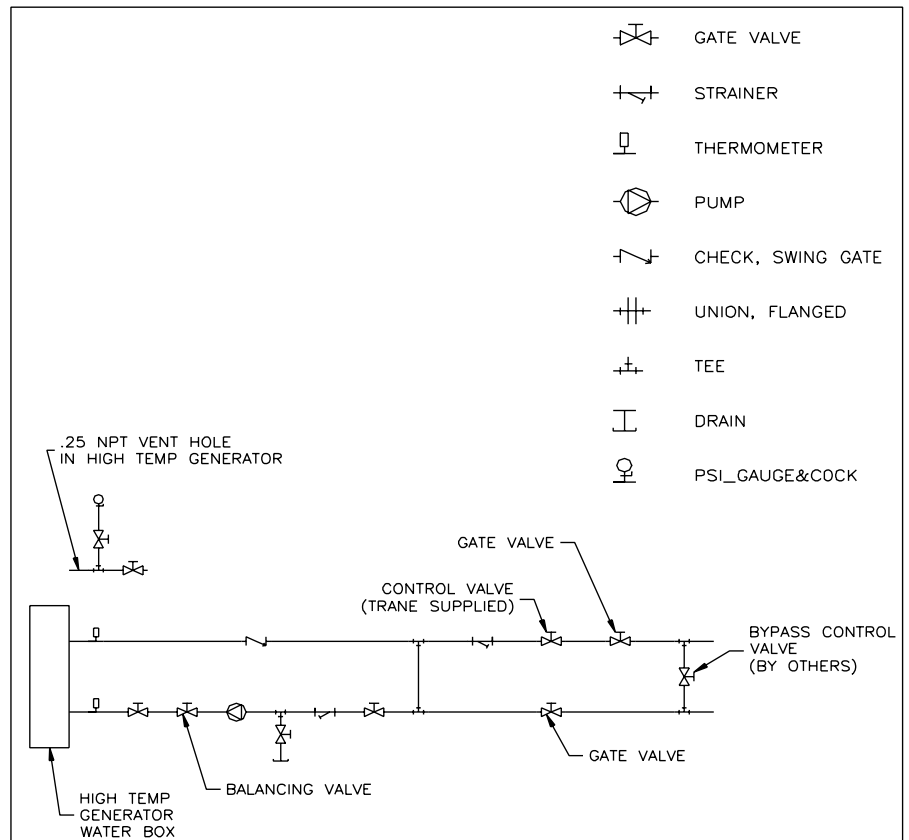


Table JC-2 – Hot Water Supply Piping Responsibilities

Item	Material Provided By		Installed By	
	Trane	Other	Trane	Other
Capacity Control Valve	X			X
Gate valve, balance valve, Y-type strainer w/valve, bypass circuit, check valve, thermometer, pressure gauge, vent shutoff valve, union or flanged connection circulating pump		X		X

Jobsite Connections

Condensate Piping

Condensate Handling

Figure JC-3 illustrates a method of condensate drain. At full load, the condensate leaving a two-stage absorption chiller is approximately 210 F (+98.9 C). This temperature minimizes flashing in a low pressure or open condensate return system. An automatic condensate trapping system is provided as standard with the unit. This system is designed to dump condensate into an atmospheric return.

Figure JC-3 – Typical Condensate Piping

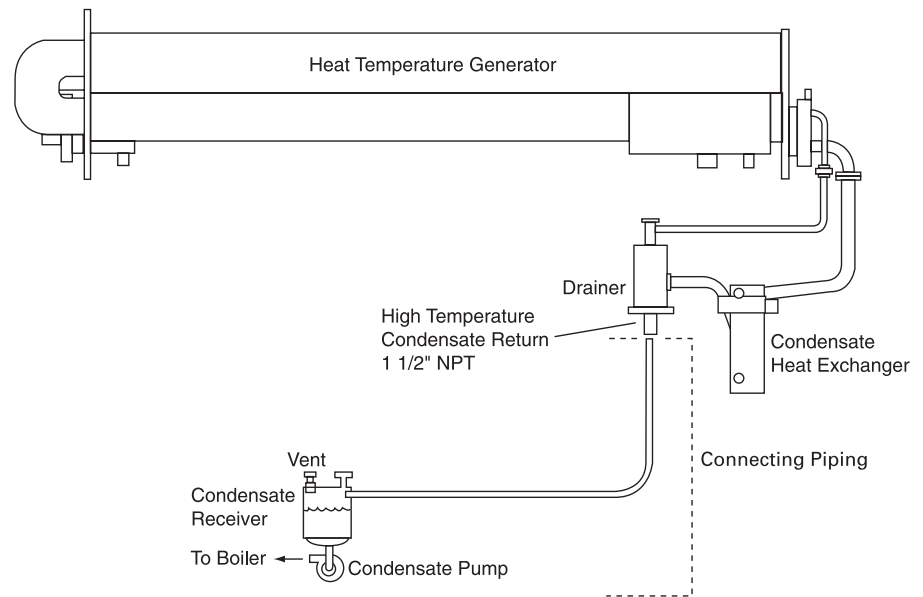


Table JC-3 – Condensate Return Piping Responsibility

Item	Material Provided By		Installed By	
	Trane	Other	Trane	Other
Drainer	X		X	
Connecting Piping		X		X

Jobsite Connections

Cooling Water Piping

Cooling Water Piping

Figure JC-4 and JC-5 illustrate the recommended methods to apply cooling water to the Trane absorption machine. In those cases where a cooling tower bypass is not used, multiple cooling tower fans are recommended.

The cooling water piping design for absorption chillers differs from conventional reciprocating and centrifugal systems in that cooling water passes through the absorber section of the machine prior to entering the condenser. **The cooling water flow must be controlled by the absorption machine as a function of normal control and machine safety.**

Trane Horizon™ two-stage absorption machines are designed to start-up with cooling tower water temperatures as low as 45 F (+7.2 C) and operate with temperatures as low as 55 F (+12.8 C). In typical applications, the machine is selected on the basis of the cooling water temperature available at full load. This is usually 85 F (+29.4 C).

With the cooling tower sized for design conditions, the temperature of the cooling water supplied to the unit will decrease with any decrease in cooling load or depression of outside wet bulb temperature. These reduced cooling water temperatures will normally tend to increase the capacity potential of the absorption machine. The Trane control system takes advantage of this improved efficiency by using automatic controls that limit the energy input to the machine based on entering cooling water temperature.

Cooling water temperature control is always required. At light loads with cold outside conditions, cycling of the cooling tower fan will result in undesirable variation in steam demand and leaving chilled water temperature. Consequently, Trane recommends consideration of multiple speed tower fans or a cooling tower bypass valve to reach equilibrium at all load conditions. Rate of change allowable is 1 degree per minute.

Water temperature sensors are factory-installed on the entering and leaving sides of the absorber and condenser water connections. The operating temperatures can be monitored from the control panel.

Figure JC-4 – Cooling Water Piping with Cooling Tower

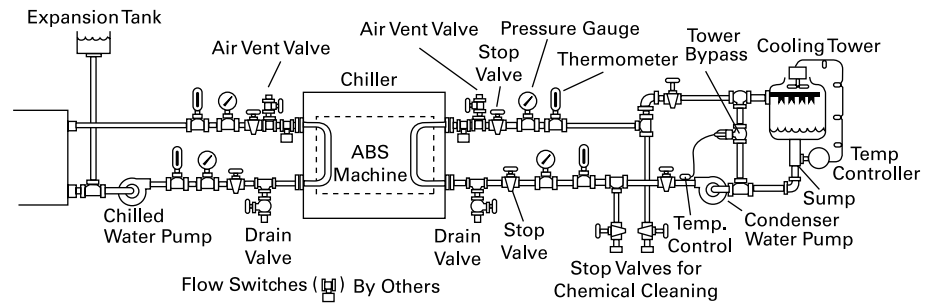


Figure JC-5 – Cooling Water Piping with Well or River Water

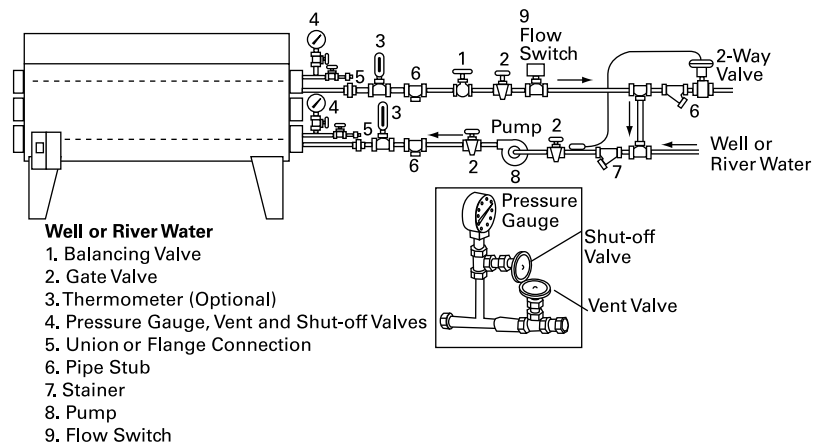


Table JC-4 – Condenser/Absorber Piping Responsibility

Item	Material Provided By		Installed By	
	Trane	Other	Trane	Other
Crossover Pipe	X		X	
Flow Switch	(optional) X or	X		X
Balancing valve, gate valve, thermometer (optional), pressure gauge vent and shutoff valve, Victaulic or flange connection, pipe stub, strainer, pump.		X		X

Mechanical Specifications

General

Unit is a complete double effect steam or hot water fired absorption chiller consisting of high temperature generator, low temperature generator/condenser section, evaporator/absorber section, controls, pumps, heat exchangers, and steam control valve. All units are a completely hermetic design, factory assembled and leak tested prior to shipment. Units can be separated and shipped disassembled for rigging purposes (largest sizes always ship disassembled). The control panel, energy valve, and sensors are factory installed. Unit is painted prior to shipping with two coats consisting of a water base air dry primer and finish coat. Standard method of shipment is by truck from the USA.

Low Temperature Generator/Condenser-Evaporator/Absorber

The shell material is carbon steel. Standard low temperature generator tube material is cupro-nickel, Evaporator is copper, absorber is cupro-nickel and condenser is copper. Tubes are mechanically rolled into the tubesheets and are replaceable from either end. Condenser, evaporator and absorber tube supports are fixed. The low temperature generator consists of fixed and floating tube supports to allow for even tube expansion. Spray systems are replaceable from end of unit without sacrificing the hermetic integrity of the unit.

Design working pressure for the water boxes is 150 psig (10.5 kg/cm²). All tube bundles are tested at 150 percent of design working pressure. All water boxes, except the second-stage generator, have gasketed removable covers for access. Marine type water boxes are provided on the condenser and absorber section. Water connections are provided with either Victualic or raised-face flanged connections.

Heat Exchangers

Three welded hermetic plate solution heat exchangers are provided to improve unit performance. Heat exchanger surfaces are 300 series stainless steel.

Pumps

Solution and refrigerant are circulated by means of four hermetic, single stage centrifugal pumps. The pump impeller is cast iron with a steel shaft supported by two tapered carbon bearings. The bearings are lubricated and the fluid that is pumped cools the motor. An adjustable frequency drive is provided on the low temperature generator pump and absorber pump to provide solution control.

Purge

Purge system includes a collection chamber in 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 removal of the non-condensables. The purge operates automatically to remove non-condensables from the unit during periods of chiller operation and shutdown. Logging of purge information is provided via the unit control panel.

High Temperature Generator

The shell is carbon steel. Tube sheets are steel and standard generator tubes are constructed of stainless steel. The high temperature generator has fixed and floating tube supports to allow for even tube expansion. The steam side of the generator is designed and stamped for 150 PSI ASME construction. Unit high temperature generator includes rupture disk which is sized to meet ANSI/ASHRAE STD 15. Factory mounted and wired energy control valve is standard.

Mechanical Specifications

Control Panel

The UCP2™ is a microprocessor-based chiller control system that provides complete stand-alone operation. It is a factory mounted package including a full compliment of controls to safely and efficiently operate the absorption liquid chiller. The UCP2 consists of the following items:

Control Functions:

- Chilled water temperature control
- Concentration control

System Features and Functions:

- User interface with a 40 character, 2 line display and a 16 key keypad, capable of displaying 7 languages and SI or English units
- Passwords for protection of unit setup and configuration
- Chilled water pump control
- Absorber/Condenser pump control
- Automatic and manual control of solution and refrigerant pumps
- Economical solution flow control of the low temperature solution pump and absorber pump via an adjustable frequency drive
- Anti-crystallization through dilution control
- Automatic and manual purge system
- Chilled water reset
- Two-way valve assembly for hot water flow control or steam flow control.

Adaptive Limits:

- Evaporator water temperature limit
- High interstage pressure 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
- High interstage pressure cutout to prevent excessive pressure
- Emergency stop/shutdown
- Under/over voltage detection

Monitor and Displays:

- Chilled water temperature entering and leaving
- Absorber/condenser water temperature entering and leaving
- Solution concentrations
- Solution temperatures
- Interstage pressure
- Total pump current
- Unit voltage
- Chiller run time and starts
- Purge operation and run time

Interfaces to UCP2:

- External machine manual reset alarm indication output
- External machine auto reset warning indication output
- External limit warning indication output
- Interstage pressure relief request output
- Maximum capacity indication output
- External auto-stop/emergency shutdown
- External chilled water setpoint



Mechanical Specifications

Contractor Responsibilities

1. Install the unit on a level surface. Neoprene isolation pads supplied by the manufacturer shall be placed under the unit.
2. Connect-unit control panel to all operating external safety and auxiliary control devices.
3. Insure that piping adjacent to the machine does not restrict removal of headers for inspection, cleaning and removing tubes.
4. Provide gauge cocks and optional thermometer wells for temperature and pressure readings at the inlet and outlet of the evaporator, at the inlet and outlet of the absorber, and at the outlet of the condenser.
5. Provide balancing valves in all external water circuits to allow balance and trim of the system.
6. Provide and install strainers ahead of all pumps and automatic modulating valves to insure proper pump and valve operation.
7. Insulate the chilled water headers and other portions of the unit, as pointed out in the manufacturer's installation literature to prevent condensation on cold surfaces and heat loss from hot surfaces to the equipment room. External unit pipes with surface temperatures sufficiently hot to constitute a danger to operating personnel shall also be insulated.
8. Provide and install a flow switch in the chilled water circuit and interlock it with the starting control circuit of the unit. Proof of flow is required prior to permitting unit operation. Provide and install a flow switch in the condenser water circuit, which shall be interlocked with the starting control circuit of the unit such that proof of flow is required to prevent machine damage
9. Provide necessary distilled or demineralized water for refrigerant charge, and trim charge.
10. Provide labor to charge the machine with lithium bromide solution and refrigerant water, and assist in machine starting and calibration under supervision of the manufacturer's representative.
11. Provide sufficient sized vacuum pump and personnel to evacuate the unit prior to charging (if required).
12. Field assemble machines (if required) and leak test in accordance with instructions in the manufacturer's installation bulletin.
13. Connect the rupture disc to an appropriate floor drain or retention chamber. The vent piping shall be supported and connected by a flexible connector to prevent stress at the connection.
14. Install any control components provided by the manufacturer for installation external to the machine.
15. Furnish and install, external to the unit control panel, a separately fused disconnect switch, if not provided.
16. Install required power supply wiring to the control panel. Use copper wire only.

Insulation Required

Insulation is required on hot areas to protect operating and service personnel and on cold areas to prevent sweating. Cold insulation can be ordered as a factory installed option. Hot insulation for the high temperature generator; high, low and condensate heat exchangers; float chamber and 8" and 10" (203 and 254 mm) piping can be ordered as a field installed option. Hot insulation for the connecting piping is field provided, field installed.

Insulation for the hot insulation area should be 3-inch (76.2 mm) #8 density mineral wool applied over stud weld pins it should be applied on the generator, high temperature heat exchanger and associated piping.

Insulation for cold insulation area should be ¾-inch (13 mm) Armaflex or equal should be applied to evaporator waterboxes, refrigerant storage tank, refrigerant pump and refrigerant piping.

Unit Options

Unit options shall include:

- 300 psi waterboxes
- Marine-style waterboxes on the evaporator
- Special tubing
- Disassembled unit
- Factory installed cold insulation
- NEMA 4X controls

Standard Features/ Options/Design Special Options

Standard Features

- Lithium bromide filter
- Victaulic water connections
- 50,000 hours design life solution pumps
- Industrial-grade tubes unmatched in the industry
 - 1st Stage Generator – 409 Stainless Steel
 - 2nd Stage Generator – .028" wall 95/5 CuNi
 - Evaporator – .025" Copper
 - Absorber – .022" wall 95/5 CuNi
 - Condenser – .028" wall Copper
- Factory mounted and tested microprocessor controls
- 150 PSIG water boxes
- Marine water boxes on the condenser and absorber sections
- Factory installed cooling-water crossover pipe
- Industrial duty factory mounted energy valve
- Environmentally friendly inhibitor
- Fixed and floating tube supports which allow for expansion of tubes without problems of high stress
- Designed, manufactured and tested for superior hermetic integrity
- Fully automatic purge

Options

- 150 PSIG raised face flanges for the evaporator, condenser, and absorber water connections
- Major component disassembly in two or three pieces for installations that can benefit from the handling of smaller components
- Factory provided, factory installed cold insulation
- Factory provided, field installed hot insulation

Design Special Options

Horizon™ chiller production in La Crosse WI maintains its high production standards for its standard product lines while also producing design specials under the same high standards. Design special options include:

- 035-.049 wall tubes
- 90/10 CuNi, stainless steel and titanium tubes
- 300 PSIG water boxes
- Epoxy coated waterboxes
- NEMA 4 and 4X for additional chiller protection against to outdoor elements or water impingement from various directions
- Alternate pass arrangements
- Explosion-proof for specifications that require additional chiller/control panel enclosure
- Marine style evaporator water boxes
- Epoxy paint – primer and finish ships with chiller for added protection against outdoor elements or corrosive environments such as chemical plants or salt water locations
- Special paints for special applications
- Sacrificial anodes for use where corrosive water is present
- Gantries for "swing out" end plates for easy tube cleaning capability
- Custom control configurations
- Specials for compliance with code/market requirements
- Special packaging requirements
- Options for using non-standard heat sources
- Hinged water box covers



Standard Conversion Table

To Convert From:	To:	Multiply By:	To Convert From:	To:	Multiply By:
Length			Energy and Power and Capacity		
Feet (ft)	meters (m)	0.30481	British Thermal Units (BTUH)	Kilowatt (kW)	0.000293
Inches (In)	millimeters (mm)	25.4	British Thermal Units (BTU)	KCalorie (Kcal)	0.252
Area			Tons (refrig. effect)	Kilowatt (refrig. effect)	3.516
Square Feet (ft ²)	square meters (m ²)	0.093	Tons (refrig. effect)	Kilocalories per hour (Kcal/hr)	3024
Square Inches (In ²)	square millimeters (mm ²)	645.2	Horsepower	Kilowatt (kW)	0.7457
Volume			Pressure		
Cubic Feet (ft ³)	Cubic meters (m ³)	0.0283	Feet of water (ftH ₂ O)	Pascals (PA)	2990
Cubic Inches (In ³)	Cubic mm (mm ³)	16387	Inches of water (inH ₂ O)	Pascals (PA)	249
Gallons (gal)	litres (l)	3.785	Pounds per square inch (PSI)	Pascals (PA)	6895
Gallons (gal)	cubic meters (m ³)	0.003785	PSI	Bar or KG/CM ²	6.895 x 10 ⁻²
Flow			Weight		
Cubic feet/min (cfm)	cubic meters/second (m ³ /s)	0.000472	Ounces (oz)	Kilograms (kg)	0.02835
Cubic Feet/min (cfm)	cubic meters/hr (m ³ /hr)	1.69884	Pounds (lbs)	Kilograms (Kg)	0.4536
Gallons/minute (GPM)	cubic meters/hr (m ³ /hr)	0.2271	Fouling factors for heat exchangers		
Gallons/minute (GPM)	litres/second (l/s)	0.06308	0.00075 ft ² °F hr/BTU	= 0.132 m ² °K/kW	
Velocity			0.00025 ft ² °F hr/BTU	= 0.044 m ² °K/kW	
Feet per minute (ft/m)	meters per second (m/s)	0.00508			
Feet per second (ft/s)	meters per second (m/s)	0.3048			

Temperature – Centigrade (°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			Temperature			Temperature			Temperature			Temperature		
°C	C or F	°F	°C	C or F	°F	°C	C or F	°F	°C	C or F	°F	°C	C or F	°F
-40.0	-40	-40.0	-15.0	+5	+41.0	+10.0	+50	+122.0	+35.0	+95	+203.0	+60.0	+140	+284.0
-39.4	-39	-38.2	-14.4	+6	+42.8	+10.6	+51	+123.8	+35.6	+96	+204.8	+60.6	+141	+285.8
-38.9	-38	-36.4	-13.9	+7	+44.6	+11.1	+52	+125.6	+36.1	+97	+206.6	+61.1	+142	+287.6
-38.3	-37	-34.6	-13.3	+8	+46.4	+11.7	+53	+127.4	+36.7	+98	+208.4	+61.7	+143	+289.4
-37.8	-36	-32.8	-12.8	+9	+48.2	+12.2	+54	+129.2	+37.2	+99	+210.2	+62.2	+144	+291.2
-37.2	-35	-31.0	-12.2	+10	+50.0	+12.8	+55	+131.0	+37.8	+100	+212.0	+62.8	+145	+293.0
-36.7	-34	-29.2	-11.7	+11	+51.8	+13.3	+56	+132.8	+38.3	+101	+213.8	+63.3	+146	+294.8
-36.1	-33	-27.4	-11.1	+12	+53.6	+13.9	+57	+134.6	+38.9	+102	+215.6	+63.9	+147	+296.6
-35.6	-32	-25.6	-10.6	+13	+55.4	+14.4	+58	+136.4	+39.4	+103	+217.4	+64.4	+148	+298.4
-35.0	-31	-23.8	-10.0	+14	+57.2	+15.0	+59	+138.2	+40.0	+104	+219.2	+65.0	+149	+300.2
-34.4	-30	-22.0	-9.4	+15	+59.0	+15.6	+60	+140.0	+40.6	+105	+221.0	+65.6	+150	+302.0
-33.9	-29	-20.2	-8.9	+16	+60.8	+16.1	+61	+141.8	+41.1	+106	+222.8	+66.1	+151	+303.8
-33.3	-28	-18.4	-8.3	+17	+62.6	+16.7	+62	+143.6	+41.7	+107	+224.6	+66.7	+152	+305.6
-32.8	-27	-16.6	-7.8	+18	+64.4	+17.2	+63	+145.4	+42.2	+108	+226.4	+67.2	+153	+307.4
-32.2	-26	-14.8	-7.2	+19	+66.2	+17.8	+64	+147.2	+42.8	+109	+228.2	+67.8	+154	+309.2
-31.7	-25	-13.0	-6.7	+20	+68.0	+18.3	+65	+149.0	+43.3	+110	+230.0	+68.3	+155	+311.0
-31.1	-24	-11.2	-6.1	+21	+69.8	+18.9	+66	+150.8	+43.9	+111	+231.8	+68.9	+156	+312.8
-30.6	-23	-9.4	-5.5	+22	+71.6	+19.4	+67	+152.6	+44.4	+112	+233.6	+69.4	+157	+314.6
-30.0	-22	-7.6	-5.0	+23	+73.4	+20.0	+68	+154.4	+45.0	+113	+235.4	+70.0	+158	+316.4
-29.4	-21	-5.8	-4.4	+24	+75.2	+20.6	+69	+156.2	+45.6	+114	+237.2	+70.6	+159	+318.2
-28.9	-20	-4.0	-3.9	+25	+77.0	+21.1	+70	+158.0	+46.1	+115	+239.0	+71.1	+160	+320.0
-28.3	-19	-2.2	-3.3	+26	+78.8	+21.7	+71	+159.8	+46.7	+116	+240.8	+71.7	+161	+321.8
-27.8	-18	-0.4	-2.8	+27	+80.6	+22.2	+72	+161.6	+47.2	+117	+242.6	+72.2	+162	+323.6
-27.2	-17	+1.4	-2.2	+28	+82.4	+22.8	+73	+163.4	+47.8	+118	+244.4	+72.8	+163	+325.4
-26.7	-16	+3.2	-1.7	+29	+84.2	+23.3	+74	+165.2	+48.3	+119	+246.2	+73.3	+164	+327.2
-26.1	-15	+5.0	-1.1	+30	+86.0	+23.9	+75	+167.0	+48.9	+120	+248.0	+73.9	+165	+329.0
-25.6	-14	+6.8	-0.6	+31	+87.8	+24.4	+76	+168.8	+49.4	+121	+249.8	+74.4	+166	+330.8
-25.0	-13	+8.6	0.0	+32	+89.6	+25.0	+77	+170.6	+50.0	+122	+251.6	+75.0	+167	+332.6
-24.4	-12	+10.4	+0.6	+33	+91.4	+25.6	+78	+172.4	+50.6	+123	+253.4	+75.6	+168	+334.4
-23.9	-11	+12.2	+1.1	+34	+93.2	+26.1	+79	+174.2	+51.1	+124	+255.2	+76.1	+169	+336.2
-23.3	-10	+14.0	+1.7	+35	+95.0	+26.7	+80	+176.0	+51.7	+125	+257.0	+76.7	+170	+338.0
-22.8	-9	+15.8	+2.2	+36	+96.8	+27.2	+81	+177.8	+52.2	+126	+258.8	+77.2	+171	+339.8
-22.2	-8	+17.6	+2.8	+37	+98.6	+27.8	+82	+179.6	+52.8	+127	+260.6	+77.8	+172	+341.6
-21.7	-7	+19.4	+3.3	+38	+100.4	+28.3	+83	+181.4	+53.3	+128	+262.4	+78.3	+173	+343.4
-21.1	-6	+21.2	+3.9	+39	+102.2	+28.9	+84	+183.2	+53.9	+129	+264.2	+78.9	+174	+345.2
-20.6	-5	+23.0	+4.4	+40	+104.0	+29.4	+85	+185.0	+54.4	+130	+266.0	+79.4	+175	+347.0
-20.0	-4	+24.8	+5.0	+41	+105.8	+30.0	+86	+186.8	+55.0	+131	+267.8	+80.0	+176	+348.8
-19.4	-3	+26.6	+5.5	+42	+107.6	+30.6	+87	+188.6	+55.6	+132	+269.6	+80.6	+177	+350.6
-18.9	-2	+28.4	+6.1	+43	+109.4	+31.1	+88	+189.4	+56.1	+133	+271.4	+81.1	+178	+352.4
-18.3	-1	+30.2	+6.7	+44	+111.2	+31.7	+89	+192.2	+56.7	+134	+273.2	+81.7	+179	+354.2
-17.8	0	+32.0	+7.2	+45	+113.0	+32.2	+90	+194.0	+57.2	+135	+275.0	+82.2	+180	+356.0
-17.2	+1	+33.8	+7.8	+46	+114.8	+32.8	+91	+195.8	+57.8	+136	+276.8	+82.8	+181	+357.8
-16.7	+2	+35.6	+8.3	+47	+116.6	+33.3	+92	+197.6	+58.3	+137	+278.6	+83.3	+182	+359.8
-16.1	+3	+37.4	+8.9	+48	+118.4	+33.9	+93	+199.4	+58.9	+138	+280.4	+83.9	+183	+361.4
-15.6	+4	+39.2	+9.4	+49	+120.2	+34.4	+94	+201.2	+59.4	+139	+282.2	+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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