Thermachill™ Absorption Chillers

Thermachill™ Two-Stage Direct-Fired Absorption Chillers
100-1100 Tons

October 2004

Features and Benefits

Thermachill™ Absorption Chillers

The Thermachill direct-fired absorption chiller is available from 100 to 1100 tons. All sizes have the ability to produce both chilled water for space cooling and hot water for space heating. And for some applications, the direct-fired absorption chiller can replace the traditional combination of chiller plus boiler, saving a significant amount of floor space.

The Trane direct-fired absorption chiller uses a two-stage absorption cycle resulting in a COP of 1.0, including the burner. Again, these performance characteristics make the direct-fired absorption chiller ideal for areas where electric rates have risen dramatically in recent years.

Continuing the Trane Tradition of Reliability

The Thermachill absorption chiller is very similar to the conventional steam and hot water fired absorption chillers that Trane has manufactured for over 30 years. The design of the direct-fired absorption machine is based on traditional absorption and burner technology. In place of the conventional steam/hot water generator, a burner — which is an integral part of the chiller — uses natural gas or other fuels to fire the absorption refrigeration cycle. The refrigeration cycle uses the proven, safe and environmentally compatible lithium bromide and water combination.

Customer satisfaction with the performance and reliability of its chillers has solidified Trane as the world leader in commercial water chillers. The Trane Thermachill absorption chiller continues in the Trane tradition of commitment to innovation, quality and reliability, offering you a proven choice in how you consume energy to produce chilled water.

Thermachill Absorption Chiller Technology

- Energy efficient design uses a patented two-stage, reverse cycle. A high efficiency heat economizer further enhances energy savings by recovering thermal energy from exhaust gas.
- Welded body construction and design results in hermetic integrity for quality, airtight construction.
- High temperature generator and exhaust gas economizer use a simplified design to reduce maintenance costs and improve reliability. A unique generator design eliminates tubes.
- Factory-installed and wired control panel.
- Factory-installed and tested purge pump to assure hermetic integrity and improve reliability.
- Integral absorber-to-condenser crossover pipe.
- Run-tested at design conditions to assure dependable performance.
- High efficiency option available.
- Gordon-Piatt burner provides flexibility to meet local U.S. codes.
- Optional dual fuel burners fired by natural gas, No. 2 oil or LPG.
- Other burners are also available for international applications.

Contents

Features and Benefits

Hermetic Integrity
High quality design, construction and testing are critical to assuring hermetic integrity. Since the absorption chiller operates in an extreme vacuum, it is critical that this condition be maintained for both efficiency and reliability. Air leakage into the machine decreases capacity, increases fuel consumption and depletes the solution inhibitors. Air leakage must be minimized and inhibitor levels must be maintained to prevent corrosion from reducing the life of the machine. The Trane design assures that purge requirements are minimal.

State-of-the-art mass spectrometer testing is performed on every Thermachill chiller to make sure the unit is leak-tight before leaving the factory. Minimal use of valves and gasketed joints further insures leak tightness.

This is a key item for long life, reduced crystallization potential and for excessive inhibitor consumption in any absorption product.

Necessary valves are either a diaphragm type or a special design system type with an effective double seal. This leak-tight construction requires purging only a few times per year by the mechanical purge pumps. In Japan, models 240 tons and below are not even equipped with mechanical purge pumps.

Energy Efficient Cycle
A unique reverse solution flow allows this design to greatly reduce fuel consumption. The use of an economizer enhances fuel consumption. Cooling and heating efficiency is increased by recovering thermal energy from the exhaust gas.

Auxiliary Component Operation Unnecessary During Shutdown Cycle
Operation of auxiliary equipment such as cooling water pumps, chilled water/hot water pumps and cooling tower fans during a dilution cycle is unnecessary, further reducing energy costs.

Simplified Generator Design
The high-temperature or direct-fired generator uses a concentric cylinder design which contains no tubes in the fire chamber. This both increases reliability and reduces maintenance. Solution recirculation provides uniform temperatures and reduces thermal stresses.

Gordon-Piatt Combustion Burner
Trane is working with the U.S. burner manufacturer that has set the standard for combustion burners in the United States for over 40 years. Gordon-Piatt supplies burners for many heating products and almost all direct-fired absorption chillers supplied in the United States. They bring the knowledge, experience and flexibility to meet local codes. The combustion burner, burner control panel and pre-piped gas train ship directly to the jobsite for installation independent from the chiller.

Factory-Installed and Wired Control Panel and Purge Assembly
Both the unit control panel and the purge pump assembly are factory mounted and tested, and ship on the unit. The unit control panel will be supplied with an interconnecting cable for connection to the burner control panel. The purge assembly requires no field-mounting or field-wiring.

Single Cooling/Heating Switch Valve
All models can provide heating or cooling from the same evaporator section. This concept minimizes installation piping and control. The changeover from cooling to heating or back is accomplished by simply switching one valve on the machine. Four-pipe cooling/heating systems require additional installation and control.

Factory Performance Tested
Every assembled unit is factory performance tested at specific design conditions. The performance of the chiller is detailed, assuring that the chiller meets specified performance before it leaves the factory. This test is certified with a report, signed by an officer of the company.

Crossover Pipe
Integral to the design is the crossover between the absorber and condenser sections which supplies cooling water to the unit. This feature saves the installing contractor both material and labor.

Other Cost-Solving Features
Project costs are further reduced because units up through the model ABDL-900 can ship factory-charged with proper solution levels. Optionally, models ABDL-800 to 1100 can ship disassembled for critical access jobsite limitations, and are field run-tested.

All units come with a factory-installed rupture disk, in accordance with ANSI/ASHRAE 15.

Models ABDL-800 to 1100 are provided with marine-style water boxes as standard, reducing maintenance costs by allowing tubes to be cleaned without disconnecting large system water piping.

All sizes use a single burner with one top exhaust flue connection. A flue access duct connection is provided for field installation to the stack.

Features and Benefits

Reliable by Design

Experience
The Trane Company has been the leading manufacturer of absorption chillers in the United States for over 40 years. Trane has been the only company that has continued to produce domestically and remain in the marketplace through the changing of absorption markets. This has given Trane a solid base for continuing improvements which provide customers with high efficiency alternatives for the economics of energy choices in the next decade.

Trane is pleased to work with the Japanese leader in large tonnage absorption chillers, Kawasaki Thermal Engineering (KTE). This specific design has a proven record of superior reliability in over 2000 installations for nearly 10 years.

Advanced Operating Cycle
The reverse solution flow cycle used on the Thermachill product is one of the most efficient refrigerant cycles in production today. Reverse solution flow simply means the lithium bromide solution is pumped to the low temperature generator first and then to the direct-fired or high temperature generator. Improved efficiencies of COP's near 1.04 (HHV) are achieved by operating at higher concentrations in the high-temperature generator.

These concentrations are at safe levels because the operating temperatures are farther from the crystallization line than the temperatures of solutions leaving low temperature heat exchangers on other designs. These concentrations are mixed to safe levels as they are cooled throughout the cycle.

Control System
Control of the chiller is an integrated circuit with built-in logic to operate and protect an unsafe condition. Standard safety controls include crystallization concentration limiting, high and low temperature and pressure limits, and additional safeties are added externally to meet UL requirements. Crystallization concentration limiting senses impending crystallization and takes action to prevent it.

Materials and Construction
The solution and refrigerant pumps are a hermetic design with long-life, self-lubricating carbon bearings. Stainless steel construction is used for both pump and motor construction. Periodic maintenance is not required.

The basic unit is constructed with steel shells and tubesheets with many internal parts being stainless steel, such as screens, eliminators and flow distribution devices. Tubing is steel, copper and stainless steel which are compatible with the inhibitor system used.

The absorbent-refrigerant used in the Thermachill design is lithium bromide and water. The Thermachill unit uses a highly successful proprietary inhibitor to protect against corrosion. Trane has broad experience with corrosion inhibitors and fully recognizes the superiority of the KTE system.

The Thermachill inhibitor system in use for about 15 years has proven that the choice of tube and shell materials provides a reliable design. Further, the design of the direct-fired generator avoids the use of tubes in the fire chamber and has a unique solution distribution pattern that eliminates hot spots which can cause excessive inhibitor depletion, thermal stress and tube failures.

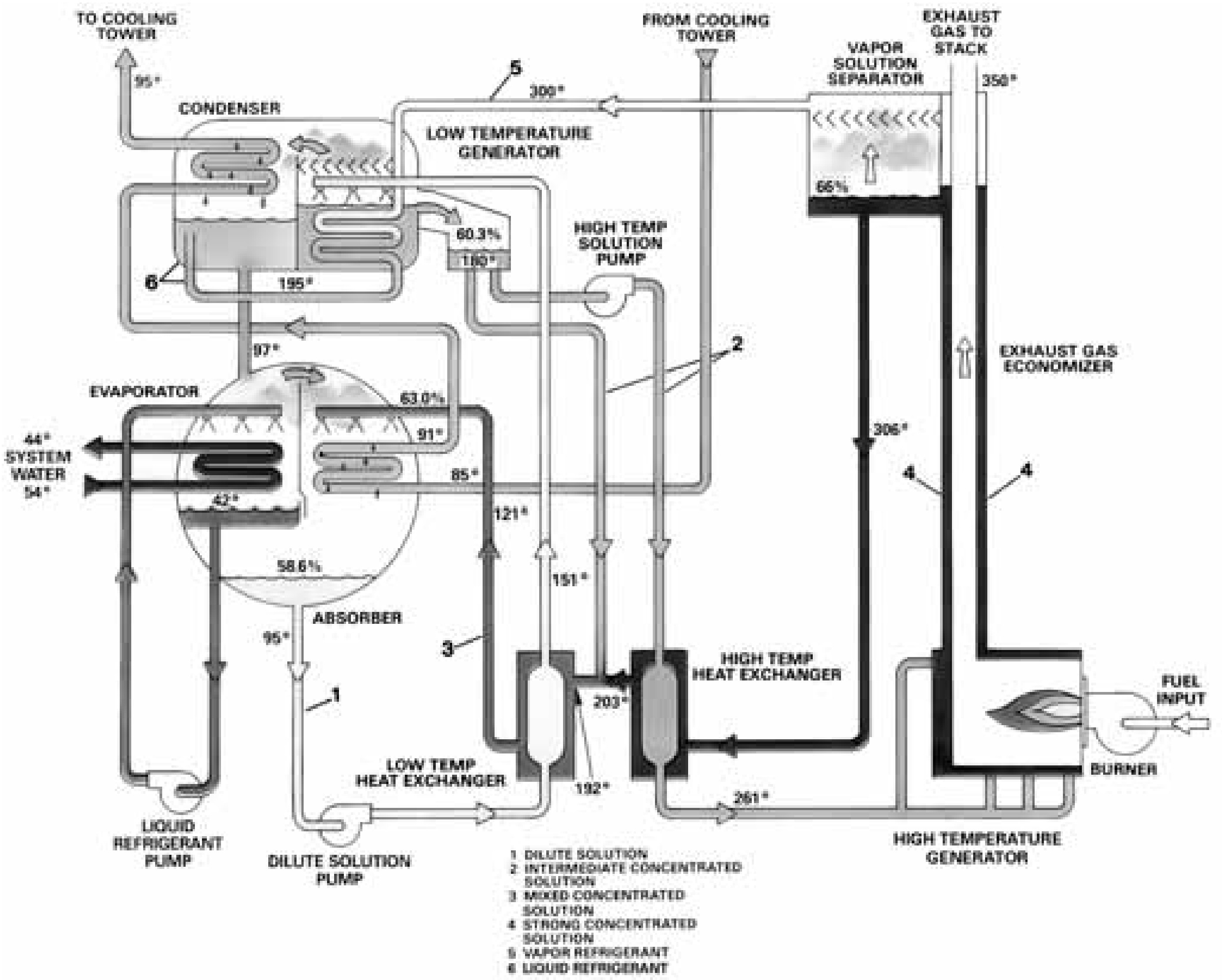
Purging
Every Thermachill chiller has a dual purge system that operates with the unit. First the system collects and traps non-condensable gas in a chamber external to the unit so that it can periodically be removed by the mechanical vacuum pump. This operation is required only a few times per year. Secondly, in any absorption unit, small amounts of hydrogen gas are generated. Palladium cells are provided which will selectively remove hydrogen gas and expel it from the unit to prevent inefficient operation.

Summary
And finally, one more point which we believe adds a real touch of reliability—the Trane name. As the worldwide leader in water chillers and the domestic leader in Classic and Horizon style absorption design, Trane understands chilled water system design

To protect you long term, warranty and service contract programs can be tailored to your individual needs. And Trane Integrated Comfort™ systems can offer a higher level of control, monitoring and diagnostics.

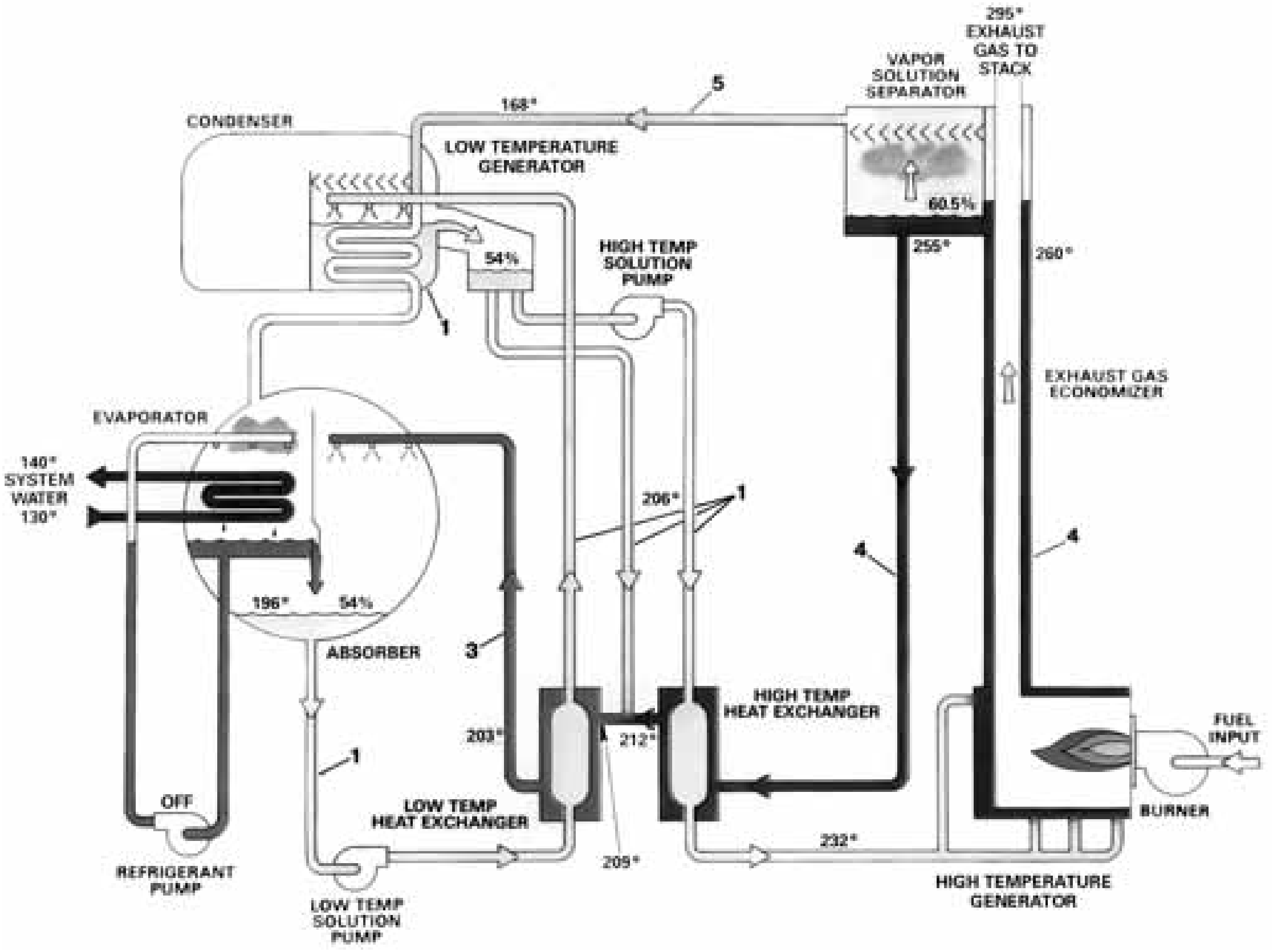
Refrigeration Cycle

Cooling Cycle



Refrigeration Cycle

Heating Cycle



Refrigeration Cycle

Cooling Cycle Overview
The absorbent/refrigerant combination is a traditional lithium bromide/water solution. The dilute solution is first pumped from the absorber to the low temperature generator where it is partially concentrated. A heat exchanger transfers heat from the generator and preheats the incoming solution.

Part of the solution is then pumped to the direct-fired (high temperature) generator where it is further concentrated, while the rest of the flow from the low temperature generator is mixed with the strong solution from the direct-fired high temperature generator. This process forms the mixed concentration absorber spray. Refrigerant for the cycle is produced in both generators and is condensed in the condenser and flows to the evaporator through orifices.

Evaporator/Absorber
Liquid refrigerant (water) enters the evaporator from the condenser orifice. As refrigerant passes to the low pressure evaporator, flashing occurs, cooling the remaining liquid refrigerant to the evaporator saturation temperature. This chilled refrigerant falls to the evaporator pan and is circulated continuously to the evaporator sprays by the refrigerant pump. The transfer of heat from the system water to the refrigerant causes the refrigerant to vaporize, cooling the system water. This refrigerant vapor flows to the lower pressure absorber.

In the absorber, refrigerant is absorbed by the lithium bromide solution, because it has a high affinity for water vapor. This is the fundamental principal of the absorption process. The pressure in the absorber is determined by the temperature and concentration of the solution sprayed over the tubes. A mixed concentration is used to provide a greater quantity of solution in the absorber for more effective tube wetting. As the refrigerant vapor is absorbed by the solution, it transfers the heat acquired in the evaporator to the cooling water which is pumped through the absorber tubes. The dilute solution is then pumped through heat exchangers by the solution pumps to the generators for regeneration.

Low Temperature Generator
The dilute solution is pumped into the low temperature generator after being preheated by the low temperature heat exchanger. The primary purpose of this generator is to produce refrigerant vapor for this cycle. To achieve this, vapor from the direct-fired generator is used as the energy source to boil the solution. This vapor condenses inside the tubes and flows to the condenser sump. The intermediate concentration solution leaving the low temperature generator has two paths: the first is to the generator pump and on to the direct-fired generator; the second is mixed with strong concentrated solution forming a mixed concentration for the absorber spray.

Solution Heat Exchangers
The low temperature heat exchanger recovers heat from the mixed concentration and preheats the dilute solution going to the low temperature generator. Preheating the dilute solution reduces the heat energy required to induce boiling within the low temperature generator. In turn, the reduction in mixed solution temperature decreases the load on the cooling tower.

The high temperature heat exchanger recovers heat from the strong concentration solution and preheats the intermediate concentration solution going into the direct-fired generator. Less heat is needed in the direct-fired generator to further concentrate the preheated intermediate solution. Preheating the solution results in improved cycle efficiency.

Refrigeration Cycle

Direct-Fired High Temperature Generator
The direct-fired high temperature generator uses combustion of natural gas, No. 2 fuel oil or LP gas as an energy source.

The intermediate concentration solution enters at the bottom of the generator after being preheated by the high temperature heat exchanger. Heat from combustion and the flue gas economizer are used to produce refrigerant vapor for the low temperature generator.

The solution then flows into a chamber where liquid and vapor are separated. From there, the refrigerant vapor flows to the low temperature generator, and the concentrated solution returns to the absorber through the high temperature heat exchanger.

Condenser
Refrigerant is introduced into the condenser from two sources: Liquid refrigerant from the tube side of the low temperature generator; and refrigerant vapor produced by the low temperature generator.

All refrigerant vapor condenses and returns to the evaporator through an orifice. The orifice further reduces temperature and pressure as the refrigerant enters the evaporator. The cycle is now completed.

The cooling water within the condenser bundle is the same water that flowed through the absorber. The absorber/ condenser cooling water crossover pipe is integral to the design.

Heating Cycle
By simply turning the cooling/ heating switch valve, hot water can be delivered in a heating mode by the same system line used to supply chilled water in a cooling mode.

The evaporator becomes a condenser in the heating mode, condensing refrigerant vapor produced by the direct-fired generator. While condensing on the tube bundle, heat is transferred to the system water and condensed refrigerant falls to the evaporator pan and overflows into the absorber.

The dilute solution flows through the low temperature generator and heat exchangers on its way to the direct-fired high temperature generator. No boiling occurs in the low temperature generator because no condenser/absorber water is being circulated during the heating mode to remove heat.

The dilute solution coming from the heat exchangers enters the direct-fired, high temperature generator where refrigerant is vaporized and flows through the low temperature generator on to the evaporator to repeat the process.

Application Considerations

Gas Cooling

Basic Information
The Thermachill is a high efficiency two-stage direct-fired machine that utilizes the evaporator section to provide chilled water for cooling or hot water for heating on commercial HVAC systems.

The machine is UL listed and is exempt within the ASME Section VIII code because of the vacuum operation pressure. Standard machine safety devices provide machine protection from overpressure, high and low temperatures, and solution crystallization. The burner control provides combustion safety protection.

Fuel Handling
The burner is designed for natural gas or oil as the primary fuel sources. Local codes determine how these fuels are employed. The gas supply systems are selected by the burner manufacturer based upon the local codes, available gas pressure, and the gas flow rate. The gas train supplied is pre-piped and wired for ease of installation. The gas train is sized for minimum seven inches water column at the inlet for sizes ABDL 100-240 and fourteen inches water column minimum on ABDL 300-1100. The burner, gas train, burner control panel, and burner front plate sections are provided. They must be field-mounted by the installing contractor. Refer to “Burner Installation” within the Jobsite Connections section for details.

Electrical Service
A 200-volt three-phase power source is required to power the unit. Table PD-3 identifies the power requirements. All field wiring must be in accordance with the national electric code (NEC), state and local requirements.

The 200-volt three-phase power service and other field panel wiring is the responsibility of the installing contractor. All burner related wiring is factory supplied with cabled assemblies. The installing contractor must connect one end of the cable assembly.

See specific submittal drawings for detailed information.

Machine Installation
A housekeeping pad or support rails are necessary to elevate the machine for maintenance and to provide clearance for the burner housing. Any foundation pad should provide adequate structural support and keep the installed machine level within $^{1}/_{16}$-inch by length and width for reliable operation. Leveling marks on the lower shell can be used to check the machine after its positioned on the pad. Refer to “Field Installation” within the Jobsite Connections section for details.

Exhaust Gas Duct
A duct section with pre-drilled flanges is provided for field installation. It has an inspection cover, condensate drain, temperature gauge port, and connections for exhaust gas analysis. This section should be connected directly to the generator exhaust flange. The field constructed duct should have a removable section above the factory supplied section that can be removed for duct and machine maintenance. For multiple machine installation, it is advisable to connect each machine directly to the main stack using separate ducts, each having balancing dampers. The stack and connecting duct must be heat resistant to 675 F.

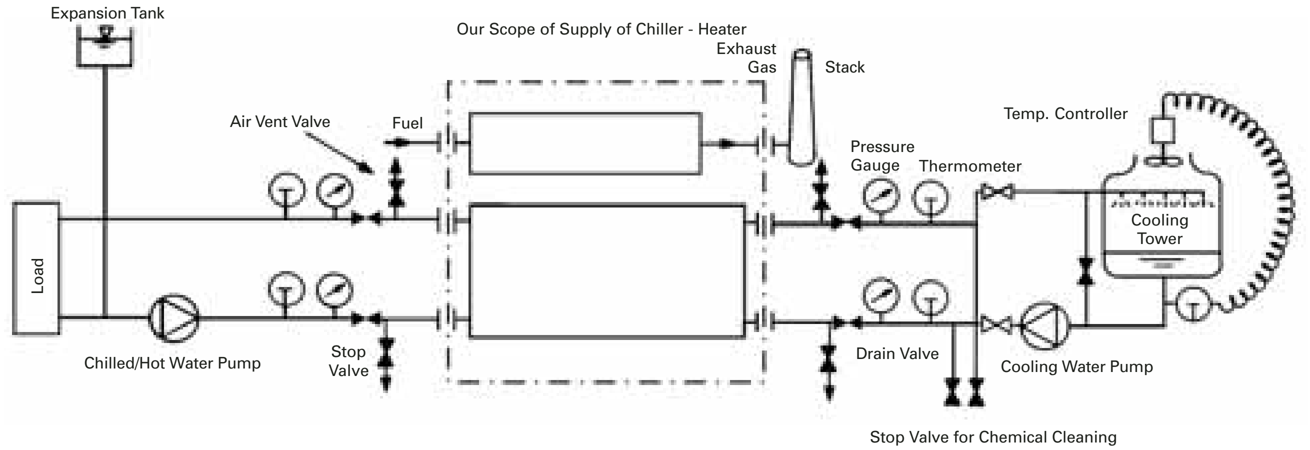
Duct dampers must be employed to maintain the machine exhaust outlet pressure between 0 and -0.2 inches water column. This requirement ensures reliable and efficient burner combustion. ASHRAE Equipment Handbook offers design details.

Operating Ambients
The minimum recommended ambient temperature with the machine shutdown in the cooling mode is 40 F. If shut down in the heating mode the minimum temperature is 25 F. If lower ambient temperatures are expected, special additional protective measures are required. Machines installed outdoors where ambient temperatures will drop below the minimums indicated must have heated enclosures.

The machine room must be ventilated to insure that all exhaust gas is removed and sufficient burner makeup air is available for efficient combustion. Maintain a positive equipment room pressure. At no time should the equipment room pressure be allowed to drop below the exhaust pressure.

Separated Machine Sections
Disassembled machines ship to the jobsite in two main sections. One section contains the evaporator/absorber/ condenser and low temperature generator. The other section is the high temperature generator. Both sections ship empty with a nitrogen holding charge. The sections must be field-connected and leak-tested. Lithium bromide charge is supplied in barrels with the machine.

Figure AC-1 — Machine Installation



Outside of this line ____ . ____is out of Trane scope of supply

Machine Piping and Instruments
Figure AC-1 illustrates the recommended instrumentation and hardware that is contractor supplied and installed. Detail items related to water piping are also discussed. All connecting water pipes should have a short flanged section that can be removed to access the water boxes for maintenance.

1. All instruments illustrated on piping outside of the chiller-heater are standard.
2. A dedicated chilled/hot water pump and a cooling water pump is necessary for each machine. In case only one cooling water pump is provided for two or more chiller-heaters, please contact your local sales office for advise.
3. The chilled/hot water and cooling water flow rates must be maintained at design conditions. When the chilled/hot water flow rate lowers below minimum, the chiller-heater will stop and cannot be operated.
4. Provide air vent valves at the top of the outlet of the chilled/hot water and cooling water piping.
5. Provide drain valves at the bottom of the inlet of the chilled/hot water and cooling water pipes.
6. Provide valves (two places) on the cooling water piping for chemical cleaning.
7. Drain the water in the piping of the chiller-heater to prevent freezing during cold-season shutdown when necessary.
8. The header cover of the machine is bolted for ease of removal for brushing or exchange of tubes. Water leakage may occur if the connecting pipe is not supported. Therefore, make sure that the machine water boxes do not have excessive loads from the piping system.
9. The water in the cooling water line of the chiller-heater can reach temperatures up to 195 F during heating operation unless it is drained. Use lined or steel pipes at least for the piping between chiller-heater and isolation valves.
10. Provide valves in the supply and return pipes of the cooling water circuit to be used for isolation. The absorber and condenser sections are not used during the heating mode and must be drained before converting to heating.

Application Considerations

Water System

Cooling Water

Regular maintenance of evaporator and cooling water quality is critical for efficient daily operation and long term tube life.

Cooling tower water temperature must be maintained at or above 72 F for reliable part load operation and 78 F for full load operation. Control panel logic circuits allow start-up at temperatures below 72 F and also protect against unsafe conditions but must be warmed to 72 F minimum within 20 minutes of operation. Typical cooling tower control is illustrated below. A cooling tower bypass is recommended for reliable control. Recommended cooling water fan thermostat examples follow.

Water Treatment

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

Table AC-1 — Typical Cooling Tower Control

System 1 – Operation for summer season

Recommendations for cooling tower fan thermostat calibration.

Setting Temperature		1 Fan	2 Fans	
			No. 1 Fan	No. 2 Fan
Fan	Off	78 F	78 F	81 F
	On	84 F	82 F	84 F

System 2 – Operation for low load and winter season

Incorporate a three-way valve. Start and stop the cooling tower fan based upon the following fan thermostat temperature of 78 F to 84 F.

Application Considerations

Controls and Interface

Controls

The panel switch determines the operating mode (cooling or heating). Switched to either position the panel will control the machine to provide temperature control from the evaporator section for cooling or heating. The actual temperature is determined by calibrated set points for both cooling and heating. Conversion from cooling to heating and back is a manual operation.

Panel lights indicate machine status, they are, power on, operation and combustion. There are nine abnormal condition lights to determine what event terminated normal operation. A normal sequence for cooling service assumes the machine is prepared for cooling operation.

Cooling

With the machine panel switched to cooling the panel will start the chilled water and cooling water pumps in sequence, confirm chilled water flow and confirm that all machine safeties are go. Then the machine solution pumps are started. The burner executes its flame safeguard start-up and initial combustion. Control of burner firing rate and refrigerant pump operation is controlled by the machine panel as the water temperature changes. Between 30 and 100 percent of cooling the burner firing rate is adjusted to meet the cooling load. Below 30 percent of design the burner is cycled while all machine pumps remain on to allow a 10 percent minimum load. At minimum design cooling the refrigerant pump is cycled. An increase in chilled water temperature will initiate a restart sequence of the refrigerant pump and/or burner as required. The chilled water and condenser water pumps continue to operate along with the solution pumps until the panel is switched off or an abnormal condition occurs. During normal operation the cycle guard control monitors machine temperatures to protect solution concentrations.

Heating

The machine must be converted to heating service before the panel heating switch is activated. With the panel switch activated the panel starts the evaporator water pump, confirms flow and checks machine safeties. The condenser water pump and refrigerant pump remain off in heating. Solution pumps and the burner are started with the burner fire rate modulated with heating load. Below 30 percent of design the burner is cycled. The burner is restarted when evaporator water drops below a predetermined temperature. A 15 minute dilution cycle is initiated upon placing the operational switch to stop position. During this 15 minute dilution cycle the solution pumps and operation indicator remain on.

Automation System Interface

Tracer™ Interface
Remote monitoring and control via Tracer products can be accomplished by using an intermediate interface panel, or by hard-wiring the individual control points to a Tracer.

TIM-E Interface
The TIM-E provides six binary outputs, three binary inputs and three analog inputs that can be controlled/monitored by the Tracer. These points can be connected in whatever arrangement best suits the customer; a recommended arrangement follows.

BOP1	Chiller Enable/Disable
BIP1	Operation Indication
BIP2	Cooling Indication
BIP3	Alarm Indication
AIP1	Leaving Chilled Water Temperature
AIP2	Entering Chilled Water Temperature
AIP3	Entering Condenser Water Temperature

Hard-Wired Interface

Tracer hard-wired interface is the same as the interface for generic BAS Interface systems.

Multiple Unit Control

The chiller control panel is compatible with the Chiller sequencing program found in Tracer products, and is also compatible with the Tracer DDC Chiller Sequencer Panel. For information on the features of the Chiller Sequencing program, contact your local Trane office.

Generic BAS Interface

Standard Control Panel Interface Points

Remote Control. The control panel has a binary input point that can be used to remotely start and stop the chiller.

Cooling Indicator. The control panel provides a binary output that closed whenever the chiller is set to the cooling mode.

Heating Indicator. The control panel provides a binary output that closes whenever the chiller is set to the heating mode.

Operation Indicator. The control panel provides a binary output that closes whenever the chiller is enabled to provide cooling or heating.

Combustion Indicator. The control panel provides a binary output that closes whenever the burner is firing. Burner operation is not continuous under low load conditions.

Alarm Indicator. The control panel provides a binary output that closes whenever an abnormal operation condition exists at the chiller.

External Interlock. The control panel provides a binary input that can be used to shut down and lock out chiller operation. When this input opens, chiller operation is terminated following a dilution cycle; operation is prevented until the chiller is manually reset at the front panel.

Non-Standard Interface Points
The standard chiller controls do not include any provisions for monitoring temperatures. Monitoring unit temperatures requires field selection and installation of sensors.

Chiller Supply Temperature

When the chiller load falls below 30 percent, the burner must cycle to keep the supply water temperature from dropping too far below set point. Although this cycling provides the proper average level of system cooling, the supply water temperature fluctuates.

In systems with two or more chillers, burner cycling is not normally a problem since the building load rarely falls below the minimum load of one chiller. This is especially true if the chillers are unequally sized and the smallest chiller is the last on.

Burner cycling does not normally cause building space temperature variations in single-chiller systems, either. Since cycling occurs when the building load is light, flow modulation at the coils can easily compensate for supply water temperature fluctuations.

Supply water temperature can be held to the normal range provided by the chiller's proportional control scheme by designing the chilled water system as shown in Figure AC-2. Whenever the chiller is operating at part-load conditions, the tank is charged with chilled water. When the burner cycles off, the chiller pump is turned off and chilled water is pulled from the tank. The chiller and its chilled water pump are restarted when the tank is discharged.

Heating and Cooling Systems

The chiller can be used to satisfy both the heating and cooling needs of the building, but only if the system was designed to handle both functions. There are a wide variety of system designs intended to meet the dual requirements of heating and cooling. One of the simplest is the two-pipe changeover system illustrated in Figure AC-3. The simplicity of this system lies in the use of the same set of components (i.e., pipes, coils, pumps) for both heating and cooling. Typically, the system is switched between these modes and on a seasonal basis.

Several alternatives are also available to provide simultaneous heating and cooling if it is required. On a two-pipe system, simultaneous heating and cooling demands during the transition between heating and cooling seasons can be addressed using outside air or some secondary heating or cooling source.

When outside air is not an acceptable method for providing simultaneous heating and cooling, other system types — such as a four-pipe system — should be explored. Four-pipe systems provide all or selected loads with both hot and chilled water at all times. Selection of the system configuration depends on the variation in heating and cooling demands. Using multiple chillers affords a great deal of flexibility for matching heating and cooling loads to the heating and cooling capacities of the chillers. In the sample shown in Figure AC-4, any combination of chillers can be used for heating and cooling.

As depicted in Figure AC-5, simultaneous heating and cooling can also be accomplished in single-chiller applications by adding an auxiliary heater.

Figure AC-2

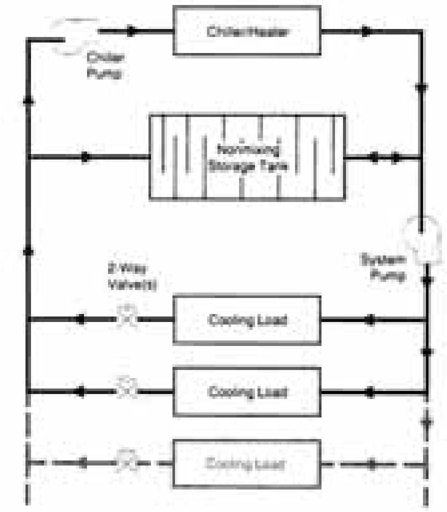


Figure AC-3

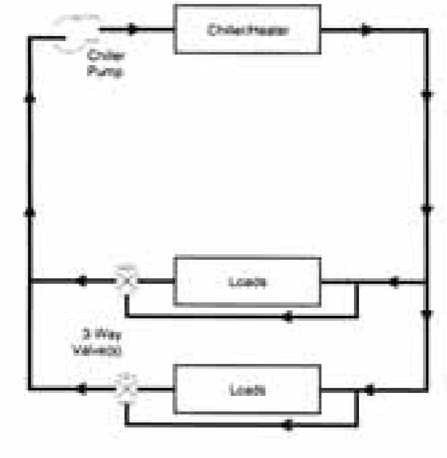


Figure AC-4

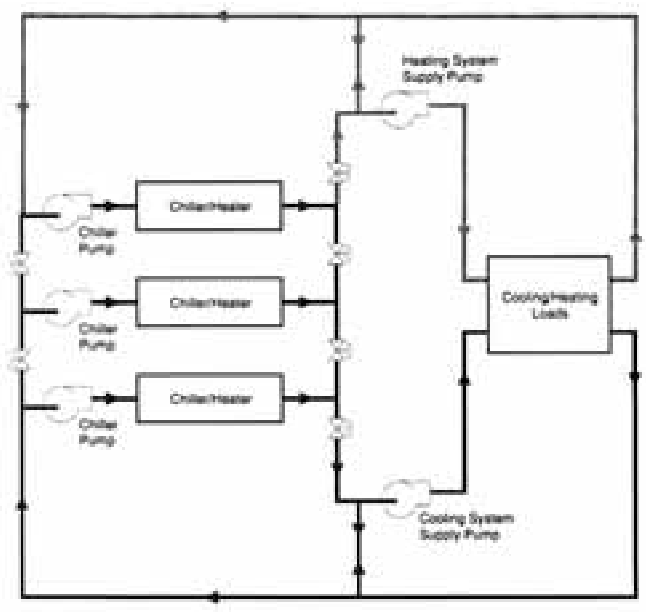
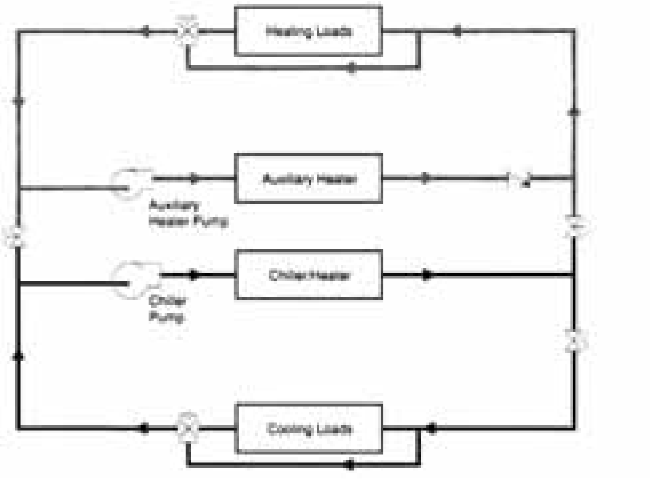


Figure AC-5



Selection Procedure

The Thermachill Absorption Chiller performance is rated in accordance with ARI Standard 560. The product line provides numerous individual unit selections over a capacity range of 100 to 1100 tons. This catalog contains performance data for all standard units. Additional chiller selections and performance information can be obtained through the use of the Thermachill Absorption Chiller selection program available through local Trane sales offices.

Performance
The information on the following pages provide performance data at ARI standard conditions, including capacity in tons, C.O.P., heating capacity, flow rates and water pressure drops. All capacities are net tons and are based on standard fouling factors for the evaporator and absorber/condenser watersides. For the other fouling factors, refer to the paragraph on nonstandard fouling factors below. All final selections should be made using the computer selection program.

Fouling Factors
Unit performance at non-standard fouling factors will vary from standard performance. Fouling factors estimate the heat transfer penalty that occurs as the tubing gets dirty through normal chiller operation. ARI tube fouling standards are shown below:
Fouling factors @ ARI 560-92

Clean	Standard	Excessive
0.00000	0.00025	0.00075

All selections should have a minimum fouling factor of 0.00025 to best estimate the chiller performance in an equipment room and to comply with ARI 560-1992. Any selection that uses a fouling factor above 0.00025 is a more conservative estimate that should only be used if there is an abnormal amount of fouling contamination in the water system. The effect of non-standard fouling factors should be determined by the Trane Direct-Fired Absorption Selection Program.

General Data Tables
General unit data is shown in the data section. General unit information includes refrigerant charge, absorbent charge, chiller shipping and operating weights.

Evaporator and Absorber/Condenser Data Tables
Located in the data section, evaporator and absorber/condenser data includes water storage capacities, minimum and maximum flow limits, pressure drop at nominal flow, water connection size, and number of passes. If the maximum flow limit is exceeded, tube erosion may result. Flow rates less than the minimum result in laminar flow with a resultant reduction in performance and increased fouling and corrosion potential.

Part Load Performance
The Thermachill Absorption Chiller exhibits good part load performance characteristics. Air conditioning system loads are usually significantly less than full load design conditions. Therefore, the chillers operate at full load relatively little of the time. Part load chiller operation is normally associated with reduced condenser 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 condenser water entering the chiller and improved unit performance to a point. To determine specific unit part load performance, use of the Thermachill Absorption Chiller selection program is recommended. A minimum of 72 degrees F entering cooling water to the absorber/condenser must be maintained at all load conditions.

Unit Performance with Fluid Media Other Than Water
The performance examples contain data using water as cooling and heat rejection media. For media other than water, contact the local Trane sales office.

Electrical Data
Total kW and MCA are shown for the Thermachill Absorption Chiller parasitic components. These include solution and refrigerant pump motors, purge pump motor, control panel, and combustion burner fan motor. The unit is to be supplied with 200V, 3 Phase, 60 hertz (50 hertz optional for international applications) power. Field wiring should be properly sized in accordance with the National Electric Code.

Dimensional Drawings
The dimensional drawings illustrate overall measurements of the unit. The recommended service clearances indicate clearances required to easily service the Thermachill Absorption Chiller. 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. Note the requirement for a “pad” or rails to allow burner mounting and service access. A minimum of a 6” pad is required on all sizes except the ABDL - 500 and 550 packaged units, which require 14” minimum pad height.

Model Number Description

The components and options for any Thermachill Absorption unit can be identified by referring to the alphanumeric product coding block located on the service nameplate for the unit. The coding block precisely identifies all characteristics of a unit. An example of a typical product code is given at right:

Model Number Description

MODL-ABDL	NTON-100	VOLT-200
HTRZ-60	ENSR-DGAS	TYPE-STD
AGLT-UL	EVPR-150	CDPR-150
TEST-CWTR	OPTI-DSSY	

Product Code Explanation

MODL — Unit Model
ABDL = Direct Fired Absorption

DSEQ — Design Sequence
1A = Direct Fired

NTON — Unit Nominal Tonnage
100 = 100 Nominal Ton Unit
120 = 120 Nominal Ton Unit
150 = 150 Nominal Ton Unit
180 = 180 Nominal Ton Unit
200 = 200 Nominal Ton Unit
240 = 240 Nominal Ton Unit
300 = 300 Nominal Ton Unit
350 = 350 Nominal Ton Unit
400 = 400 Nominal Ton Unit
450 = 450 Nominal Ton Unit
500 = 500 Nominal Ton Unit
550 = 550 Nominal Ton Unit
600 = 600 Nominal Ton Unit
700 = 700 Nominal Ton Unit
800 = 800 Nominal Ton Unit
900 = 900 Nominal Ton Unit
1000 = 1000 Nominal Ton Unit
1100 = 1100 Nominal Ton Unit

VOLT — Unit Voltage
200 = 200 Volt Unit

HRTZ — Unit Hertz
50 = 50 Hertz Unit
60 = 60 Hertz Unit

ENSR — Unit Energy Source
DGAS = Direct Fired Gas
DUAL = Direct Fired Gas/Oil
DGLP = Direct Fired Gas/LP Gas
DOIL = Direct Fired Oil

TYPE
STD = Standard
HIEF = High Efficiency

AGLT
UL = U.L. Listed (Standard)
IRI = I.R.I. Certified
FCMT = Factory Mutual
BKUG = Brooklyn Union Gas
CLCA = California Code Approval
CONN = Connecticut Natural Gas Corp.
ILSR = Illinois School 145 (Retrofit)
ILSN = Illinois School 157 (New)
IRM = Improved Risk Mutuals
LILI = Long Island Lighting
MASS = Massachusetts Code
MINN = Minnesota Code Approval
NYC = New York City (Bureau of Air Resources)
NCAR = North Carolina School Code
SPL = Special

EVPR — Evaporator Water Side Pressure
150 = 150 PSIG

CDPR — Condenser/Absorber Water Side Pressure
150 = 150 PSIG

TEST — Factory Performance Test
PTR = Performance Test and Report (standard)
CWTR = Customer Witnessed Test and Report

Unit Options
DSSY = Disassembled (NTON 600-1100)
AAZ = Asia/America Zone Specification

Performance Data

Table PD-1 — Performance Data

		Coefficient Of Performance (COP)				Cooling Duty Fuel Consumption (MBH)				Heating Performance		
	Capacity	Std. Eff. Unit		High Eff. Unit		Std. Eff. Unit		High Eff. Unit		Capacity	Fuel Consumption (MBH)	
Model	(tons)	(HHV)	(LHV)	(HHV)	(LHV)	(HHV)	(LHV)	(HHV)	(LHV)	(MBH)	(HHV)	(LHV)
ABDL-100	96	0.97	(1.07)	1.03	(1.14)	1,191	(1,072)	1,119	(1,007)	1,099	1,286	(1,157)
ABDL-120	115	0.97	(1.08)	1.03	(1.14)	1,429	(1,286)	1,343	(1,209)	1,317	1,543	(1,389)
ABDL-150	144	0.97	(1.08)	1.03	(1.14)	1,787	(1,608)	1,679	(1,511)	1,651	1,928	(1,736)
ABDL-180	173	0.97	(1.08)	1.03	(1.14)	2,144	(1,929)	2,015	(1,813)	1,980	2,314	(2,083)
ABDL-200	192	0.97	(1.08)	1.03	(1.14)	2,382	(2,144)	2,238	(2,015)	2,198	2,571	(2,314)
ABDL-240	230	0.97	(1.08)	1.03	(1.14)	2,859	(2,573)	2,686	(2,417)	2,639	3,086	(2,777)
ABDL-300	288	0.97	(1.08)	1.03	(1.14)	3,573	(3,216)	3,358	(3,023)	3,297	3,856	(3,471)
ABDL-350	336	0.97	(1.08)	1.03	(1.14)	4,169	(3,752)	3,918	(3,526)	3,849	4,502	(4,051)
ABDL-400	384	0.97	(1.08)	1.03	(1.14)	4,764	(4,288)	4,478	(4,030)	4,397	5,142	(4,627)
ABDL-450	432	0.97	(1.08)	1.03	(1.14)	5,360	(4,824)	5,037	(4,534)	4,948	5,787	(5,208)
ABDL-500	480	0.97	(1.08)	1.03	(1.14)	5,956	(5,360)	5,597	(5,037)	5,496	6,427	(5,785)
ABDL-550	528	0.97	(1.08)	1.03	(1.14)	6,551	(5,896)	6,157	(5,541)	6,047	7,073	(6,365)
ABDL-600	576	0.97	(1.08)	1.03	(1.14)	7,146	(6,432)	6,717	(6,045)	6,595	7,714	(6,942)
ABDL-700	672	0.97	(1.08)	1.03	(1.14)	8,337	(7,504)	7,836	(7,052)	7,694	8,999	(8,099)
ABDL-800	768	0.97	(1.08)	1.03	(1.14)	9,528	(8,575)	8,956	(8,060)	8,793	10,285	(9,257)
ABDL-900	864	0.97	(1.08)	1.03	(1.14)	10,719	(9,647)	10,075	(9,067)	9,892	11,571	(10,414)
ABDL-1000	960	0.97	(1.08)	1.03	(1.14)	11,910	(10,719)	11,194	(10,075)	10,991	12,856	(11,571)
ABDL-1100	1056	0.97	(1.08)	1.03	(1.14)	13,101	(11,791)	12,314	(11,082)	12,090	14,142	(12,728)

Based upon the following conditions:
cooling duty: 54-44 F chilled water, 85-95 F condenser water, std. fouling factors.
heating duty: 130-140 F hot water, std. fouling factor.

Table PD-2 — Weights

	Basic Model				Enclosed Outdoor Model				Unit Brine Charge			
	Standard Efficiency		High Efficiency		Standard Efficiency		High Efficiency		Standard Model		High Efficiency Model	
	Shipping	Operation	Shipping	Operation	Shipping	Operation	Shipping	Operation	Solution	Refrig.	Solution	Refrig.
Model	(Lbs.)	(Lbs.)	(Lbs.)	(Lbs.)	(Lbs.)	(Lbs.)	(Lbs.)	(Lbs.)	(Lbs.)	(Gals.)	(Lbs.)	(Gals.)
ABDL-100	9,500	10,800	10,100	11,400	11,600	10,300	12,300	11,200	1,466	23	1,620	21
ABDL-120	10,600	11,900	11,200	12,800	12,800	11,400	13,600	12,300	1,720	27	1,885	25
ABDL-150	12,100	13,700	13,000	14,500	14,500	13,100	15,600	14,000	2,083	33	2,271	32
ABDL-180	14,100	15,900	15,200	17,000	17,000	15,300	18,100	16,200	2,623	37	2,778	36
ABDL-200	15,200	17,100	16,500	18,400	18,400	16,200	19,700	17,700	2,877	40	3,120	36
ABDL-240	17,200	19,300	18,500	20,700	20,900	18,500	22,000	19,800	3,395	50	3,759	49
ABDL-300	25,000	29,000	26,800	30,800	32,300	28,200	34,000	30,000	4,541	70	4,971	68
ABDL-350	27,900	32,200	29,600	34,200	35,400	31,000	37,400	32,800	5,181	82	5,666	79
ABDL-400	30,200	35,000	32,400	37,200	38,200	33,400	40,400	35,600	5,820	93	6,360	91
ABDL-450	33,100	38,100	35,500	40,800	42,400	37,300	45,100	39,700	6,911	95	7,540	93
ABDL-500	36,700	42,500	39,200	45,200	46,800	40,900	49,400	43,400	7,617	106	8,267	102
ABDL-550	41,400	47,600	44,200	50,400	52,900	46,600	55,800	49,500	8,344	116	9,017	111
ABDL-600	51,400	60,400	56,000	65,200	N/A	N/A	N/A	N/A	9,612	114	10,637	109
ABDL-700	55,100	64,800	61,500	71,100	N/A	N/A	N/A	N/A	10,351	130	11,552	123
ABDL-800	61,900	73,300	69,000	80,300	N/A	N/A	N/A	N/A	12,280	154	13,702	146
ABDL-900	69,400	81,200	77,100	88,900	N/A	N/A	N/A	N/A	13,547	169	15,090	161
ABDL-1000	67,300	93,500	74,100	101,500	N/A	N/A	N/A	N/A	14,363	188	16,027	179
ABDL-1100	72,000	100,200	79,700	109,200	N/A	N/A	N/A	N/A	16,468	206	18,353	196

Performance Data

Table PD-3 — Selection Data

	Chilled Water		Hot Water		Cond./Abs. Water				Aux. Power		
Model	Flow Rate (GPM)	Pr.Drop (Feet)	Flow Rate (GPM)	Pr.Drop (Feet)	Flow Rate (GPM)	Pr.Drop (Feet)	Combustion Air (CFM)	Exhaust Gas (CFM)	Without High-Temp. Hot Water (KW)	With High-Temp Hot Water (KW)	(KVA)
ABDL-100	230	12.6	219	11.4	423	16.2	250	410	3.92	4.07	27.8
ABDL-120	276	12.3	266	11.4	507	24.7	300	490	4.15	4.30	28.7
ABDL-150	346	13.5	332	12.5	635	18.6	380	620	4.50	4.65	30.8
ABDL-180	415	15.1	397	13.9	762	28.3	450	740	5.95	6.10	36.8
ABDL-200	461	10.6	441	9.8	847	20.1	500	820	5.95	6.10	36.8
ABDL-240	553	10.9	529	10.0	1,014	30.4	600	990	5.95	6.10	36.8
ABDL-300	691	15.2	660	13.9	1,270	23.5	750	1,230	8.90	9.10	50.9
ABDL-350	806	10.1	769	9.3	1,482	12.8	870	1,440	8.90	9.10	50.9
ABDL-400	922	11.4	879	10.5	1,693	17.4	1,000	1,640	8.90	9.10	50.9
ABDL-450	1,037	15.4	992	14.2	1,905	22.9	1,120	1,850	9.30	9.50	52.9
ABDL-500	1,152	20.1	1,101	18.6	2,117	29.5	1,240	2,050	9.30	9.50	52.9
ABDL-550	1,267	25.8	1,210	23.7	2,328	37.2	1,370	2,260	9.30	9.50	52.9
ABDL-600	1,382	18.7	1,318	17.1	2,540	25.6	1,490	2,460	9.70	11.40	62.8
ABDL-700	1,613	26.6	1,538	24.5	2,963	36.0	1,740	2,870	14.4	14.50	79.4
ABDL-800	1,843	13.4	1,758	12.2	3,387	28.6	1,990	3,280	14.4	14.50	79.4
ABDL-900	2,074	17.5	1,977	16.1	3,810	37.2	2,240	3,690	14.4	14.50	79.4
ABDL-1000	2,304	10.5	2,197	12.2	4,233	18.6	2,490	4,100	18.0	18.10	99.1
ABDL-1100	2,534	13.4	2,417	12.2	4,657	23.1	2,740	4,510	18.0	18.10	99.1

Notes:
1. Based upon the following conditions:
   cooling duty: 54-44 F chilled water, 85-95 F condenser water, std. fouling factors.
   heating duty: 130-140 F hot water, std. fouling factor.
2. Auxiliary power includes the electrical power consumption of the following components:
   refrigerant pump, solution pumps, burner fan, control power, palladium cells.

Table PD-4 — Water Flow Rates

	Flow Rate Limitations						System Water Capacity	
	Std. Evaporator		Hi Eff. Evaporator		Condenser/Absorber			
Model	Min (GPM)	Max (GPM)	Min (GPM)	Max (GPM)	Min (GPM)	Max (GPM)	Evap. (Gal.)	Cond/Abs. (Gal.)
ABDL-100	167	379	167	379	277	528	29	71
ABDL-120	203	387	203	387	335	528	34	82
ABDL-150	255	511	255	511	423	894	40	95
ABDL-180	308	511	308	511	511	894	48	111
ABDL-200	339	766	339	766	559	1,057	53	119
ABDL-240	410	766	410	766	678	1,057	61	140
ABDL-300	511	801	511	801	845	1,458	82	293
ABDL-350	594	1,224	594	1,224	986	2,166	90	325
ABDL-400	678	1,224	678	1,224	1,127	2,171	100	357
ABDL-450	766	1,224	766	1,224	1,268	2,171	108	388
ABDL-500	854	1,466	854	1,466	1,413	2,457	122	428
ABDL-550	938	1,462	938	1,462	1,554	2,453	129	460
ABDL-600	1,022	1,933	1,022	1,620	1,708	2,774	291	608
ABDL-700	1,198	1,933	1,198	1,625	1,995	3,325	317	634
ABDL-800	1,365	2,897	1,365	2,439	2,281	3,844	370	766
ABDL-900	1,541	2,906	1,541	2,439	2,567	4,161	396	819
ABDL-1000	1,708	3,800	1,708	3,206	2,853	5,504	449	1,110
ABDL-1100	1,880	3,813	1,880	3,192	3,135	5,504	476	1,136

Dimensional Data

Figure DD-1 — Unit Sizes 100-240

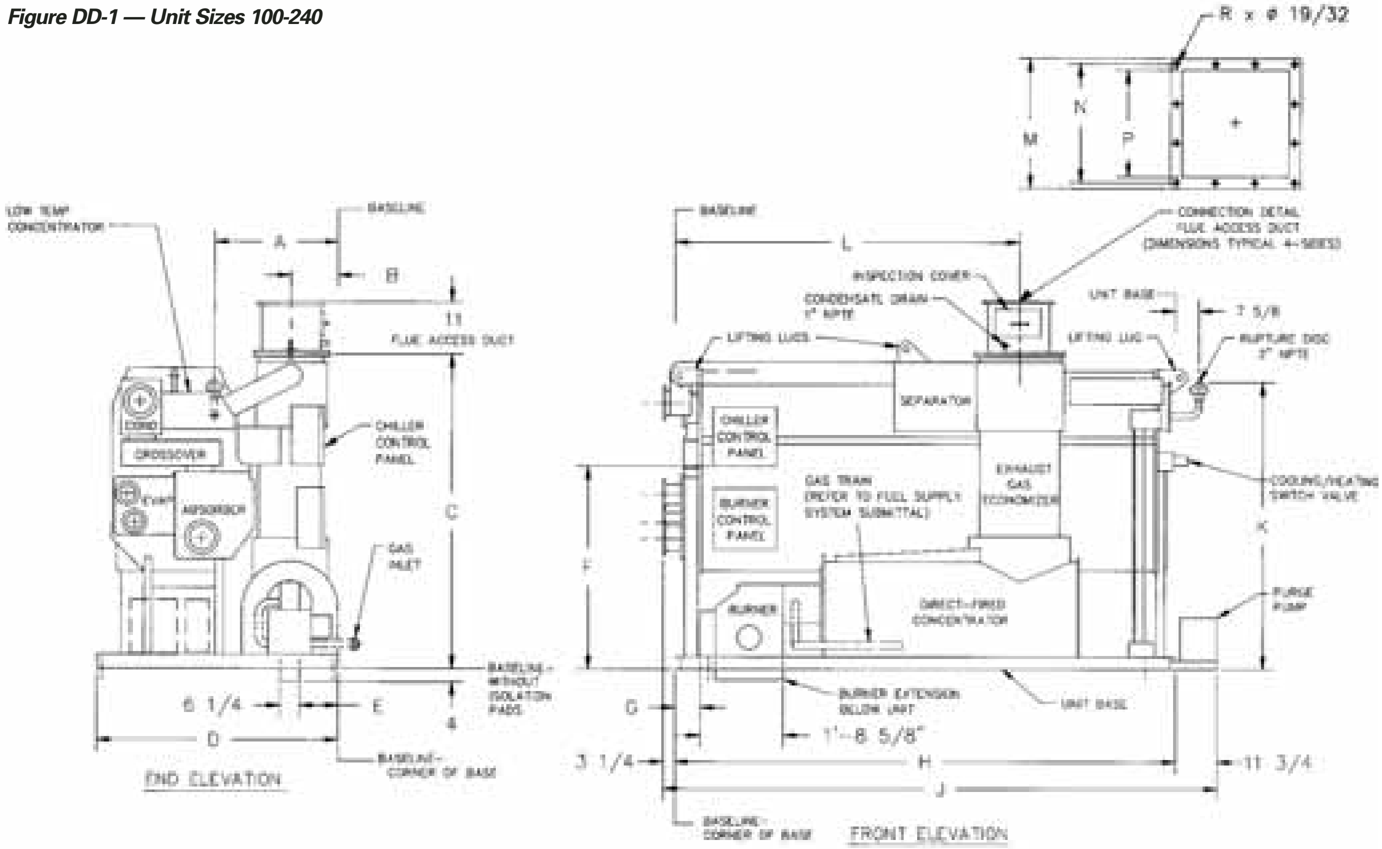


Table DD-1 — Unit Sizes 100-240

Figure Reference	Unit Sizes with Dimensions					
	100	120	150	180	200	240
A	2'- 8 5/8"	2'- 8 5/8"	2'- 8 5/8"	3'- 1 5/8"	3'- 1 5/8"	3'- 1 5/8"
B	10 1/2"	10 1/2"	10 1/2"	1'-1 1/8"	1'-1 1/8"	1'-1 1/8"
C	7'-2"	7'-2"	7'-2"	7'-4 5/8"	7'-4 5/8"	7'-4 5/8"
D	4'-10 1/2"	4'-10 1/2"	4'-10 1/2"	5'-3 3/8"	5'-3 3/8"	5'-3 3/8"
E	7 3/8"	7 3/8"	7 3/8"	10"	10"	10"
F	4'-3/8"	4'-3/8"	4'-3/8"	4'-2 3/4"	4'-2 3/4"	4'-2 3/4"
G	7 3/8"	1'-0"	1'-5 5/8"	1'-3 1/4"	2'-3"	4'-4 1/4"
H	9'-7 3/8"	10'-3 1/4"	11'-5"	13'-1"	14'-3 3/4"	16'-11 1/8"
J	10'-10 3/8"	11'-6 1/4"	12'-8"	14'-4"	15'-6 1/4"	18'-2 1/8"
K	7'-3/8"	7'-3/8"	7'-3/8"	7'-2 3/4"	7'-2 3/4"	7'-2 3/4"
L	6'-10 1/2"	7'-6 3/8"	8'-8 1/4"	8'-8 3/4"	9'-11"	12'-7"
M	1'-4 3/8"	1'-5 3/4"	1'-6 3/4"	1'-7 7/8"	1'-8 7/8"	1'-11 1/4"
N	1'-2 7/8"	1'-4 1/8"	1'-5 1/8"	1'-6 1/4"	1'-7 1/4"	1'-9 5/8"
P	1'-1"	1'-2 1/4"	1'-3 1/4"	1'-4 3/8"	1'-5 3/8"	1'-7 3/4"
R (Qty.)	12	12	12	16	16	16

Note:
All dimensions listed in above figure are similar for unit sizes 100 thru 240. Dimensions that vary in unit size are identified by letter (A thru R) and must reference above table for specific dimension(s).

Dimensional Data

Figure DD-2 — Unit Size 300-550

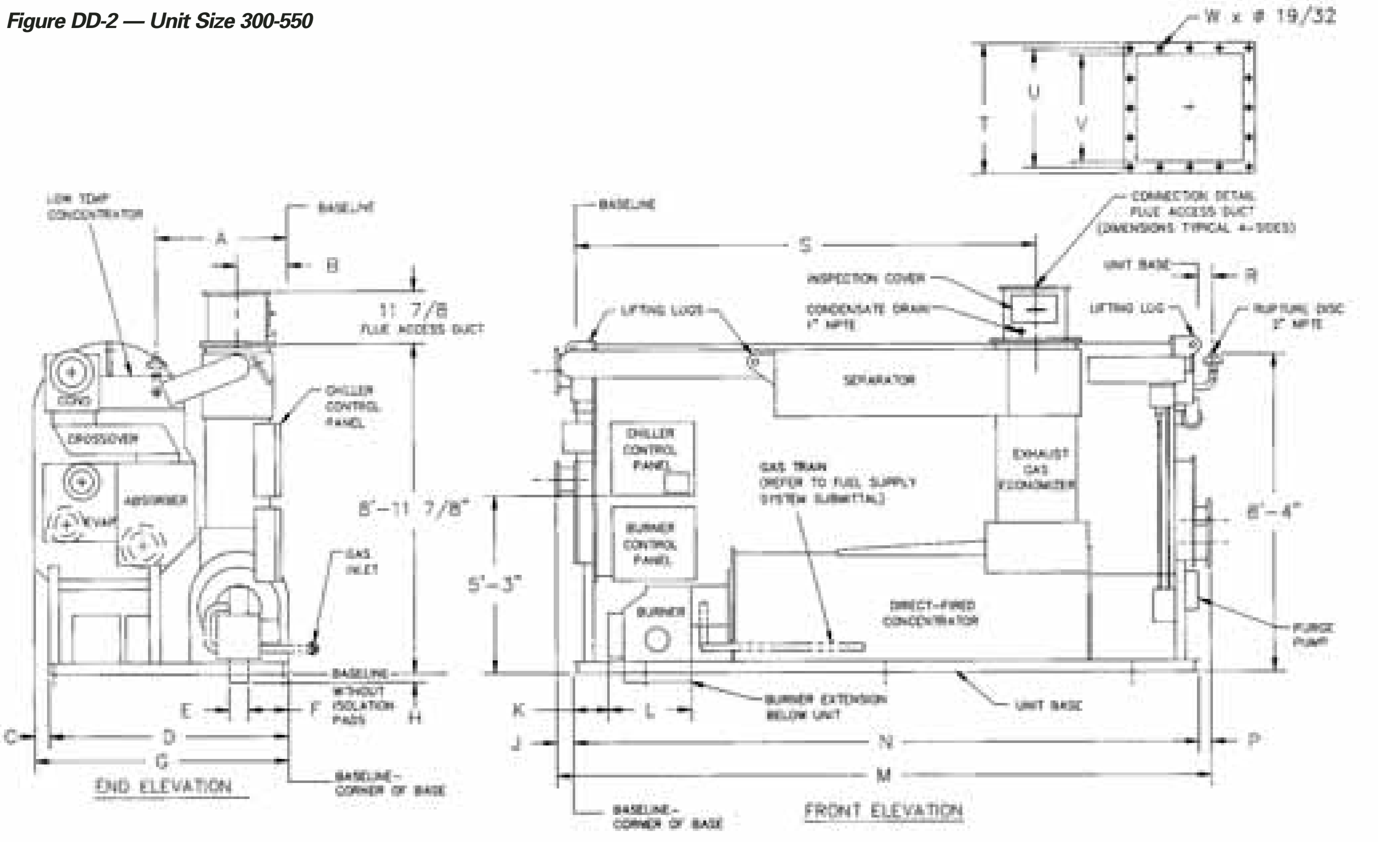


Table DD-2 — Unit Size 300-550

Figure Reference	Unit Sizes with Dimensions					
	300	350	400	450	500	550
A	3′-1″	3′-1″	3′-1″	3'-6 1/2"	3'-6 1/2"	3'-6 1/2"
B	1′-3″	1′-3″	1′-3″	1'-5 3/4"	1'-5 3/4"	1'-5 3/4"
C	4 3/4″	4 3/4″	4 3/4″	5 1/8"	5 1/8"	5 1/8"
D	6′-2″	6′-2″	6′-2″	6'-7 1/2"	6'-7 1/2"	6'-7 1/2"
E	6 1/4″	6 1/4″	6 1/4″	6 1/4"	2'-5 3/8"	2'-5 3/8"
F	11 7/8″	11 7/8″	11 7/8″	1'-2 5/8"	3'	3'
G	6′-6 3/4″	6′-6 3/4″	6′-6 3/4″	7'-5/8"	7'-5/8"	7'-5/8"
H	4″	4″	4″	4"	1'-2"	1'-2"
J	4 3/8″	6 3/8"	6 3/8"	1'-1 7/8"	1'-1 7/8"	1'-1 7/8"
K	7 1/2″	1'-6 1/8"	2'-4"	3'-3/8"	3'-7 3/4"	4'-6 3/8"
L	1′-11 3/8″	1'-11 3/8"	1'-11 3/8"	1'-11 3/8"	2'-6 1/4"	2'-6 1/4"
M	14′-7 1/8″	16'-5 3/8"	18'-5"	20'-3 1/8"	22'-5 7/8"	24'-4"
N	13′-11 1/8″	15'-7 3/8"	17'-7"	18'-2 1/8"	20'-4 7/8"	22'-3"
P	3 5/8″	3 5/8"	3 5/8"	11 1/8"	11 1/8"	11 1/8"
R	4 1/8″	4 1/8"	4 1/8"	11 3/4"	11 3/4"	11 3/4"
S	9′-7 1/8″	11'-3 3/8"	13'-3"	13'-1 3/4"	15'-4 1/2"	17'-2 1/2"
T	1′-11 1/8″	2'-1 1/2"	2'-1 7/8"	2'-1 7/8"	2'-3 3/8"	2'-4 3/8"
U	1′-9 5/16″	1'-11 3/4"	2'-1/4"	2'-1/4"	2'-1 5/8"	2'-2 5/8"
V	1′-7 5/8″	1'-10"	1'-10 7/16"	1'-10 7/16"	1'-11 7/8	2'-7/8"
W (Qty.)	16	20	20	20	24	24

Note:
All dimensions listed in above figure are similar for unit sizes 300 thru 550. Dimensions that vary in unit size are identified by letter (A thru W) and must reference above table for specific dimension(s).

Dimensional Data

Figure DD-3 — Unit Sizes 600-1100

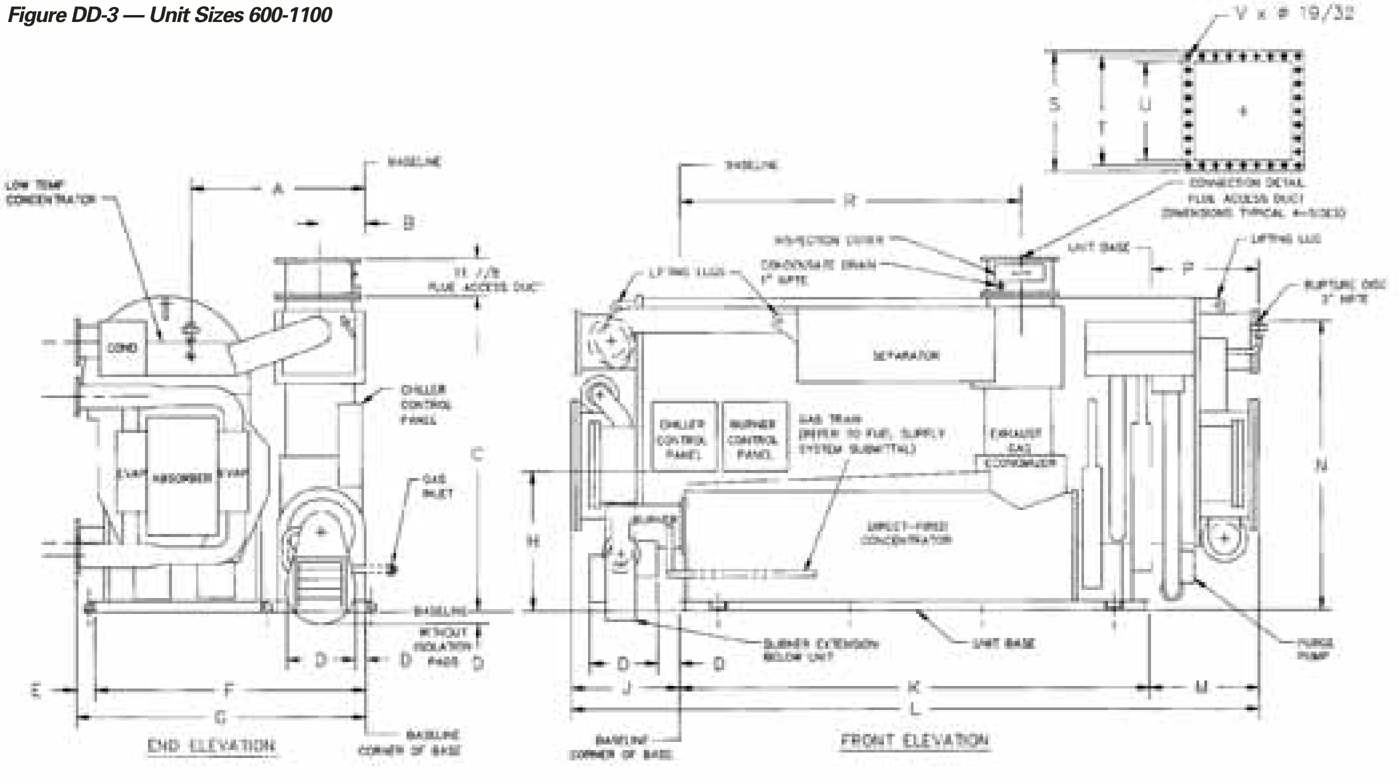


Table DD-3 — Unit Sizes 600-1100

Figure Reference	Unit Sizes with Dimensions					
	600	700	800	900	1000	1100
A	5′-11 1/8″	5′-11 1/8″	6′-5 1/2″	6′-5 1/2″	7'-7 3/8″	7'-7 3/8″
B	1′-5 7/8″	1′-5 7/8″	1'-9 1/4″	1'-9 1/4″	1'-10 1/2″	1'-10 1/2″
C	10'-11 1/8″	10′-11 1/8″	10'-11 1/8″	10'-11 1/8″	12'-7/8″	12'-7/8″
D	See unit submittals for specific dimensions.					
E	10′-1/4″	10′-1/4″	10′-1/4″	10'-1/4″	1'-1 3/8″	1'-1 3/8″
F	8′-10 7/8″	8′-10 7/8″	9'-5 3/8″	9'-5 3/8″	11'-1 1/8″	11'-1 1/8″
G	9′-9 1/8″	9′-9 1/8″	10'-3 5/8″	10'-3 5/8″	12'-2 1/2″	12'-2 1/2″
H	4′-9 1/2″	4′-9 1/2″	4'-11″	4'-11″	5'-8 7/8″	5'-8 7/8″
J	3′-5 5/8″	3′-4 5/8″	4'-2 3/8″	5'-3″	4'-3 7/8″	4'-7 3/4″
K	10′-6 3/8″	12′-11 1/8″	15'-7 7/8″	15'-8 1/8″	13'-2″	14'-5″
L	19′-3/4″	20′-9-3/8″	24'-5/8″	26'-1 7/8″	22'-1 1/4″	23'-8″
M	5′-3/4″	4′-5 5/8″	4'-2 3/8″	5'-2 3/4″	4'-7 3/8″	4'-7 3/8″
N	10′-7/8″	10′-7/8″	10′-7/8″	10′-7/8″	11'-1 3/8"	11'-1 3/8"
P	4′-2 3/8″	3′-7 1/8″	3′-4″	4'-4 1/4″	3'-8″	3'-8″
R	8′-10 1/4″	9′-11″	12′-4 1/2″	13'-9″	11'-1 3/4″	12'-4 3/4″
S	2′-6 3/4″	2′-8″	2′-11 1/8″	3'- 7/8″	3'-5 7/8″	3'-5 7/8″
T	2′-5 1/16″	2′-6 5/16″	2'-9 1/2″	2'-11 1/4″	3'-4 1/8″	3'-4 1/8″
U	2′-3 1/2″	2′-4 3/4″	2'-7 7/8″	2'-9 5/8″	3'-2 5/8″	3'-2 5/8″
V (Qty.)	24	24	28	28	32	32

Note:
All dimensions listed in above figure are similar for unit sizes 600 thru 1100. Dimensions that vary in unit size are identified by letter (A thru V) and must reference above table for specific dimension(s).

Dimensional Data

Water Connection Location

Figure DD-4 — Unit Sizes 100, 120

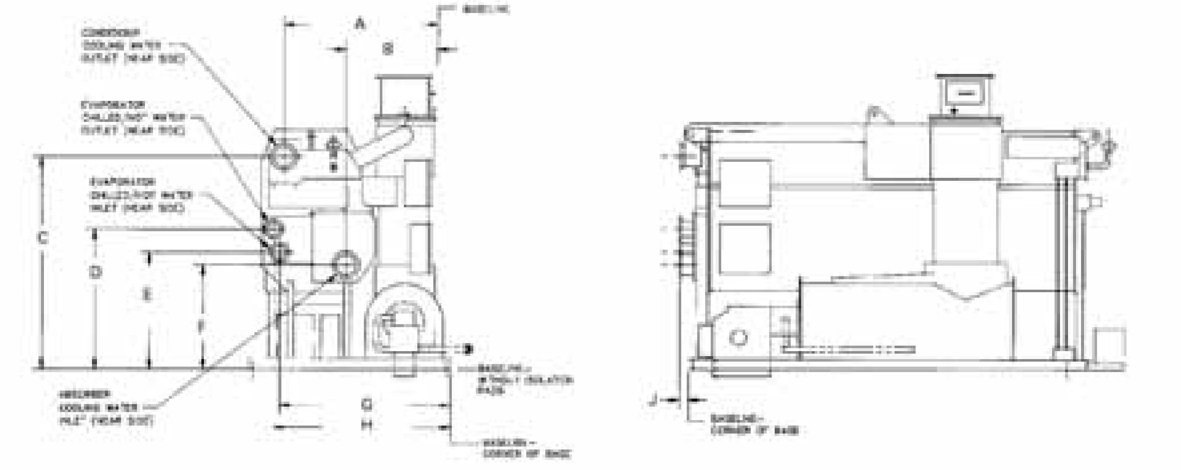


Figure DD-5 — Unit Sizes 150, 180

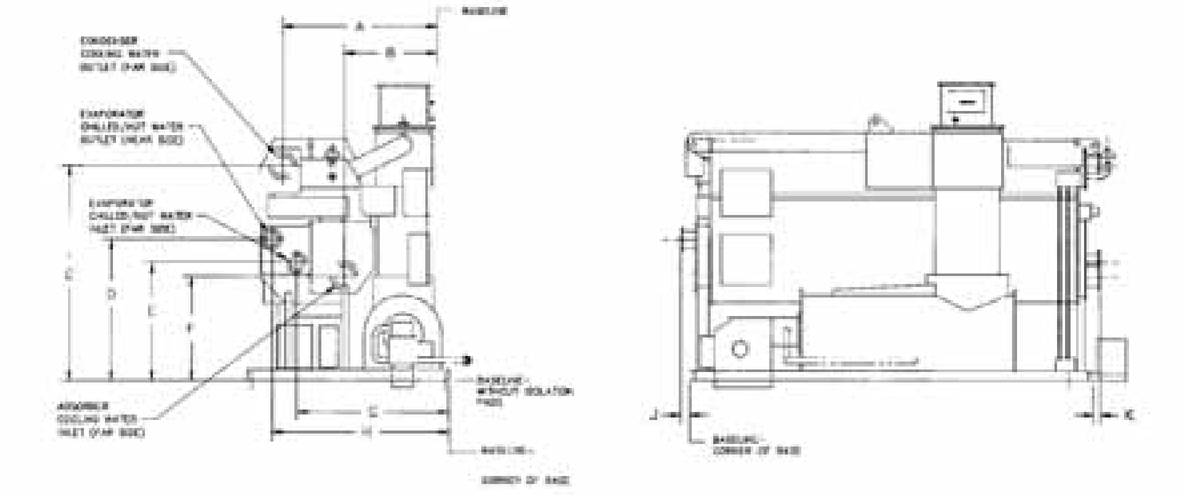
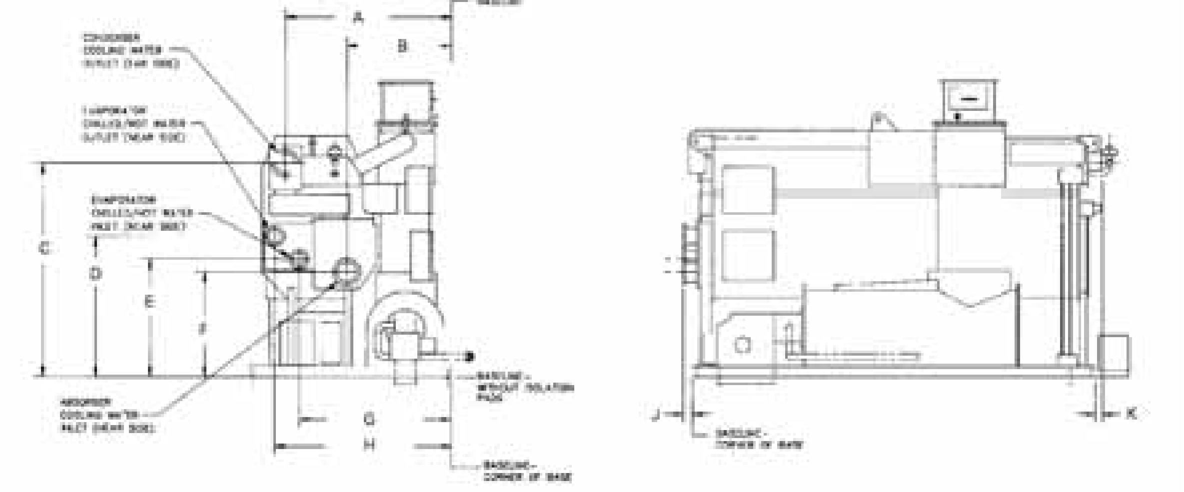


Figure DD-6 — Unit Sizes 200, 240



Dimensional Data

Water Connection Location

Figure DD-7— Unit Size 300

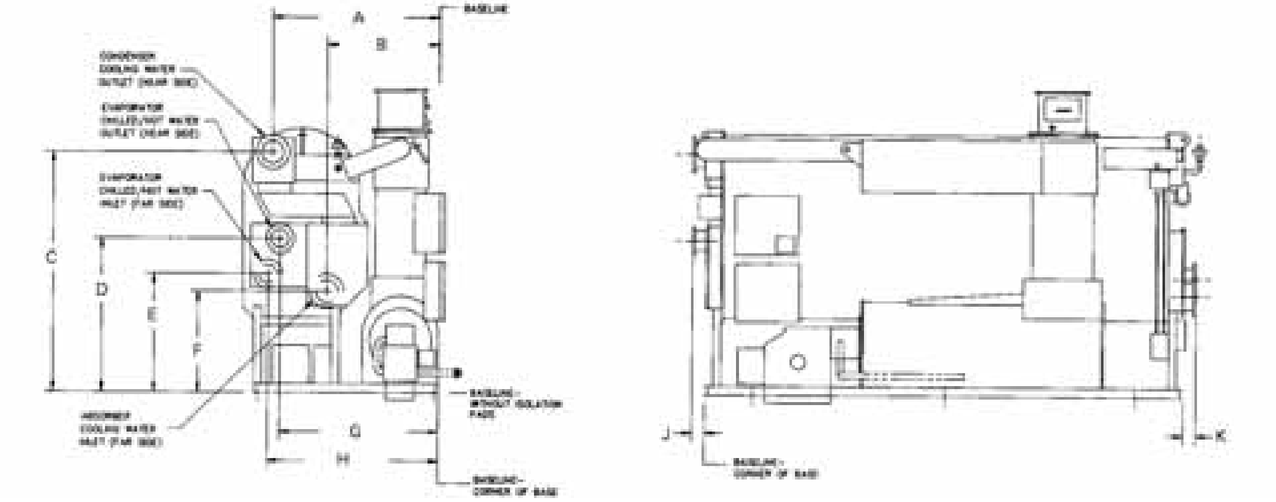


Figure DD-8 — Unit Sizes 350, 400, 450, 500, 550

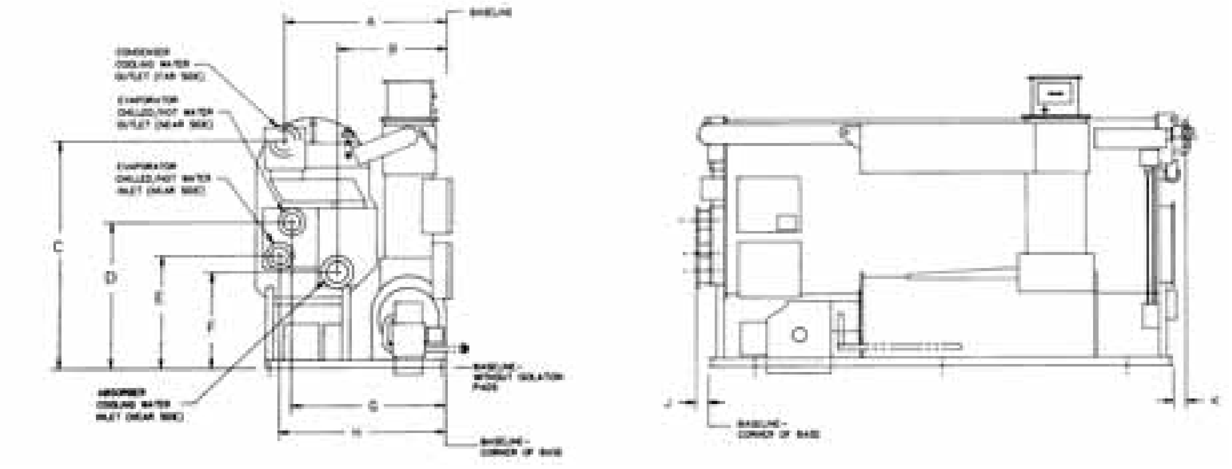


Table DD-4 — Water Connections, Unit Sizes 150 to 550

	Water Connection Dimension by Unit Size									
Dimension	100	120	150	180	300	350	400	450	500	550
A	3'-11 7/8″	3'-11 7/8″	3'-11 7/8″	4'-4 3/4″	5'-5 1/2"	5'-5 1/2"	5'-5 1/2"	5'-11 1/8"	5'-11 1/8"	5'-11 1/8"
B	2'-9 1/8"	2'-9 1/8"	2'-5 3/8″	2'-10 1/4″	3'-8 5/8"	3'-8 5/8"	3'-8 5/8"	4'-2 1/4"	4'-2 1/4"	4'-2 1/4"
C	6'-3 1/4"	6'-3 1/4"	6'-2 5/8″	6'-5″	7'-10 1/4"	7'-10 1/4"	7'-10 1/4"	7'-10 1/4"	7'-10 1/4"	7'-10 1/4"
D	3'-11 3/8"	3'-11 3/8"	3'-11″	4'-1 3/8″	5'-0 5/8"	5'-0 5/8"	5'-0 5/8"	5'-0 5/8"	5'-0 5/8"	5'-0 5/8"
E	3'-1 1/2"	3'-1 1/2"	3'-2 3/8″	3'-4 3/4″	4'-0"	4'-0"	4'-0"	4'-0"	4'-0"	4'-0"
F	2'-6 3/4"	2'-6 3/4"	2'-7 1/8″	2'-9 1/2″	3'-5 1/8"	3'-5 1/8"	3'-5 1/8"	3'-5 1/8"	3'-5 1/8"	3'-5 1/8"
G	4'-1 3/4"	4'-1 3/4"	3'-4 3/4″	3'-9 5/8″	5'-2 5/8"	5'-2 5/8"	5'-2 5/8"	5'-8 1/8"	5'-8 1/8"	5'-8 1/8"
H	4'-3 5/8"	4'-3 5/8"	3'-10 7/8″	4'-3 3/4″	5'-8 1/4"	5'-8 1/4"	5'-8 1/4"	6'-1 7/8"	6'-1 7/8"	6'-1 7/8"
J	3 1/4"	3 1/4"	3 1/4"	3 1/4"	4 3/8"	6 3/8"	6 3/8"	11 7/8"	11 7/8"	11 7/8"
K			3 1/4"	3 1/4"	3'-5/8"	3'-5/8"	3'-5/8"	11 1/8"	11 1/8"	11 1/8"

Table DD-5 — Inlet and Outlet Diameters, Unit Sizes 100 to 550

	Water Connection Pipe Size Diameters (Inches) by Unit Size			
Inlet/Outlet	100, 120	150, 180	200, 240	300, 350, 400, 450, 500, 550
Evaporator	4	5	6	8
Absorber	5	6	8	10
Condenser	5	6	8	10

Dimensional Data

Water Connection Location

Figure DD-9 — Unit Sizes 600, 700

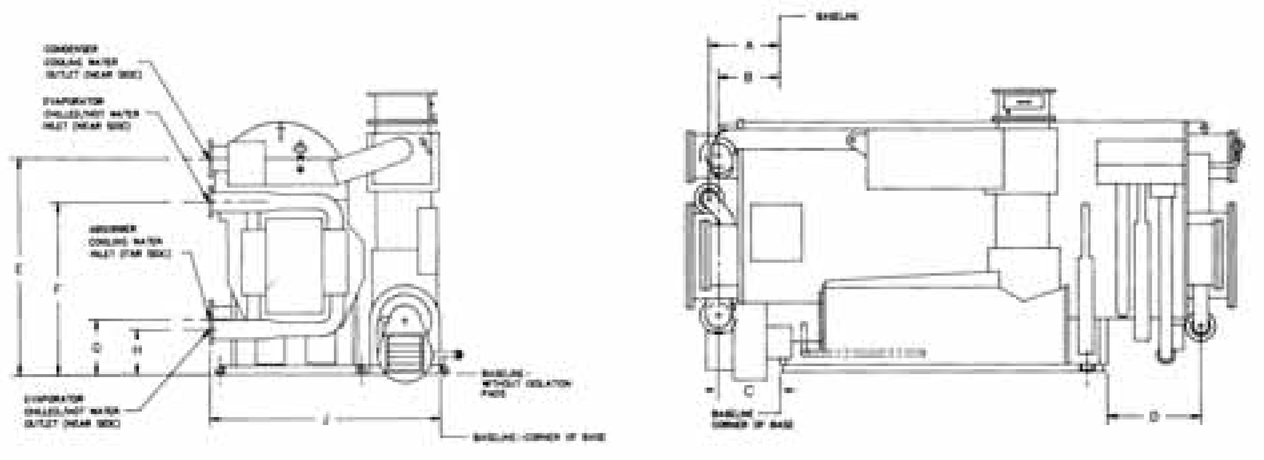


Figure DD-10 — Unit Sizes 800, 900, 1000, 1100

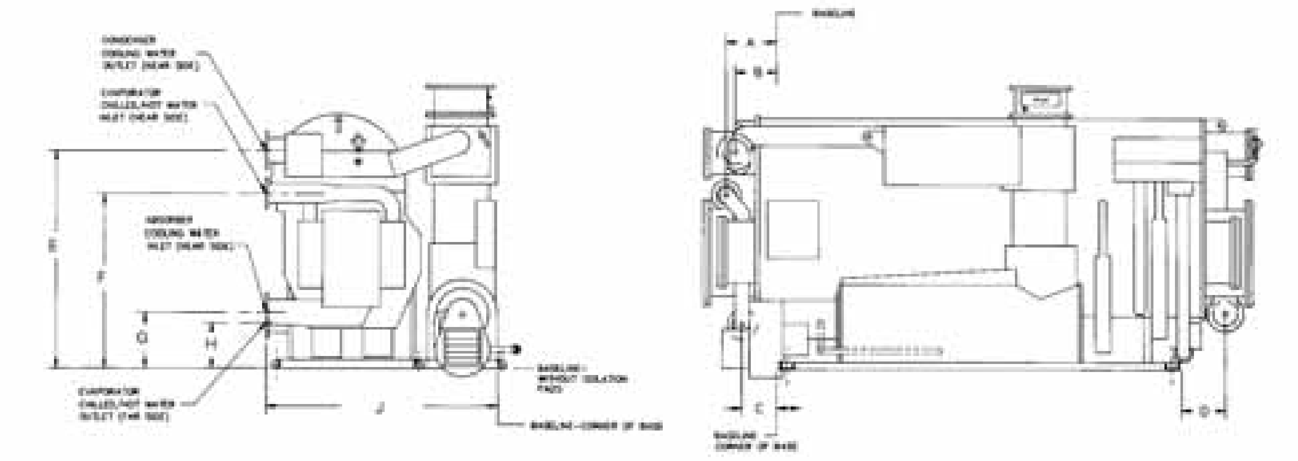


Figure DD-6 — Water Connections, Unit Sizes 600 to 1100

	Water Connection Dimension by Unit Size					
Dimension	600	700	800	900	1000	1100
A	2′-8 1/2″	2′-7 3/8″	3'-5 3/8"	4'-6″	3'-5 3/4″	3'-9 1/2″
B	2′	1′-11″	2'-8 3/4″	3'-9 3/8″	2'-10 1/2″	3'-2 3/8″
C			2'-8 1/4″	3'-8 3/4″	2'-8 1/2″	3'- 3/8″
D	3′-6 5/8″	2′-11 3/8″	2'-8 3/4″	3'-9 1/8″	3'-2 1/4″	3'-2 1/4″
E	9′-6 1/8″	9′-6 1/8″	9'-6 3/8″	9'-6 3/8″	10'-7″	10'-7″
F	7′-6 1/8″	7′-6 1/8″	7'-7 1/2″	7'-7 1/2″	8'-3″	8'-3″
G	2′-10″	2′-10″	2'-10″	2'-10″	2'-9 1/8″	2'-9 1/8″
H	2′-0 3/8″	2′-0 3/8″	2'- 3/8″	2'- 3/8″	2'-4 1/8″	2'-4 1/8″
J	9′-9 1/8″	9′-9 1/8″	10'-3 5/8″	10'-3 5/8″	12'-2 1/2″	

Table DD-7 — Inlet and Outlet Diameters, Unit Sizes 600 to 1100

	Water Connection Pipe Size Diameters (Inches) by Unit Size		
Inlet/Outlet	600, 700	800, 900	1000, 1100
Evaporator	8	10	12
Absorber	12	12	16
Condenser	12	12	16

Sequence of Operation

For initial start-up, the chiller/heater operation switch C-S should be in the “STOP” position, and the burner control switch S-1 is on. And on dual fuel models, select the type of fuel. Power must be applied to the control panel and the electric “source” lamp, LN1, should be lit. Abnormal lamps LN4-12 must not be lit. The hand operated fuel stop valve for the chiller/heater must be open. Power must be applied to the C/H water pump starter and the ventilator motor starter.

To start the Thermachill chiller, the operation switch C-S is moved to the “HEATING” position. The C/H water pump and the ventilator are immediately started. After the C/H water flow switch signal is received, the two refrigerant solenoid valves, the high temperature solution pump, and the low temperature solution pump are started 15 seconds later. The “OPERATION” lamp, LN2, should be lit.

The refrigerant pump and combustion control sensors then monitor the C/H water outlet temperature. If there is sufficient differential between the C/H water outlet temperature and the refrigerant pump set point, then the five minute refrigerant pump antirecycle timer starts timing and the combustion control set point, and approximately three minutes has elapsed since power up or the last C/H cycle, combustion is initiated and the “CALL FOR HEAT” lamp on the burner control panel is lit.

The burner now follows the flame safeguard sequence. The firing rate motor drives toward the “full fire” position, opening the burner air louver to provide the maximum open louver pre-purge. The firing rate motor requires approximately 30 seconds to drive “open” from the “full closed” position. The firing rate motor purge rate switch must be made showing 60 percent of full fire rate air flow or the flame safeguard timing will stop and then restart when the switch does make. If the purge rate switch is not used, the flame safeguard timing will continue to run. Air flow must be proven or the ignition portion of the sequence will not occur. The firing rate motor then drives to the “low fire” position. The firing rate motor minimum position switch must be made or the flame safeguard timing will stop and then restart when this switch does make. The “IGNITION ON” lamp on the burner control panel then lights. The gas pilot ignition transformer is energized and the safety shutoff pilot valve opens to ignite the pilot. Gas pilot flame must be proven or the flame safeguard will lock out. Provided the pilot flame is proven, the “FUEL ON” lamp on the burner control panel is lit, and the “IGNITION ON” lamp goes out. If firing on gas, the safety shutoff and the second safety shutoff, if used, gas valves open. The normally open vent valve, if used, is energized and the main burner ignites at low fire rate. If firing on oil, provided safe oil pressure is proven, if the oil pressure switch(es) are used, the safety shutoff and second safety shutoff, if used, oil valves open to ignite the main burner at low fire rate. The “COMBUSTION” indicator lamp on the unit control panel lights upon confirmation of combustion.

With the firing rate mode selector switch in the burner control panel in the “AUTO” position, the burner firing rate motor is now released to automatic firing rate control and the firing rate is modulated in proportion to the change in C/H outlet water temperature.

If the system load drops to a level where chiller/heater operations is no longer required, an automatic shutdown sequence occurs. The fuel valves close. If firing on gas, the normally open vent valve, if used, opens. The flame safeguard timing starts. The firing rate motor drives to the “closed” position. The burner motor and flame safeguard timing stop. The “COMBUSTION” indicator lamp on the unit control panel goes out. The chiller/heater is now ready should heating operation again be required.

If the chiller/heater is shutdown manually, either by placing the C-S switch in the “STOP” position, or remotely, the following sequence occurs. The C/H water pump turns off. The burner motor shuts down in the same manner as automatic operation. The dilution cycle is then initiated. After 15 minutes the dilution cycle is completed and the high temperature solution pump, the low temperature solution pump, and the ventilator motor stops. The refrigerant solenoid valves then close. The “OPERATION” lamp, LN2, should go out.

Sequence of Operation

For initial start-up, the chiller/heater operation switch C-S should be in the "STOP" position, and the burner control switch S-1 is on. And on dual fuel models, select the type of fuel. Power must be applied to the control panel and the electric "SOURCE" lamp, LN1, should be lit. Abnormal lamps LN4-12 must not be lit. The hand operated fuel stop valve for the chiller/heater must be open. Power must be applied to the C/H water pump and cooling tower pump starters, and the ventilator motor starter.

To start the Thermachill chiller/heater, the operation switch C-S is moved to the "COOLING" position. The C/H water pump and the ventilator motor are immediately started. After the C/H water flow switch signal is received, the cooling tower pump, the high temperature solution pump, and the low temperature solution pump are started 15 seconds later. The "OPERATION" lamp, LN2, should be lit.

The refrigerant pump and combustion control sensors then monitor the C/H water outlet temperature. If there is sufficient differential between the C/H water outlet temperature and the refrigerant pump set point, then the five minute refrigerant pump antirecycle timer starts timing and the combustion control set point, and approximately three minutes has elapsed since power up or the last C/H cycle, combustion is initiated and the "CALL FOR HEAT" lamp on the burner control panel is lit.

The burner now follows the flame safeguard sequence. The firing rate motor drives toward the "full fire" position, opening the burner air louver to provide the maximum open louver pre-purge. The firing rate motor requires approximately 30 seconds to drive "open" from the "full closed" position. The firing rate motor purge rate switch must be made showing 60 percent of full fire rate air flow or the flame safeguard timing will stop and then restart when the switch does make. If the purge rate switch is not used, the flame safeguard timing will continue to run. Air flow must be proven or the ignition portion of the sequence will not occur. The firing rate motor then drives to the "low fire" position. The firing rate motor minimum position switch must be made or the flame safeguard timing will stop and then restart when this switch does make. The "IGNITION ON" lamp on the burner control panel then lights. The gas pilot ignition transformer is energized and the safety shutoff pilot valve opens to ignite the pilot. Gas pilot flame must be proven or the flame safeguard will lock out. Provided the pilot flame is proven, the "FUEL ON" lamp on the burner control panel is lit and the "IGNITION ON" lamp goes out. If firing on gas, the safety shutoff and second safety shutoff, if used, gas valves open. The normally open vent valve, if used, is energized and the main burner ignites at low fire rate. If firing on oil, provided safe oil pressure is proven, if the oil pressure switch(es) are used, the safety shutoff and second safety shutoff, if used, oil valves open to ignite the main burner at low fire rate, the "COMBUSTION" indicator lamp on the unit control panel light upon confirmation of combustion.

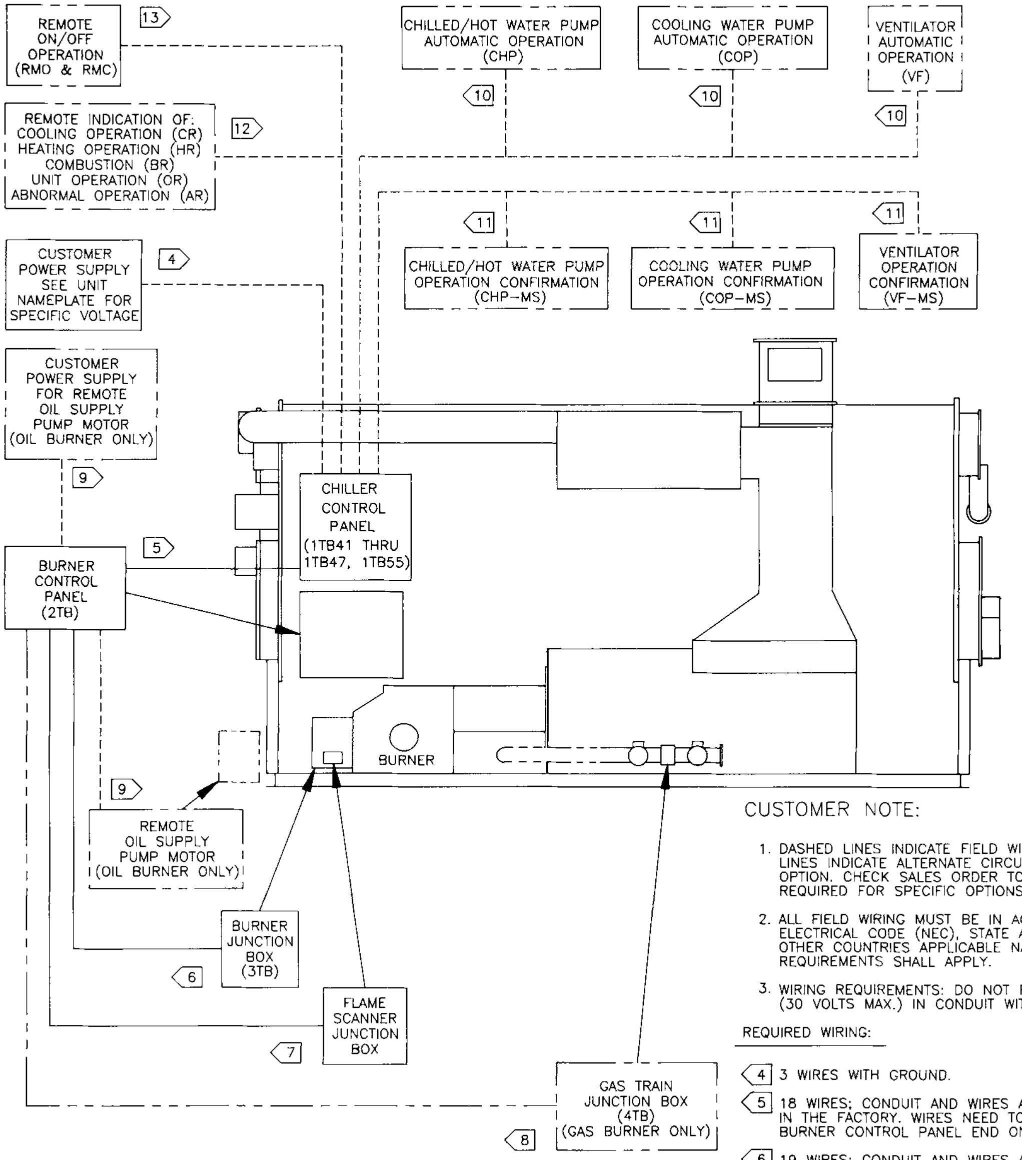
With the firing rate mode selector switch in the burner control panel in the "AUTO" position, the burner firing rate motor is now released to automatic firing rate control and the firing rate is modulated in proportion to the change in C/H outlet water temperature.

If the system load drops to a level where chiller/heater operation is no longer required, an automatic shutdown sequence occurs. The fuel valves close. If firing on gas, the normally open vent valve, if used, opens. The flame safeguard timing starts. The firing rate motor drives to the "closed" position. The burner motor and flame safeguard timing stop. The "COMBUSTION" indicator lamp on the unit control panel goes out. The chiller/heater is now ready should cooling operation again be required.

If the chiller/heater is shutdown manually, either by placing the C-S switch in the "STOP" position, or remotely, the following sequence occurs. The C/H water pump, the cooling tower water pump, and the refrigerant pump turn off. The two refrigerant solenoid valves are opened to initiate the dilution cycle. The burner motor shuts down in the same manner as automatic operation. After 15 minutes the dilution cycle is completed and the high temperature solution pump and the low temperature solution pump stops and the ventilator motor stops. The refrigerant solenoid valves then close. The "OPERATION" lamp, LN2, should go out.

Typical Wiring Diagrams

Field Connections



CUSTOMER NOTE:

1. DASHED LINES INDICATE FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTION. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.
3. WIRING REQUIREMENTS: DO NOT RUN LOW VOLTAGE CIRCUITS (30 VOLTS MAX.) IN CONDUIT WITH HIGHER VOLTAGE CIRCUITS.

REQUIRED WIRING:

<4] 3 WIRES WITH GROUND.

<5] 18 WIRES; CONDUIT AND WIRES ARE PRECUT AND TERMINATED IN THE FACTORY. WIRES NEED TO BE FIELD CONNECTED ON THE BURNER CONTROL PANEL END ONLY.

<6] 19 WIRES; CONDUIT AND WIRES ARE PRECUT AND TERMINATED IN THE FACTORY. WIRES NEED TO BE FIELD CONNECTED ON THE BURNER CONTROL PANEL END ONLY.

<7] 2 WIRES; #14-16 AWG, 600V.

OPTIONS AND CUSTOMER SUPPLIED CONTROL WIRING:

<8] 4 OR 6 WIRES; CONDUIT AND WIRES ARE PRECUT AND TERMINATED IN THE FACTORY. WIRES NEED TO BE FIELD CONNECTED ON THE BURNER CONTROL PANEL END ONLY. (FURNISHED WITH GAS BURNER ONLY)

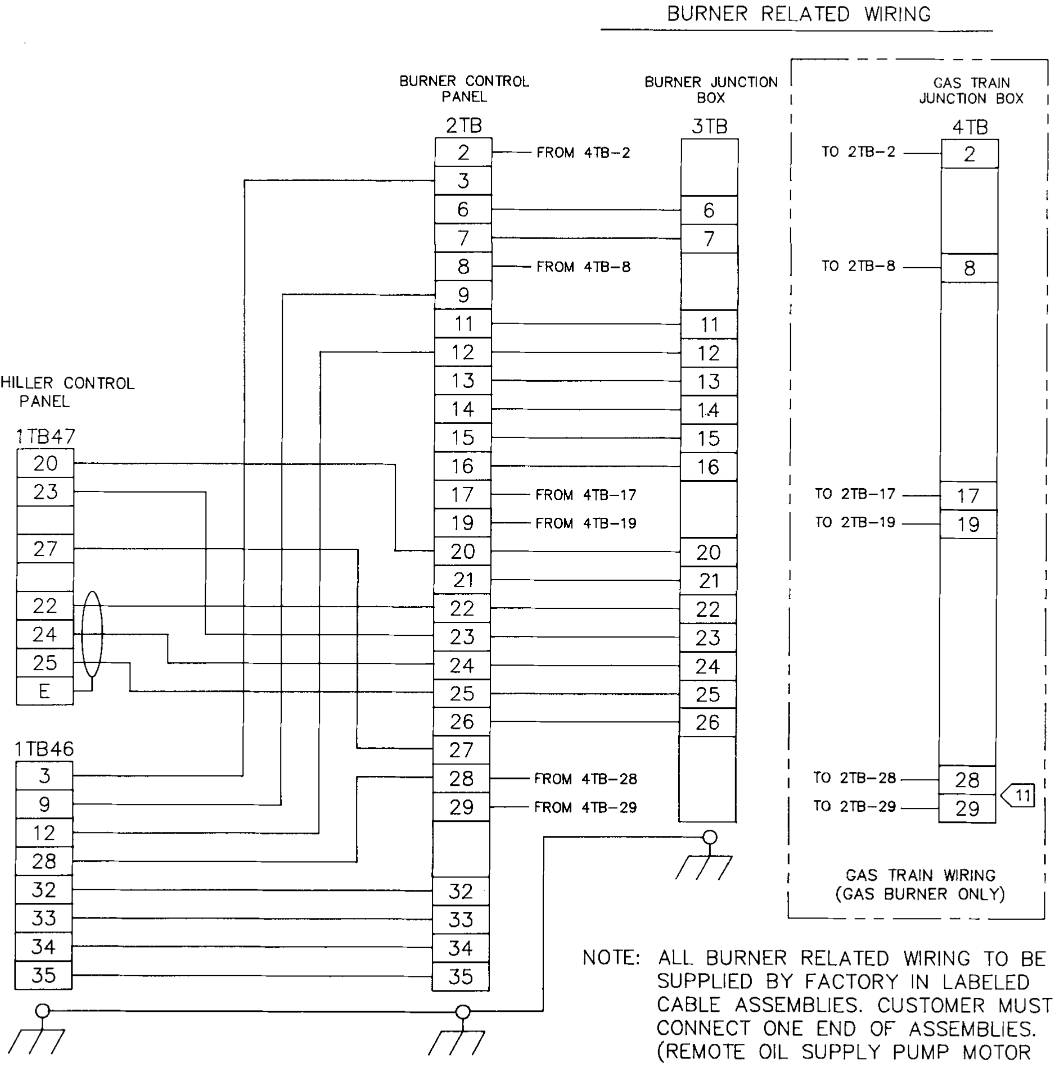
<9] 3 WIRES WITH GROUND; 1 1/2 HP MAX LOAD. VOLTAGE IS SAME AS UNIT NAMEPLATE VOLTAGE UNLESS OTHERWISE SPECIFIED. (REQUIRED WITH OIL BURNER ONLY)

<10] 2 WIRES; #14-16 AWG, 600V.

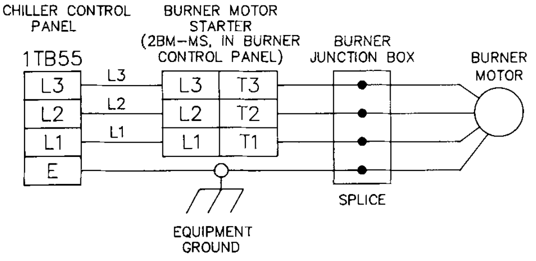
<11] 2 WIRES; #14-18 AWG, 600V. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE CIRCUITS.

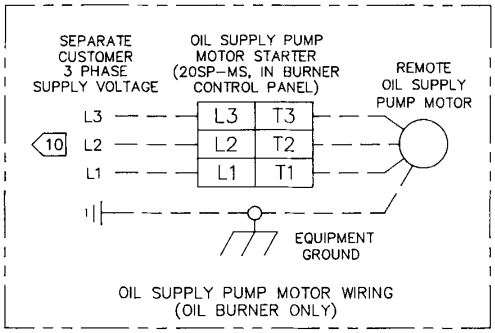
<12] EACH INDIVIDUAL INDICATION REQUIRES 2 WIRES; #14-16 AWG, 600V.

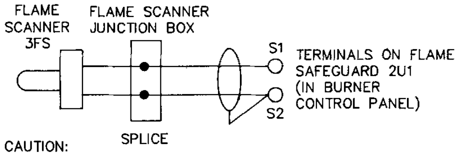
<13] REMOTE ON/OFF OPERATION MAY BE OBTAINED BY EITHER A CONTACT CLOSURE INPUT OR 24 VDC INPUT. EACH REQUIRE 2 WIRES; #14-18 AWG, 600V. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE CIRCUITS.



NOTE: ALL BURNER RELATED WIRING TO BE SUPPLIED BY FACTORY IN LABELED CABLE ASSEMBLIES. CUSTOMER MUST CONNECT ONE END OF ASSEMBLIES. (REMOTE OIL SUPPLY PUMP MOTOR WIRING IS NOT FACTORY SUPPLIED)







CAUTION:
SCANNER LEADS MUST BE INSTALLED IN ACCORDANCE WITH THE INSTRUCTIONS ON THE BURNER SCHEMATIC WIRING.

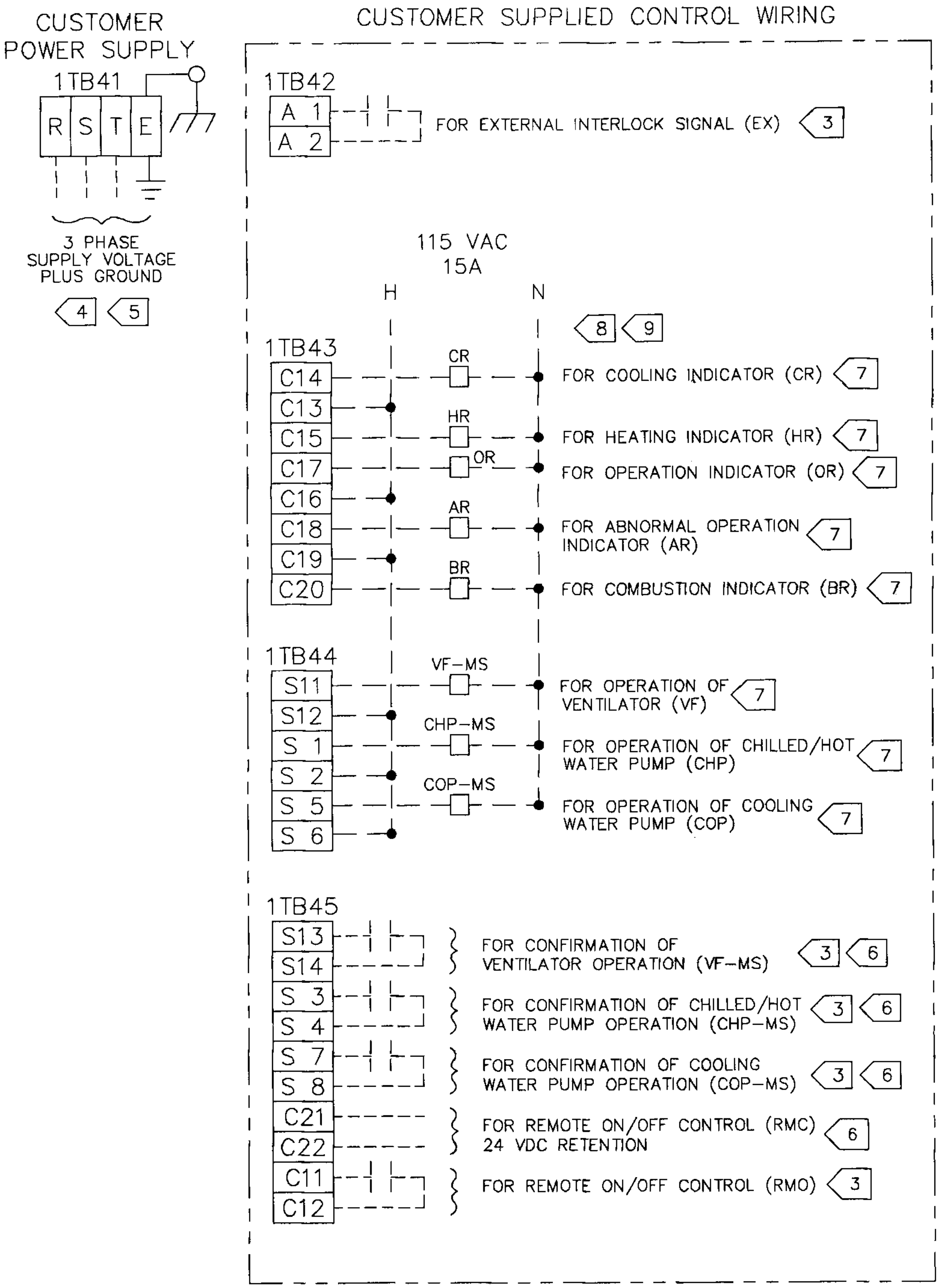
Typical Wiring Diagrams
Field Connections

CUSTOMER NOTE:

1. DASHED LINES INDICATE FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTION. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.
3. CUSTOMER SUPPLIED CONTACTS MUST BE COMPATIBLE WITH DRY CIRCUIT 24 VDC, 45 mA. GOLD PLATED CONTACTS RECOMMENDED.
4. RETIGHTEN TERMINALS A MINIMUM OF 24 HOURS AFTER INITIAL INSTALLATION. DO NOT OVER TIGHTEN.
5. COPPER WIRE, SIZED PER N.E.C., BASED ON UNIT NAMEPLATE RLA PLUS TRANSFORMER LOAD IN R & S. PHASING OF 3 PHASE INPUT: R TO A, S TO B, T TO C WHERE ABC REPRESENTS STANDARD PHASE ROTATION.
6. 30V OR LESS #14–18 AWG 600V WIRE. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE WIRE.
7. FIELD WIRED ELECTRICAL LOADING IS NOT TO EXCEED THE FOLLOWING CONTACT RATING: 2A @ 250 VAC INDUCTIVE LOAD
8. FOR CANADIAN INSTALLATION (CSA) ONLY: LOCAL INSPECTION AUTHORITIES MAY REQUIRE SINGLE POWER SOURCE DISCONNECTING MEANS.
9. 115 VAC, #14 AWG, 600V MAX FUSE SIZE 15A.
10. 1 1/2 HP MAX LOAD; VOLTAGE IS SAME AS THE UNIT NAMEPLATE VOLTAGE UNLESS OTHERWISE SPECIFIED. SEE MOTOR NAMEPLATE FOR PROPER LEAD CONNECTIONS.
11. TERMINALS 4TB–28 & 29 PRESENT ONLY WITH SAFETY SHUTOFF GAS VALVE SEAL OVERTRAVEL INTRELOCK SWITCH.

DEVICE PREFIX LOCATION CODE	
PREFIX	LOCATION
1	CHILLER CONTROL PANEL
2	BURNER CONTROL PANEL
3	BURNER JUNCTION BOX
4	GAS TRAIN JUNCTION BOX

CHILLER RELATED WIRING



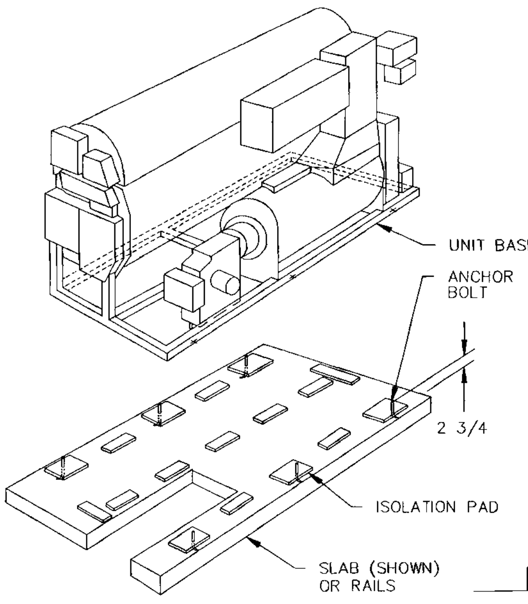
Jobsite Connections

Field Installation 100 thru 550 Tons

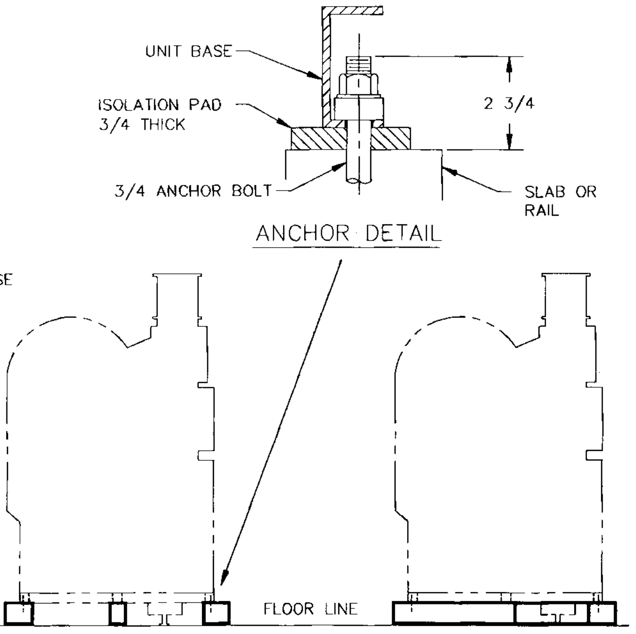
Customer Notes:

1. Refer to unit submittal for specific unit details and surrounding space requirements.
2. Unit must be elevated with clearance for burner extension below unit.
3. Overall slab or rail size to be determined by customer.
4. Foundation finish to be flat and smooth. Grade not to exceed .20" over length of unit.
5. Use unit anchoring holes, as required, to meet local codes.
6. Units with enclosure: opening(s) under unit base must be sealed off to prevent wind effect on burner.

Unit Nominal Tons	A	B	C	D	E	F	G	H	Max. Weight Per Anchoring Bolt (lbs)
100	9′-7 3/8″	4′-10 1/2″	2′-5″	2	3′-0″	2 1/2″	2′-1″	6	3,100
120	10'-3 1/4"	4′-10 1/2″	2′-5″	2	3'-5"	2 1/2″	2′-1″	6	3,400
150	11'-5"	4′-10 1/2″	2′-5″	2	3'-10"	2 1/2″	2′-1″	6	3,900
180	13'-1"	5'-3 3/8"	2'-9 7/8"	2	3'-8"	2 1/2″	2'-5 7/8"	6	4,600
200	14'-3 1/4"	5'-3 3/8"	2'-9 7/8"	2	4'-8"	2 1/2″	2'-5 7/8"	6	5,000
240	16'-11 1/8"	5'-3 3/8"	2'-9 7/8"	2	6'-9"	2 1/2″	2'-5 7/8"	6	5,500
300	13'-11 1/8"	6'-2"	3'-3 3/8"	4	3'-3"	4 1/2″	2'-8 3/8"	6	5,700
350	15'-7 3/8"	6'-2"	3'-3 3/8"	4	4'-0"	4 1/2″	2'-8 3/8"	6	6,300
400	17'-7"	6'-2"	3'-3 3/8"	4	4'-10"	4 1/2″	2'-8 3/8"	6	6,800
450	18'-2 1/8"	6'-7 1/2"	3'-8 7/8"	4	5'-6"	4 1/2″	3'-1 7/8"	6	5,700
500	20'-4 7/8"	6'-7 1/2"	3'-8 7/8"	4	6'-9"	4 1/2″	3'-1 7/8"	1'-2"	6,200
550	22'-3"	6'-7 1/2"	3'-8 7/8"	4	7'-8"	4 1/2″	3'-1 7/8"	1'-2"	7,000



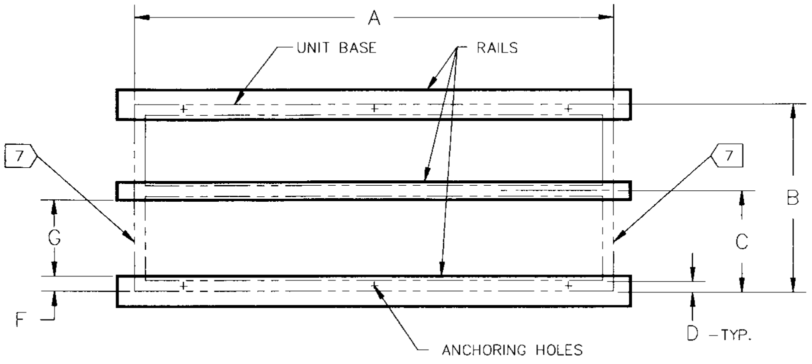
Isolation Pad Placement By Others
Unit with 6 anchor holes shown.
Other units are similar



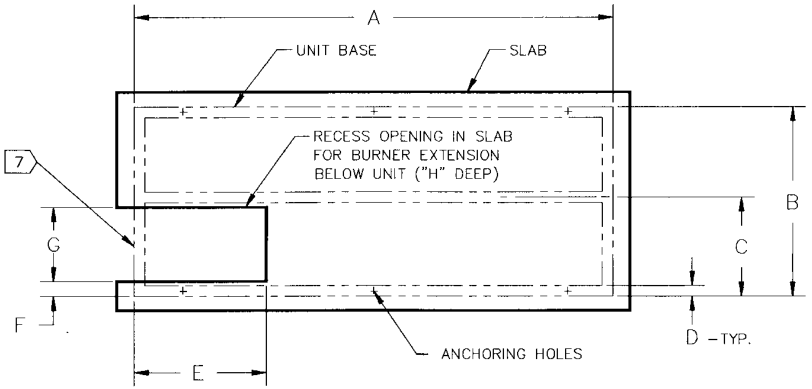
End Elevation
Rail Mounting Method

End Elevation
Slab Mounting Method

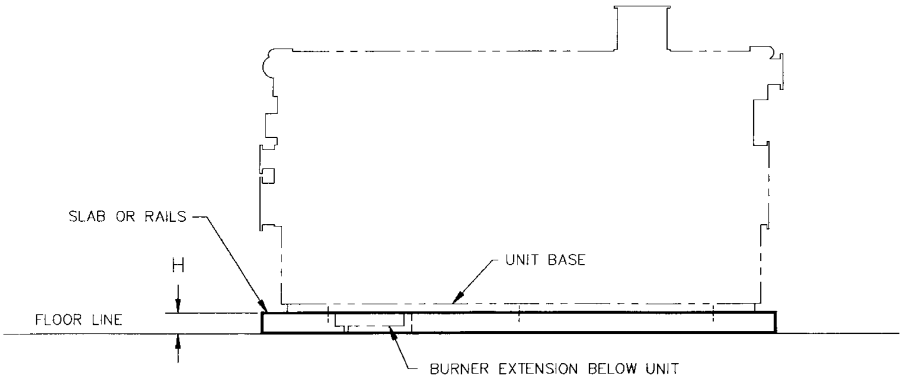
Jobsite Connections



PLAN VIEW
RAIL MOUNTING METHOD



PLAN VIEW
SLAB MOUNTING METHOD



FRONT ELEVATION

Jobsite Connections

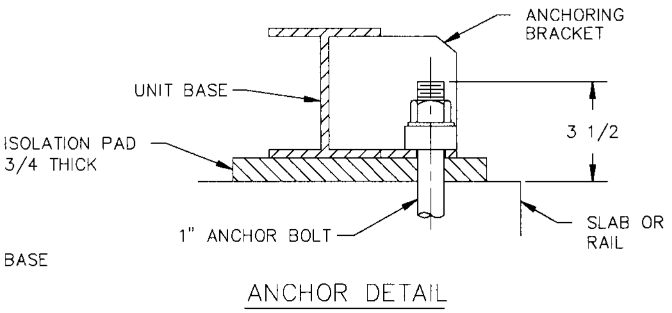
Field Installation 600 thru 1100 Tons

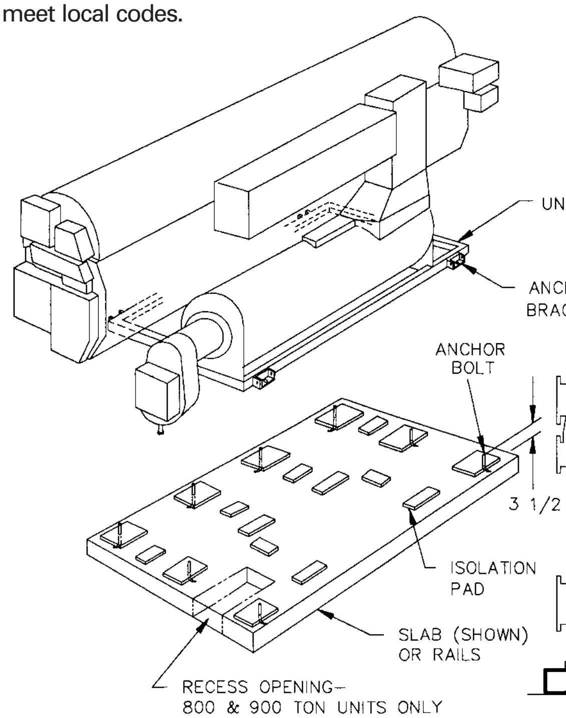
Customer Notes:

1. Sample unit is shown. Refer to unit submittal for specific unit details and surrounding space requirements.
2. 600 and 700 ton units must be elevated to provide clearance for burner extension below unit.
3. 800 and 900 ton unit must be elevated and have recess opening to provide clearance for burner extension below unit.
4. 1000 and 1100 ton units do not have to be elevated since burner does not extend below unit.
5. Overall slab or rail size to be determined by customer.
6. Foundation finish to be flat and smooth. Grade not to exceed .20" over length of unit.
7. Use unit anchoring holes, as required, to meet local codes.

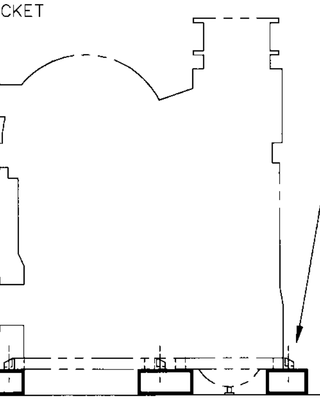
Unit Nom. Tons	A	B	C	D	E	F	G	H	J	Max. Weight Per Anchoring Bolt (lbs)
600	10'-6 3/8"	8'-10 7/8"	4'-1 1/2"	2'-9 3/8"	*	*	*	6	6 Max.	9,400
700	12'-11 1/8"	8'-10 7/8"	4'-1 1/2"	2'-9 3/8"	*	*	*	6	6 Max.	8,900
800	15'-7 7/8"	9'-5 3/8"	4'-8"	3'-4"	1'-10"	5 1/2"	2'-7 1/2"	6	1'-0" Min.	10,100
900	15'-8 1/8"	9'-5 3/8"	4'-8"	3'-4"	2'-9"	5 1/2"	2'-7 1/2"	6	6 Min.	11,100
1000	13'-2"	11'-1 1/8"	5'-4"	3'-6 3/8"	*	*	*	*	*	12,700
1100	14'-5"	11'-1 1/8"	5'-4"	3'-6 3/8"	*	*	*	*	*	13,700

*= Not Applicable

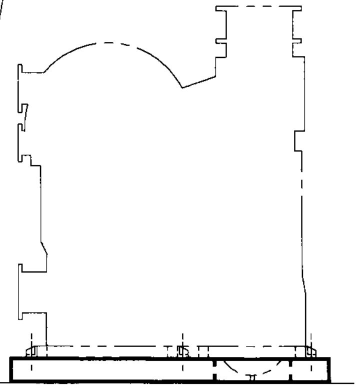




Isolation Pad Placement By Others
Unit with 8 anchor brackets shown.
Other units are similar

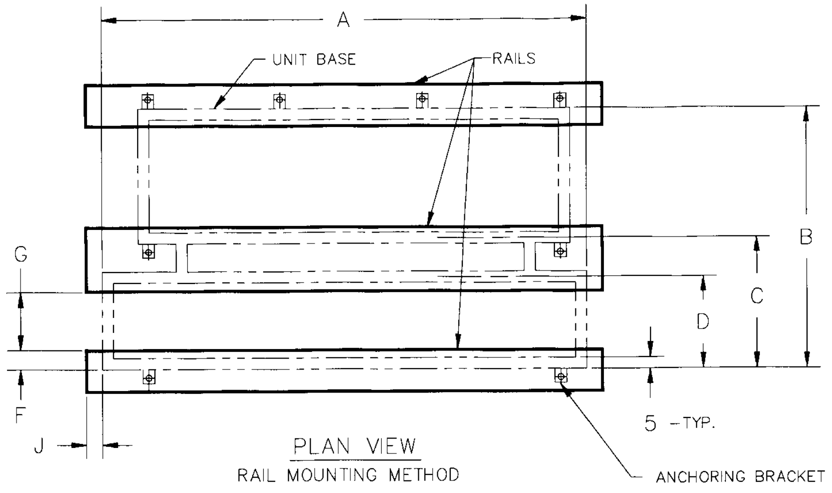


End Elevation
Rail Mounting Method

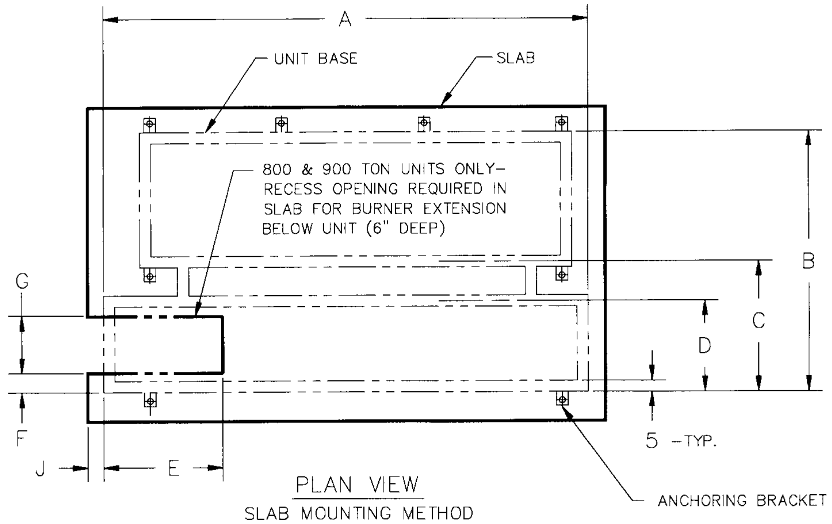


End Elevation
Slab Mounting Method

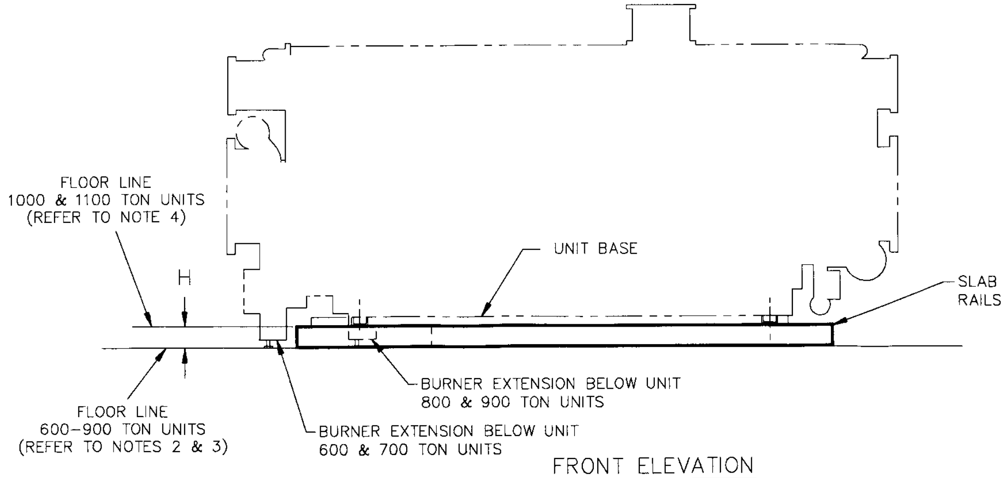
Jobsite Connections



PLAN VIEW
RAIL MOUNTING METHOD



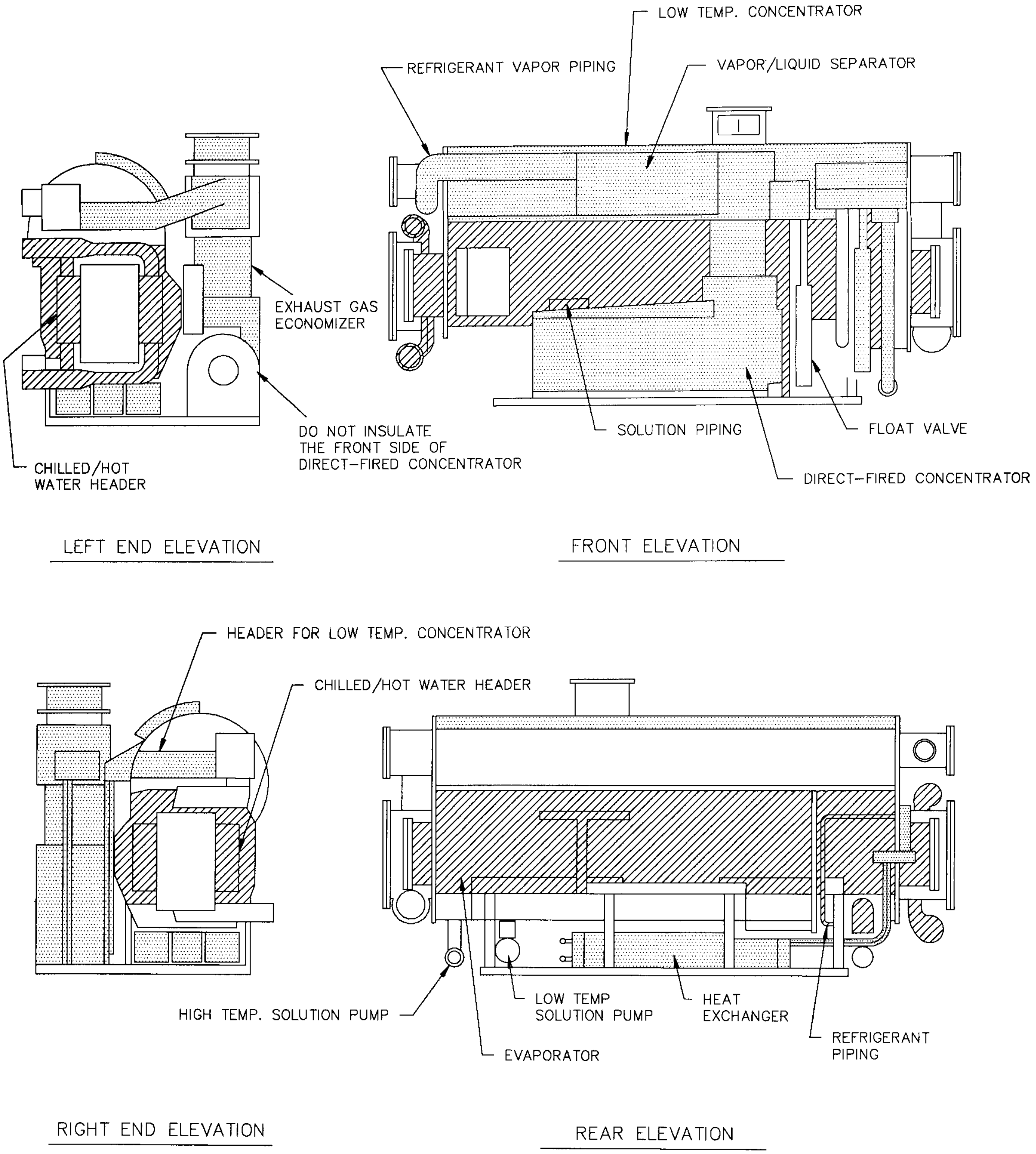
PLAN VIEW
SLAB MOUNTING METHOD



FRONT ELEVATION

Jobsite Connections

Field Insulation Requirements



LEFT END ELEVATION

FRONT ELEVATION

RIGHT END ELEVATION

REAR ELEVATION

░ HOT SURFACES TO INSULATE

▨ COLD SURFACES TO INSULATE

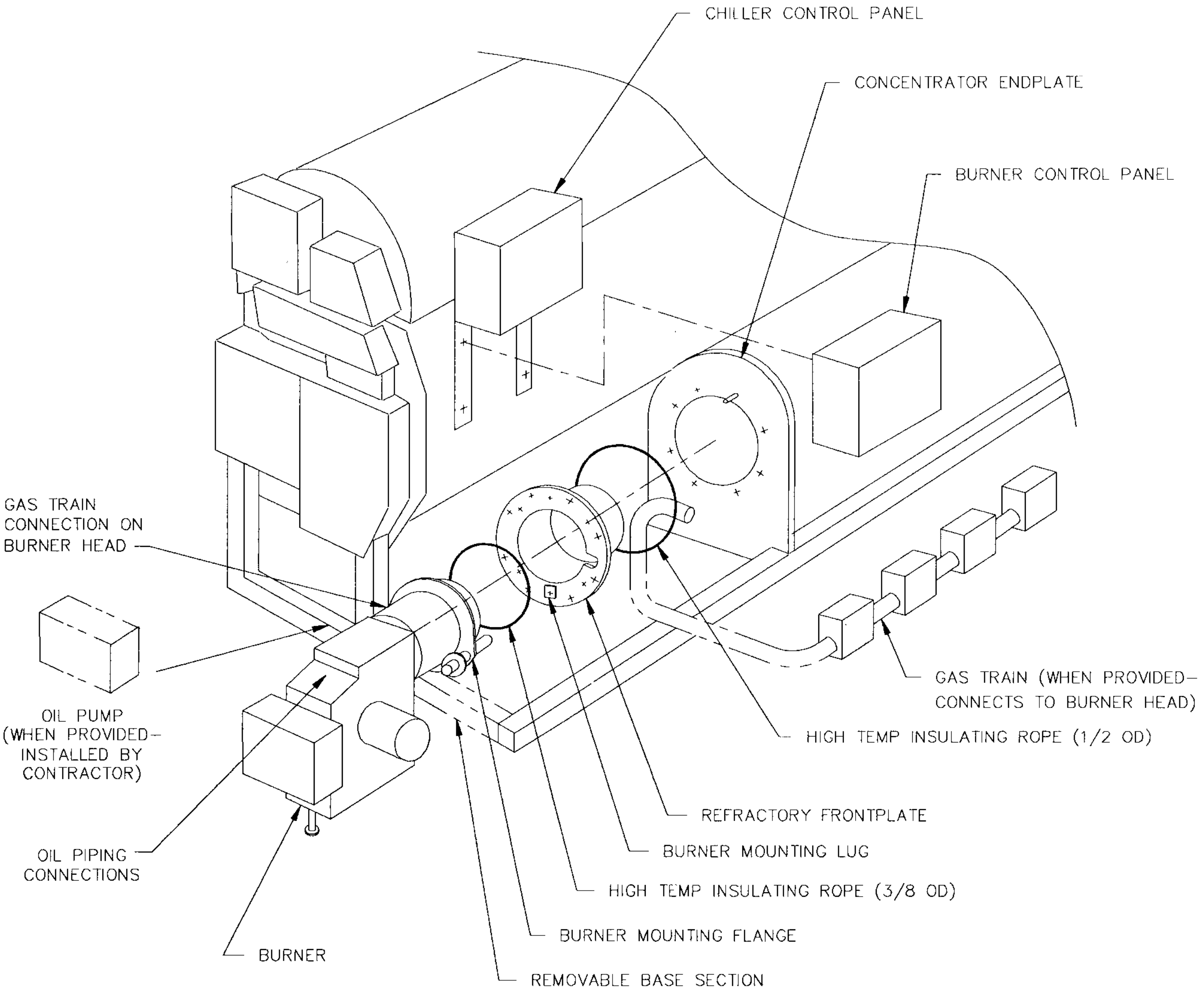
Jobsite Connections

Field Insulation Requirements

	Surface Area for Hot Insulation (Sq. Ft.)			Surface Area for Cold Insulation (Sq. Ft.)	
	Direct-Fired Generator, Exhaust Gas Economizer	Vapor/Liquid Separator, Header for Low Temp. Generator	Low Temp. Generator, Heat Exchanger, Solution Piping, Refrigerant Vapor Piping, Float Valve	Evaporator, Chilled/Hot Water Header	Refrigerant Piping
	Metal Surface Temperature				
Unit Nom. Tons	350°F Max.	350°F Max.	250°F Max.	40 to 200°F (Refer to Note 1b)	150°F Max.
100	54	23	73	39	14
120	59	23	80	44	13
150	68	23	89	52	12
180	76	29	122	59	12
200	83	29	132	63	13
240	89	29	153	73	14
300	102	43	146	96	15
350	112	43	172	108	16
400	124	43	184	121	17
450	135	48	216	131	18
500	146	48	239	145	19
550	159	48	302	157	20
600	140	81	420	226	54
700	194	102	484	269	54
800	237	118	527	301	54
900	258	129	581	334	65
1000	280	151	592	344	65
1100	301	172	603	344	65

Customer Notes:

1. Unit is painted with heat resistant material. Customer must provide and install nonflammable insulation materials to prevent dew and burn, and to keep unit at high operating efficiency. Refer to table for metal temperatures of surfaces to be insulated.
   a. Hot Insulation: Type and thickness of insulation must be sufficient so that outer skin temperature meets OSHA safety requirements for personnel protection.
   b. Cold Insulation: Insulation should be warranted to prevent sweating up to a dew point rating of 74°F and withstand a temperature of 200°F (during heating).
2. Perform vacuum test prior to insulation unit.
3. Make sure that unit cover plates and flange parts are easily detachable after insulating.
4. Make the insulation material on the top and outside of the heat exchanger removable. Do not connect it with other insulation parts using metal fasteners.



TYPICAL BURNER ASSEMBLY

Jobsite Connections

Burner Installation

Customer Notes:

1. Burner is supplied with a separate control panel, burner mounting refractory frontplate, fuel supply system, insulating rope, and mounting hardware for installation by contractor.
2. Fuel supply system is furnished to suit fuel type ordered: (Refer to fuel supply system submittal)

   Gas – A pre-piped and wired gas train will be provided with components that are selected to meet local codes. (Mandatory to consult local codes to verify gas train requirements.)

   Oil – An oil pump system is provided. Contractor to mount on unit base or other convenient location.

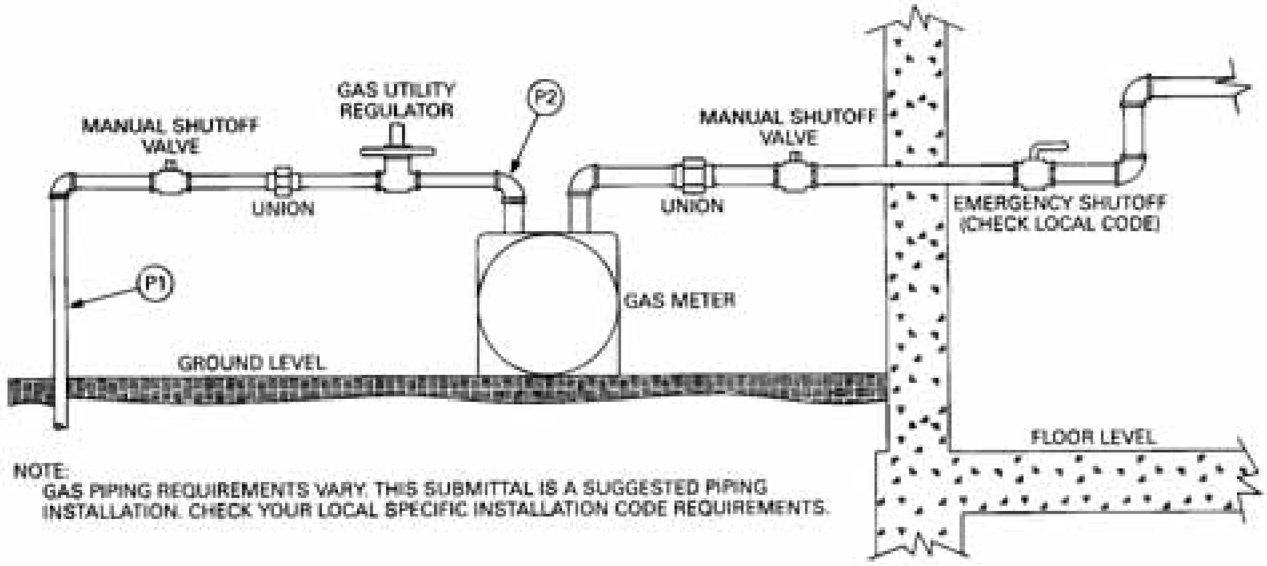
   Gas/Oil – Includes both of the above.
3. Units 100 thru 900 nominal ton must be elevated or the housekeeping pad must provide clearance for the burner which extends below the unit when installed. (Refer to unit installation submittal for details.)
4. It may be necessary to remove a section of the unit base during installation of the burner.
5. The electrical connections are furnished and must be connected after burner mounting is complete. (Refer to field wiring submittal for details.)
6. Use table to determine rigging weights and size of components. Burner weights are for a combination gas-oil dual fuel type burner

Table JC-1 – Burner Specifications

Unit	Component Weights (Approx. Lbs.)			
Nom. Tons	Burner (G/O)	Frontplate	Burner Control Panel	Gas Train
100	250	60	65	Varies With Code and Gas Flow
120	275			
150	285			
180	295	100		
200	375			
240	400			
300	600	150		
350	700			
400	700			
450	700	175		
500	1000			
550	1000			
600	1100	200		
700	1300			
800	1400	250		
900	1400			
1000	1600	300		
1100	1600			

Jobsite Connections

Gas Fuel Supply System



NOTE:
GAS PIPING REQUIREMENTS VARY. THIS SUBMITTAL IS A SUGGESTED PIPING INSTALLATION. CHECK YOUR LOCAL SPECIFIC INSTALLATION CODE REQUIREMENTS.

CUSTOMER NOTE:

1. THE GAS CONTROL SIZE FURNISHED IS SELECTED BASED UPON DESIGN MAIN PRESSURE AND GAS FLOW. THE MINIMUM GAS PRESSURE REQUIRED AT THE INLET TO THE CONTROLS IS SHOWN IN THE BURNER MATERIAL LIST CONTAINED IN THE MANUAL SHIPPED WITH THE BURNER.

2. GAS PIPING SHOULD BE SIZED TO PROVIDE THE REQUIRED MINIMUM PRESSURE AT THE MAIN MANUAL SHUT-OFF VALVE WHEN OPERATING AT MAXIMUM INPUT. CONSULT YOUR LOCAL UTILITY ON ANY QUESTIONS REGARDING GAS PRESSURE, PIPING PRESSURE DROPS ALLOWABLE AND LOCAL PIPING REQUIREMENTS.

3. GAS PIPING SHOULD BE INSTALLED IN ACCORDANCE WITH THE AMERICAN NATIONAL STANDARD, ANSI Z223.1 AND ANY OTHER LOCAL CODES WHICH MAY APPLY. ALL GAS PIPING SHOULD BE TESTED AFTER INSTALLATION WITH AIR PRESSURE OR INERT GAS FOR AT LEAST THREE TIMES THE GAS PRESSURE THAT WILL BE USED. THE PIPING AHEAD OF THE MAIN MANUAL SHUTOFF VALVE SHALL INCLUDE A FULL SIZE DIRT POCKET OR TRAP.

4. DO NOT USE TEFLON TAPE AS A GAS PIPE SEALANT. TEFLON TAPE CAN CAUSE VALVES TO FAIL CREATING A SAFETY HAZARD. WARRANTIES ARE NULLIFIED AND LIABILITY RESTS SOLELY WITH THE INSTALLER WHEN TEFLON TAPE IS USED. USE A PIPE JOINT COMPOUND RATHER THAN TEFLON TAPE.

5. ALL VENT LINES MUST BE SIZED, LOCATED, PROTECTED AND INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL OR GOVERNING CODES OR IF NOT APPLICABLE THE BURNER INSTALLATION INSTRUCTION MANUAL.

Table JC-2 – Capacity of Pipe – Natural Gas (CFH)

WITH PRESSURE DROP OF 0.3" W.C. AND SPECIFIC GRAVITY OF 0.60

PIPE LENGTH IN FEET	PIPE SIZE – INCHES (IPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	132	278	520	1050	1600	3050	4800	8500	17500
20	92	190	350	730	1100	2100	3300	5900	12000
30	73	152	285	590	890	1650	2700	4700	9700
40	63	130	245	500	760	1450	2300	4100	8300
50	56	115	215	440	670	1270	2000	3800	7400
60	50	105	195	400	610	1150	1850	3250	6800
70	46	96	180	370	560	1050	1700	3000	6200
80	43	90	170	350	530	990	1600	2800	5800
90	40	84	160	320	490	930	1500	2600	5400
100	38	79	150	305	460	870	1400	2500	5100
125	34	72	130	275	410	780	1250	2200	4500
150	31	64	120	250	380	710	1130	2000	4100
175	28	59	110	225	350	650	1050	1850	3800
200	26	55	100	210	320	610	980	1700	3500

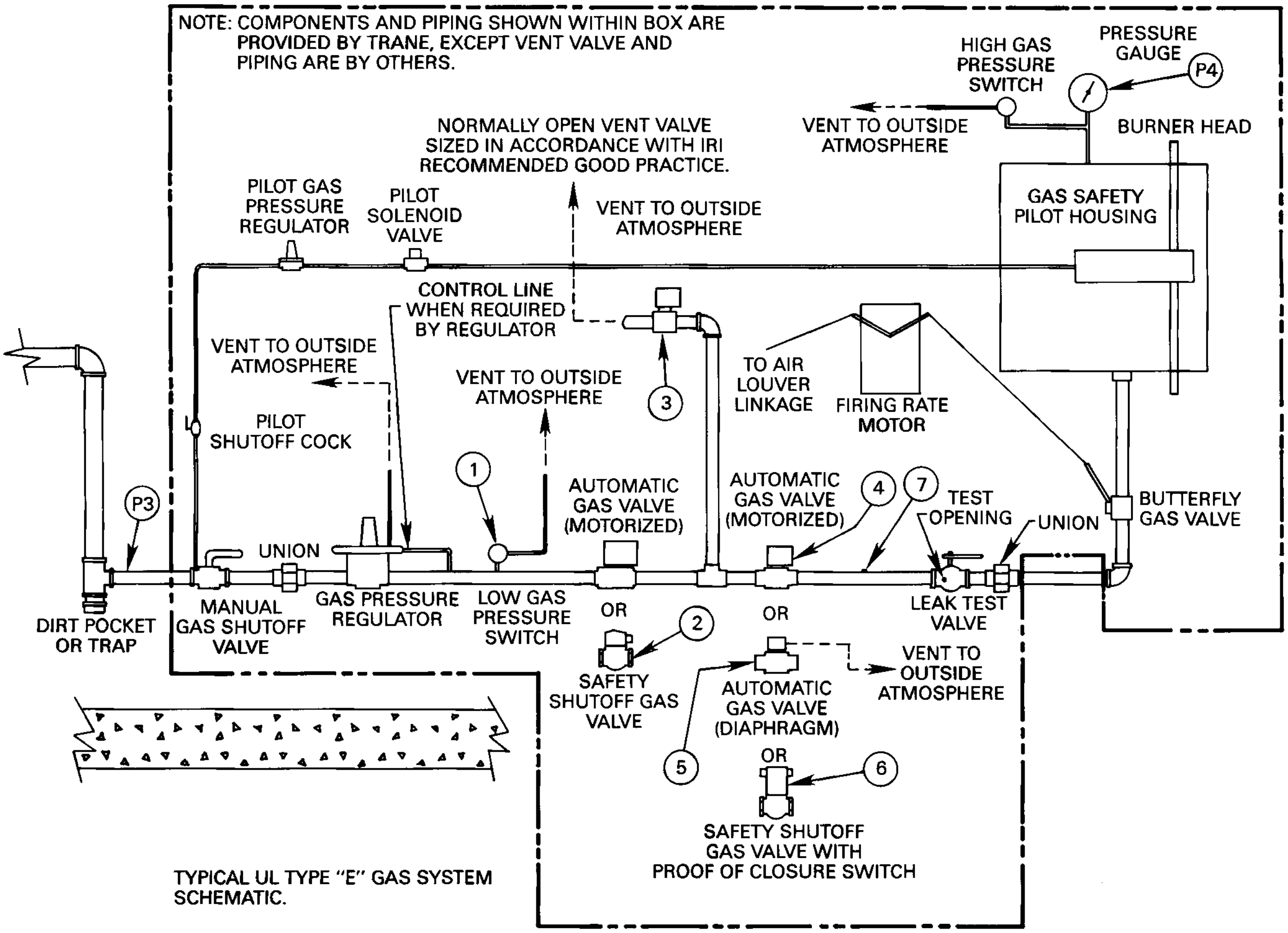
Fuel Correction Factors for Table JC-2

Table JC-3 – Specific Gravity Other than 0.60

SPECIFIC GRAVITY	MULTIPLIER OF CFH
0.50	1.10
0.60	1.00
0.70	0.926
0.80	0.867
0.90	0.817
1.00	0.775
PROPANE – AIR	
1.10	0.740
PROPANE	
1.55	0.622
BUTANE	
2.00	0.547

Table JC-4 – Pressure Drop Other Than 0.3"

PRESSURE DROP	MULTIPLIER OF CFH
0.1	0.577
0.2	0.815
0.3	1.00
0.4	1.18
0.6	1.42
0.8	1.64
1.0	1.83
2.0	2.58
3.0	3.16
4.0	3.65
6.0	4.47
8.0	5.15



TYPICAL UL TYPE "E" GAS SYSTEM SCHEMATIC.

LEGEND

① LOW AND HIGH GAS PRESSURE SWITCHES REQUIRED 2501 MBH & UP.

② SOLENOID SAFETY SHUTOFF GAS VALVE SUPPLIED UP TO 3" NPT.

③ NORMALLY OPEN VENT VALVE IS FOR 12501 MBH & UP.

④ MOTORIZED VALVE IS FOR 400 TO 5000 MBH.

⑤ DIAPHRAGM GAS VALVE IS FOR 400 TO 2500 MBH.

⑥ PROOF OF CLOSURE IS FOR 5001 MBH AND ABOVE.

⑦ TEST OPENING IF NOT IN VALVE BODIES.

(P1) GAS PRESSURE IN STREET MAIN.

VARIES DUE TO SEVERAL FACTORS (LENGTH OF SUPPLY PIPING, TOTAL LOAD, ETC.) BUT IS USUALLY MAINTAINED SEVERAL INCHES W.C. OR MORE ABOVE P2.

(P2) REGULATED METER PRESSURE.

SUFFICIENT TO MEET P3 REQUIREMENTS.

(P3) GAS PRESSURE AT INLET TO BURNER CONTROLS.

SHOULD BE MEASURED UNDER FLOW CONDITION. MINIMUM PRESSURE: 7" WATER TO 200 CFH, 1 PSIG ABOVE 200 CFH.

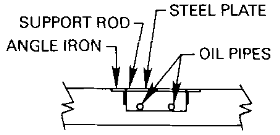
(P4) GAS PRESSURE ON BURNER MANIFOLD.

BURNER ORIFICES ARE SIZED FOR ABOUT 3-1/2" W.C. SEE BURNER MATERIAL LIST FOR REQUIRED MANIFOLD OR ORIFICE GAS PRESSURE.

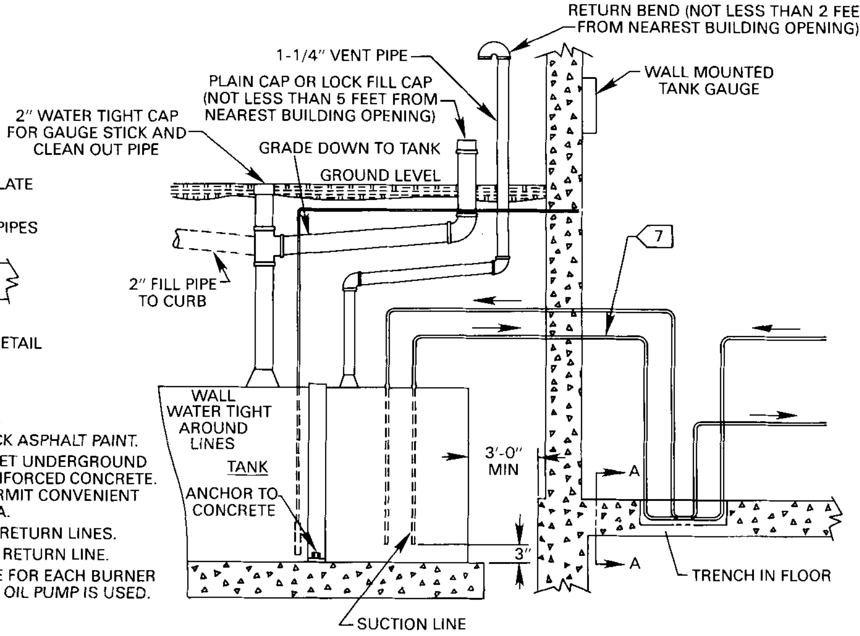
THE DIFFERENCE BETWEEN P3 AND P4 IS THE PRESSURE DROP (PD) THROUGH THE GAS CONTROL TRAIN.

Jobsite Connections

Oil Fuel Supply System



SECTION A-A
TYPICAL FLOOR TRENCH DETAIL



NOTES:

1. PITCH TANK DOWNWARD 1" PER 5 FT.
2. PAINT PIPE BELOW GRADE WITH BLACK ASPHALT PAINT.
3. TOP OF TANK MUST BE AT LEAST 2 FEET UNDERGROUND OR 12 INCHES PLUS 4 INCHES OF REINFORCED CONCRETE. FILL PIPE SHOULD BE LOCATED TO PERMIT CONVENIENT FILLING FROM A HARD SURFACE AREA.
4. DO NOT INSTALL MANUAL VALVES IN RETURN LINES.
5. DO NOT EXCEED 5 PSIG PRESSURE IN RETURN LINE.
6. PROVIDE SEPARATE OIL SUCTION LINE FOR EACH BURNER PUMP UNLESS REMOTE CIRCULATING OIL PUMP IS USED.

CUSTOMER NOTE:

1. THE FOLLOWING INFORMATION PERTAINS TO TWO-PIPE OIL SYSTEMS FOR NO. 1 OR NO. 2 FUEL OIL WHICH CAN BE BURNED WITHOUT PREHEATING. SYSTEMS DESIGNED FOR TWO-PIPE OPERATION CANNOT BE USED WITH A ONE-PIPE SYSTEM.

2. OIL TANK LOCATION - THE RULES OF THE NATIONAL BOARD OF FIRE UNDERWRITERS [PAMPHLET NO. 31] AND LOCAL CODES AND REGULATIONS SHOULD BE FOLLOWED IN LOCATING AND INSTALLING OIL STORAGE TANKS AND BURNERS.

   SOME LOCALITIES REQUIRE THAT THE TANK BE LOCATED BELOW THE BURNER LEVEL. IF ANY PART OF THE TANK IS ABOVE THE LEVEL OF THE BURNER, AN ANTI-SIPHON DEVICE MUST BE USED TO PREVENT FLOW OF OIL IN CASE OF A BREAK IN THE OIL LINE. THE ILLUSTRATION SHOWS A TYPICAL INSTALLATION OF AN OUTSIDE TANK WHICH SHOULD BE COVERED WITH NOT LESS THAN 24" OF EARTH. A CONCRETE ANCHOR BASE IS ADVISABLE TO PREVENT LIFTING OF BURIED TANK DURING WET WEATHER. AN AUXILIARY OIL PUMP IS RECOMMENDED IF OIL SUCTION LINE EXCEEDS 200' IN LENGTH OR 12' OF LIFT.

3. OIL PIPING - CONNECTIONS TO BURIED TANKS MUST BE MADE WITH SWING JOINTS OR COPPER TUBING TO PREVENT THE PIPES FROM BREAKING IN CASE THE TANKS SETTLE. IF LOCAL REQUIREMENTS STIPULATE THAT IRON PIPE BE USED, SWING JOINTS MADE UP WITH ELBOWS AND NIPPLES SEVERAL INCHES LONG SHOULD BE USED ON BOTH THE SUCTION AND RETURN LINES AS CLOSE TO THE TANK AS POSSIBLE. THE SWING JOINTS SHOULD BE MADE UP SO THAT THEY WILL TIGHTEN AS THE TANK SETTLES. NON-HARDENING PIPE JOINT COMPOUNDS SHOULD BE USED ON ALL THREADED JOINTS.

4. OIL PUMP SUCTION AND RETURN LINE SIZING - THE SIZE OF THE OIL SUCTION LINE IS DEPENDENT UPON THE TYPE OF OIL, AMOUNT OF LIFT, LENGTH OF SUCTION LINE AND THE SUCTION CAPACITY OF THE PUMP.

   ON SINGLE PUMP INSTALLATIONS, THE RETURN LINE SHOULD BE THE SAME SIZE AS THE SUCTION LINE.

   ON MULTIPLE PUMP INSTALLATIONS, EACH PUMP SHOULD HAVE ITS OWN INDIVIDUAL SUCTION LINE. ONE RETURN LINE MAY BE USED AS LONG AS IT IS "APPROPRIATELY SIZED" SINCE ALL PUMPS MAY SHARE A COMMON RETURN LINE.

   REFER TO MANUFACTURERS' BULLETINS FOR PROPER LINE SIZINGS.

   COPPER TUBING SHOULD BE USED IN PREFERENCE TO IRON PIPE, AS IT REQUIRES LESS WORK, IS NEATER, HAS LESS POSSIBILITY OF LEAKS AND DOES NOT SCALE OFF ON THE INSIDE. FLARE TYPE FITTINGS ARE RECOMMENDED AS THE SOLDERED TYPE MAY MELT IN CASE OF FIRE.

   THE LINES FROM THE TANK TO THE BURNER SHOULD BE SIZED FROM DATA CONTAINED IN THE PUMP MANFACTURERS SPECIFICATION SHEET, BUT IN NO INSTANCE SHOULD THEY BE SMALLER THAN 1/2" O.D. COPPER TUBING. INSTALL TANK SLIP FITTINGS (CHASE NO. 329 OR EQUAL) IN THE TOP OF THE TANK FOR BOTH THE SUCTION AND RETURN LINE CONNECTIONS. PUSH BOTH THE SUCTION AND RETURN LINES DOWN THROUGH THE FITTINGS UNTIL THEY TOUCH THE BOTTOM OF THE TANK AND THEN PULL THEM UP THREE INCHES AND LOCK IN POSITION WITH COMPRESSION NUTS SO EITHER LINE MAY BE USED AS A SUCTION LINE.

   MAXIMUM PRESSURE ALLOWABLE ON SUCTION SIDE OF PUMP IS 3 PSIG.

5. OIL SHUTOFF VALVE - A HAND SHUTOFF VALVE SHOULD BE PROVIDED IN THE SUCTION LINE NEAR THE BURNER.

   HAND VALVES MUST NOT BE INSTALLED ON DISCHARGE SIDE OF PUMP OR RETURN LINE WITHOUT A BYPASS RELIEF TO TANK.

6. CHECK VALVE AND STRAINER - IF THE TOP OF THE TANK IS BELOW THE BURNER LEVEL, USE A LIFT TYPE CHECK VALVE WITH NEOPRENE SEAT. AN OIL STRAINER IS RECOMMENDED FOR THOSE INSTALLATIONS WHICH DO NOT HAVE OIL PUMPS WITH BUILT-IN FILTERING DEVICES.

   SELECT A CHECK VALVE OF THE SOFT SEATED TYPE SUITABLE FOR NO. 2 OIL, WHICH WILL SEAT TIGHTLY WITH A LOW HEAD.

7. OIL SUCTION LINE - SUCTION PIPING SHOULD BE PITCHED BACK TO THE TANK SLIGHTLY WHENEVER POSSIBLE AND PARTICULAR CARE SHOULD BE TAKEN NOT TO CREATE AN AIR TRAP IN LINE. THERE IS ALWAYS A SLIGHT AMOUNT OF AIR IN SUSPENSION IN OIL, AND IF TRAPS ARE PRESENT, THEY WILL GRADUALLY FILL WITH AIR, AND THE PUMP WILL LOSE ITS PRIME. REMOVAL OF AIR IS GENERALLY VERY DIFFICULT.

   ALWAYS PROVIDE A TEE AND PLUG IN THE SUCTION LINE AT THE HIGHEST POSSIBLE POINT TO AID IN PRIMING THE PUMP AND IN EXPELLING AIR. ALSO SEE THE PUMP MANUFACTURER'S INSTRUCTIONS FOR PRIMING AND VENTING.

   A TWO-PIPE SYSTEM IS REQUIRED FOR ALL INSTALLATIONS. BOTH THE SUCTION AND RETURN PIPING SHOULD BE RUN IN A TRENCH UNDER THE FLOOR LEVEL WHERE POSSIBLE.

   OVERHEAD SUCTION LINES SHOULD BE AVOIDED UNLESS AN AUXILIARY OIL CIRCULATING PUMP SET INSTALLATION OF THE TYPE SHOWN IS USED. MAXIMUM STANDPIPE HEIGHT ABOVE THE BURNER PUMP IS 7-1/2 FEET UNLESS SPECIAL DEVICES ARE INSTALLED TO PREVENT HYDRAULIC SHOCK FROM CAUSING PUMP SEAL LEAKAGE.

8. OIL TANK FILL PIPE - THE FILL PIPE 2" I.P.S. TO THE OIL TANK MUST TERMINATE AT LEAST FIVE FEET FROM ANY WINDOW OR OTHER BUILDING OPENING. IT SHOULD SLOPE CONTINUOUSLY TOWARD THE TANK AND BE EQUIPPED WITH WITH A TIGHT-CLOSING METAL COVER DESIGNED TO PREVENT TAMPERING. THE FILL PIPE SHOULD TERMINATE AT LEAST ONE FOOT ABOVE THE GROUND TO PREVENT FLOOD WATER FROM SEEPING INTO THE PIPE. A FLUSH TYPE FILL CAP INSERTED IN THE GROUND SHOULD BE ENCLOSED IN A WATERTIGHT WELL. IF THE PIPE DOES NOT RUN VERTICALLY ABOVE THE TANK, IT IS DESIRABLE TO PLACE A TEE AT THE TANK AND RUN A STANDPIPE VERTICALLY SO THAT A GAUGE STICK MAY BE USED FOR MEASURING THE OIL IN THE TANK.

9. OIL TANK VENT - THE OIL TANK VENT LINE SHOULD NOT BE SMALLER THAN 1-1/4" STANDARD WEIGHT PIPE AND SHOULD TERMINATE OUTSIDE THE BUILDING AT A POINT NOT LESS THAN TWO FEET MEASURED VERTICALLY OR HORIZONTALLY FROM ANY WINDOW OR OTHER BUILDING OPENING. THE TOP OF THE AIR VENT MUST HAVE A RETURN BEND OR SOME APPROVED CAP, AND IT SHOULD EXTEND ABOVE THE GROUND HIGH ENOUGH TO PREVENT BEING OBSTRUCTED BY EITHER SNOW OR ICE. IN SOME LOCALITIES, CITY REGULATIONS SPECIFY THE HEIGHT OF THE RETURN BEND ABOVE THE GROUND LEVEL. ALL VENT PIPING SHOULD BE PITCHED SLIGHTLY DOWNWARD TOWARD THE TANK. AN OIL GAUGE IS RECOMMENDED FOR ALL INSTALLATIONS.

   A FOOT VALVE AT THE END OF THE SUCTION LINE IN THE TANK IS NOT RECOMMENDED.

10. DO NOT USE TEFLON TAPE AS AN OIL PIPE SEALANT. TEFLON TAPE CAN CAUSE VALVES TO FAIL CREATING SAFETY HAZARD. WARRANTIES ARE NULLIFIED AND LIABILITY RESTS SOELY WITH THE INSTALLER WHEN TEFLON TAPE IS USED. USE A PIPE JOINT COMPOUND RATHER THAN TEFLON TAPE.

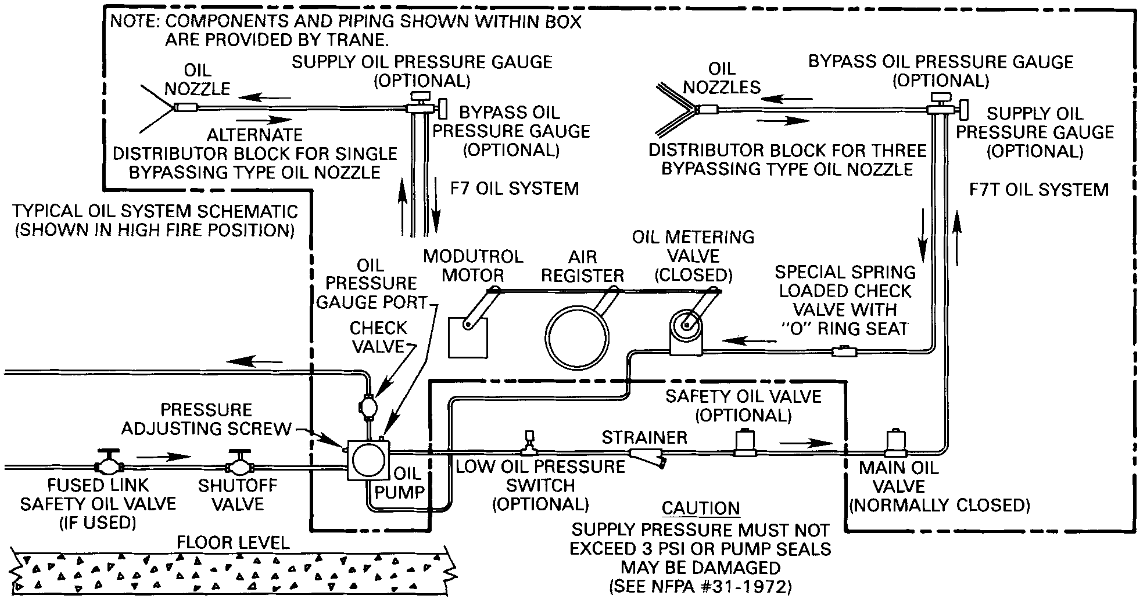


Table JC-5 – High Pressure Pump Set Specifications For No. 2 Oil

OIL PUMP SET NUMBER	NOTES	PUMP CHARACTERISTICS				MOTOR CHARACTERISTICS		TERMINAL CONNECTIONS OF PUMP SET FOR FIELD CONNECTIONS			
		DISCHARGE CAPACITY G.P.H. @ 300 PSIG	SUCTION CAPACITY G.P.H. @ 300 PSIG	MAXIMUM SUCTION IN. HG 5	REGULATING VALVE	H.P.	RPM	SUCTION OIL SUPPLY 4	OIL SUPPLY TO BURNER	RETURN TO TANK	RETURN FROM NOZZLE
HS2D-23	1 & 3	23	71	15	INTEGRAL	1/3	1725	1/4" NPTF	3/8" TUBE FLARED FTG	1/2" NPTF	3/8" TUBE FLARED FTG
HS2D-50	1 & 3	50	130	13	INTEGRAL	1/2	1725	1/4" NPTF	3/8" TUBE FLARED FTG	1/2" NPTF	3/8" TUBE FLARED FTG
HS2D-60	2 & 3	60	112	10	INTEGRAL	1/2	1725	1-1/2" NPTF	3/8" TUBE FLARED FTG	1/2" NPTF	3/8" TUBE FLARED FTG
HS2D-115	2 & 3	115	190	10	INTEGRAL	1-1/2	1725	1-1/2" NPTF	3/8" TUBE FLARED FTG	1/2" NPTF	3/8" TUBE FLARED FTG

TABLE-1 NOTES:

1 INTEGRAL ADJUSTABLE REGULATING VALVE (100-300 PSIG) AND SELF CLEANING ROTARY FILTER. A SEPARATE STRAINER IS RECOMMENDED BUT NOT PROVIDED.

2 INTEGRAL ADJUSTABLE REGULATING VALVE (100-300 PSIG) WITH SEPARATE STRAINER PROVIDED.

3 MOTOR VOLTAGE WILL BE THE SAME AS THAT OF THE BURNER UNLESS OTHERWISE SPECIFIED. DATA SHOWN APPLIES TO 60 HZ SYSTEMS ONLY.

4 SUCTION OIL SUPPLY SIZE SHOWN IS NOT NECESSARILY THE SUCTION LINE SIZE. REFER TO SUCTION LINE SIZING TABLE-2.

5 WHEN TOTAL SUCTION PRESSURE DROP CONSISTING OF VERTICAL LIFT AND SUCTION PIPING FRICTION EXCEEDS THE MAXIMUM PUMP SUCTION CAPABILITY A SEPARATE CIRCULATING PUMP SET, EITHER SIMPLEX OR DUPLEX, SHOULD BE USED (CONTACT TRANE FOR DETAILS) TO SUPPLY OIL TO THESE HIGH PRESSURE OIL PUMPS.

Table JC-6 – Suction Line size and Maximum Length

SUCTION CAPACITY - GPH @ 300 PSIG			71		130				112				190			
DISCHARGE CAPACITY GPH @ 300 PSIG			23		50				60				115			
SUCTION LINE SIZE	TUBING	NOMINAL OR I.D.	3/8	1/2	1/2	–	3/4	–	1/2	–	3/4	–	–	3/4	–	1
		O.D.	1/2	5/8	5/8	3/4	7/8	–	5/8	3/4	7/8	–	3/4	7/8	–	1-1/8
	IRON PIPE	I.P.S.	–	–	–	–	–	3/4	–	–	–	3/4	–	–	3/4	1
LIFT IN FEET	3		55	195	65	185	200	200	70	200	200	200	80	170	200	200
	6		40	140	50	135	200	200	50	175	200	200	55	120	140	200
	9		25	90	30	85	165	195	30	100	200	200	30	70	85	200
	12		25	85	30	80	160	190	10	35	75	90	10	25	35	115
	15		20	80	25	75	150	185	–	–	–	–	–	–	–	–
MAX. PUMP SUCTION IN. HG.			15		13				10				10			

TABLE-2 NOTES:

1. BASED ON NO. 2 FUEL OIL AT 40° API (60° F) GRAVITY, SPECIFIC GRAVITY 0.822 @ 68° F., 1-FT OF HEAD = 0.72" HG.
2. LENGTH OF RUN INCLUDES ALLOWANCE FOR THREE 90° ELBOWS.
3. 200 FT. IS MAXIMUM RECOMMENDED SUCTION LINE LENGTH.

Table JC-7 – Relation Between Vacuum and Vertical Lift 140 F API Oil at 60 F

IN. VACUUM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FT.-IN. LIFT	1-4	2-9	4-1	5-6	6-10	8-3	9-7	11-0	12-4	13-9	15-1	16-6	17-10	19-3	20-7	22-0	23-4	24-9	26-1	27-6

Jobsite Connections

Exhaust Gas Duct

Flue Gas Duct Connection:
The exhaust flue access duct is provided by factory for field installation. It has an inspection cover, condensate drain and pre-drilled flanges. This section should be connected to the unit before other ductwork is attached. (Refer to unit submittal for duct dimensions).

Exhaust Gas Duct and Flue Stack Design:
The flue exhaust duct and flue stack must be designed of material in compliance with municipal, state and federal regulations.

The duct and stack must be heat-resistant to accept temperatures up to 675 F. The duct and stack sectional areas should increase in diameter, avoiding sharp bends or steep changes which may cause eddy current and/or back pressure to the unit.

Avoid horizontal bends in the flue gas duct. However, if bends are inevitable due to construction of building, determine the height of the stack with respect to the length of the horizontal flue gas duct using the following formula:

Stack Height = 0.6 ft. per ft. of horizontal flue gas duct length and 4 ft. for every 90 bend, providing that the exhaust gas pressure at the unit outlet is 0 to -0.2” water gauge.

Note: Remember to provide cleaning access doors for removing soot from inside of the exhaust duct and flue stack.

Construction of Gas Duct and Flue Stack:
Penetrating duct or stack which is mounted through a wall, ceiling or other building constructions must be made with heat-resistant material (concrete, plaster, mortar, or equivalent nonflammable material).

This duct must be insulated to prevent rising ambient temperature in the equipment room or injury from being burned. Comply with municipal, state and federal codes. The use of zinc plated steel plate or normal steel structure plate as thick as practical is recommended.

Provide a lightning rod or good ground to the flue stack.

Note: When designing support, remember to consider thermal expansion.

Multiple Unit Installation:
If using the same flue stack for discharging exhaust from more than one system, it will be necessary to provide a damper preventing the back flow of exhaust in the unused unit(s) and/or fluctuations in static pressure.

Flue Stack Opening:
The outlet of the stack should be designed so that rain, wind and snow does not enter into the stack. This allows a constant draft to be maintained.

Refer to ASHRAE Equipment Handbook, Chapter 26, for further information on chimneys and stack design.

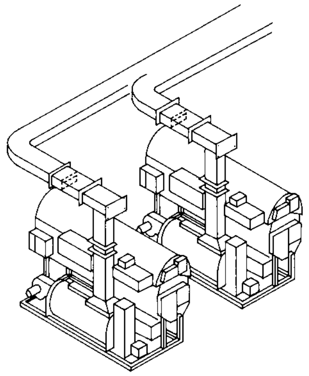
Flue Stack Location:
Considerations should be made when determining the location of the flue stack to the conditions of the atmosphere, roof, cooling tower(s), and other intake and exhaust vents.

Airflow around buildings affects worker safety, process and building equipment operation, weather and pollution protection of inlets, and the ability to control environmental factors of temperature, humidity, air motion, and contaminants. Wind causes surface pressures that vary around buildings, changing intake and exhaust system flow rates, natural ventilation, infiltration and exfiltration, and interior pressure. The mean flow patterns and turbulence of wind passing over a building can cause a recirculation of exhaust gases to air intakes.

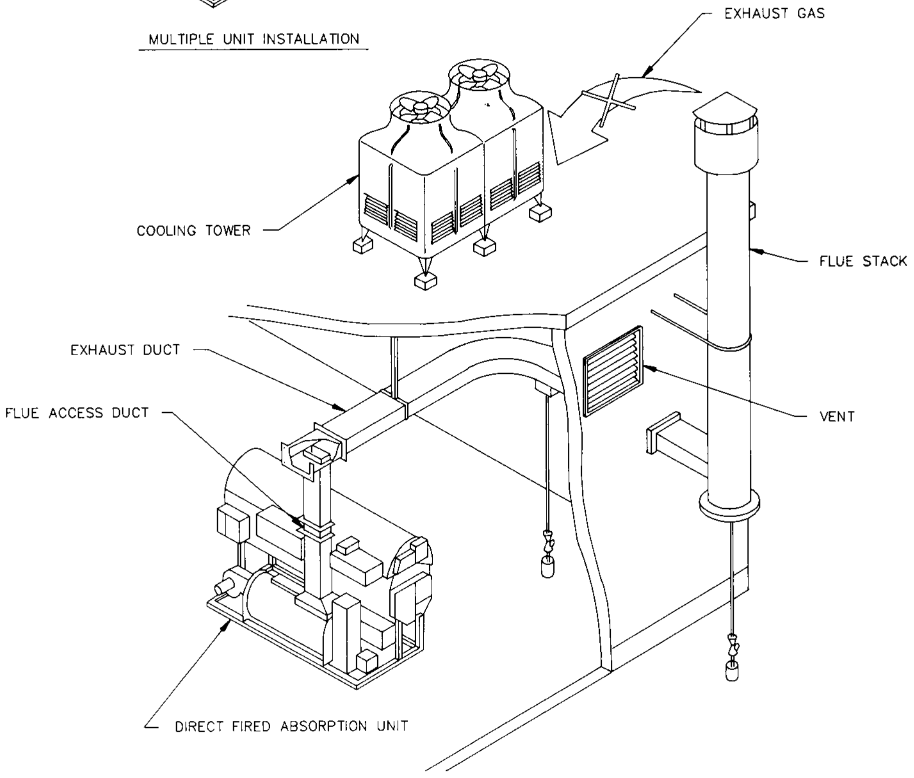
To obtain information about evaluating flow patterns, estimating wind pressures, air intake contamination, and solving problems caused by the effects of wind on intakes, exhausts, and equipment, refer to the ASHRAE Fundamentals Handbook, Chapter 14 and Equipment Volume, Chapter 26—Design of Chimneys.

Jobsite Connections

Typical Installations

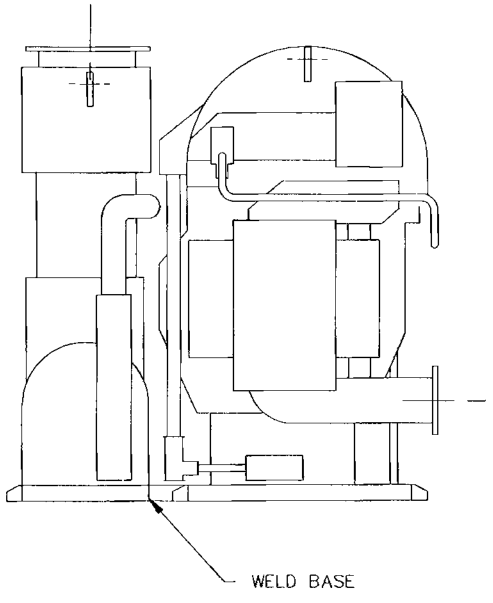


MULTIPLE UNIT INSTALLATION

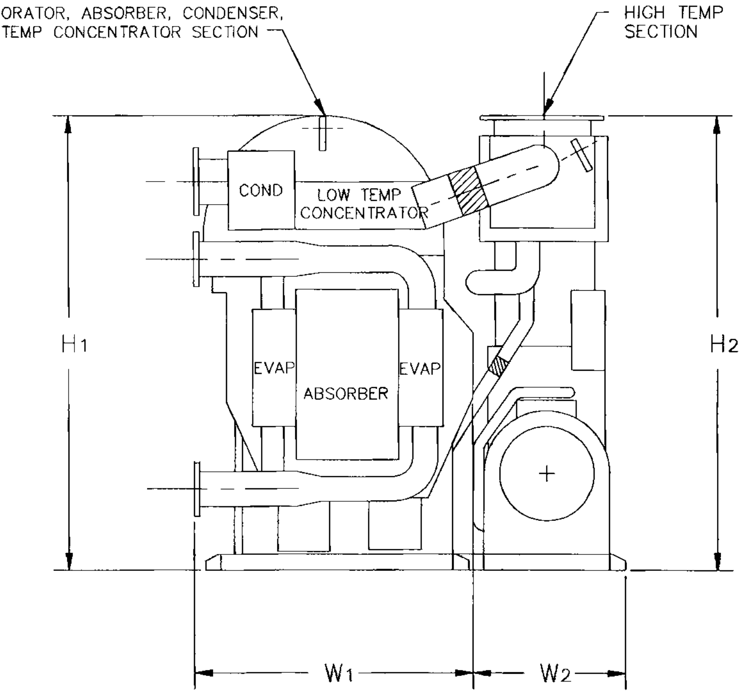


TYPICAL EXHAUST DUCT INSTALLATION

Optional Disassembled Shipment



RIGHT END ELEVATION



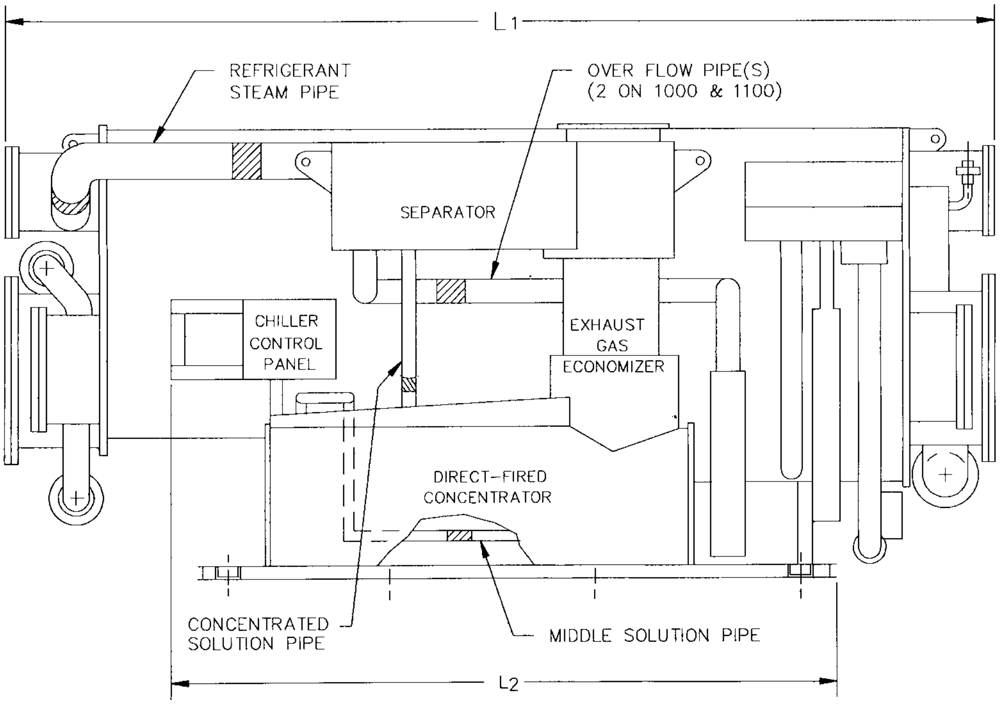
LEFT END ELEVATION

CUSTOMER NOTE:

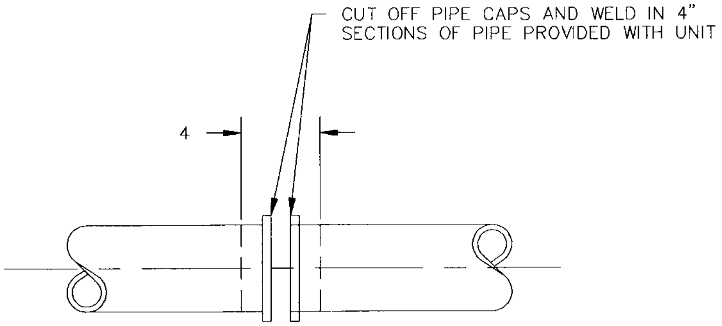
1. UNIT SHIPS TO JOBSITE IN TWO MAIN SECTIONS–
   a. EVAPORATOR, ABSORBER, CONDENSER, LOW TEMP CONCENTRATOR SECTION
   b. HIGH TEMP SECTION
2. CONTRACTOR MUST WELD SECTIONS TOGETHER AT BASE AND RECONNECT THE REFRIGERANT STEAM PIPE, OVER-FLOW PIPE(S), CONCENTRATED SOLUTION PIPE AND MIDDLE SOLUTION PIPE AS SHOWN IN DETAIL "A".

Unit	Evap/Abs/Cond/ Low Temp Conc. Section				High Temp. Section			
Nominal Tons	Length L1	Width W1	Height H1	Weight (lbs.)	Length L2	Width W2	Height H2	Weight (lbs.)
600	19'-0 3/4"	8'-5 1/4"	10'-11 1/8"	40,800	12'-10 3/8"	3'-11 7/8"	10'-11 1/8"	8,200
700	20'-9 3/8"	8'-5 1/4"	10'-11 1/8"	45,000	15'-3 1/8"	3'-11 7/8"	10'-11 1/8"	8,400
800	24'-0 5/8"	8'-5 1/4"	10'-11 1/8"	50,100	15'-9"	4'-6 1/2"	10'-11 1/8"	9,800
900	26'-1 7/8"	8'-5 1/4"	10'-11 1/8"	55,600	15'-8 1/8"	4'-6 1/2"	10'-11 1/8"	11,100
1999	22'-1 1/4"	9'-8 1/4"	12'-1"	67,800	15'-5 7/8"	4'-11 5/8"	12'-1"	11,700
1100	23'-8"	9'-8 1/4"	12'-1"	68,400	16'-8 3/4"	4'-11 5/8"	12'-1"	12,400

Optional Disassembled Shipment



FRONT ELEVATION



DETAIL–A

PIPE CONNECTION

5 PLACES 600–900 TON
6 PLACES 1000 & 1100 TON

Mechanical Specifications

Construction
Each unit is a complete chiller/heater package. The package includes an evaporator/absorber section, condenser/low temperature generator section, a high temperature (direct-fired) generator/economizer section and burner assembly. A unique reverse solution flow cycle enhanced by an exhaust gas economizer provides a high efficiency design. All units require field mounting at the burner, burner control panel and fuel supply system, which ship independently. All units are hermetic design, factory assembled and leak tested. Units that are factory charged are run-tested prior to shipment. The standard method of shipment is by vessel to the USA and rail or truck to the job location.

Units 550 nominal tons and smaller ship fully assembled and are run-tested prior to shipment. Shipping or installation constraints on units 600-1100 nominal tons may require shipment and installation in sections. In this case, field assembly, charging and run-testing are required at the jobsite.

Standard waterside working pressure are 150 psig and are tested at 150 percent of design pressure. All water boxes have lifting lugs, gasketed removable covers, drains and vents.

The low temperature generator head is welded to the unit. Steel tubes are provided. Solution heat exchangers are an efficient plate type design that enhance the solution cycle.

Shell and Tube Bundles
The shell material is carbon steel. Tube sheets are carbon steel, drilled, reamed and grooved to accommodate tubing. Tubes are individually replaceable and are mechanically expanded into the tubesheet. Evaporator, absorber and condenser tubes are copper. Eliminators are positioned to insure efficient operation by separating the absorber from the evaporator and the condenser from the low temperature generator. A rupture disc is provided on the generator section.

The shell side of the unit is leak-tested. The unit is both air proof tested and leak checked. A helium mass spectrometer test is performed under vacuum to insure hermetic integrity.

Motor and Pump
The unit has three motor/pump assemblies. The pump is direct-coupled to the motor. Carbon bearings are lubricated and cooled by the fluid being pumped. Stainless steel is used throughout the pump and motor. The motor is a submersible type with the rotor and stator protected by stainless steel liners. The motors are 3 phase 200V 50/60 cycle as standard.

Electrical Power
Unit control panel control circuit is 200V 1 phase. Burner control panel control circuit power is 115 V 1 phase transformed from 200V 1 phase. Oil-fired units require separate 115 V supply for oil pump.

Mechanical Specifications

Standard Control Capabilities

The unit control panel is integrated circuit board based in a factory- mounted package that includes a full complement of controls to operate the chiller safely and efficiently. Unit status and diagnostic control monitor lights on the panel define status. The controls maintain a selected chilled water temperature over a full range of loads. The unit controls must be interconnected with jobsite safety interlocks provided by others for proper unit operation.

Chiller control of chilled or hot water is accomplished by metering the amount of heat introduced into the absorption cycle from a Gordon-Piatt combustion burner assembly. The burner assembly is fired by natural gas, No. 2 fuel oil, LP gas or a combination burner that will handle multiple fuels.

The UL listed Gordon-Piatt burner and control assembly is supplied with flame safeguard and other burner control stand-alone safety functions that are designed for safe burner operation. A separate Gordon-Piatt burner control panel is provided.

The unit control assembly monitors refrigerant and lithium bromide solution temperatures. If an evaporator freeze condition or the lithium bromide solution approaches an unsafe condition, automatic correction action is initiated to maintain a safe condition. The unit is shut down if the unsafe condition continues. The panel features operating status and diagnostic display.

The temperature of the chilled or hot water leaving the evaporator section of the absorption unit is measured by factory mounted sensors located in the evaporator water leaving the unit. The unit is started and stopped at predetermined set points which are activated by sensor temperature. The ultimate burner firing rate is determined by the cooling or heating requirement of the water circulating through the evaporator section.

With the unit panel switch in the cooling mode and design water flow through the evaporator and condenser circuit, the unit control will respond to a cooling requirement by starting the chiller and burner in sequence. The burner is modulated from 100 to 30 percent of design as needed to control the leaving evaporator water temperature. Below 30 percent of design, the burner is cycled to allow the chiller to reach a 10 percent minimum load. Upon turning the unit off, a 15 minute dilution cycle is initiated to dilute the lithium bromide solution. Heating operation is similar with the panel switched to heating mode. A cooling/heating switch valve is also manually operated to accomplish changeover. Hot system water is provided in the evaporator circuit. During heating cycle operation the cooling water must be isolated and drained from the unit.

Purge System

The purge is designed to remove noncondensable gas from the unit automatically while the unit is operating. The purge system contains an isolation tank that has palladium cells attached which remove gas collected by the purge process. A mechanical pump is used to remove any air accumulation and is provided as part of the machine as standard.

Crystallization Guard

A solenoid valve system is provided to transfer refrigerant into the lithium bromide solution when an unsafe condition occurs such as low refrigerant temperature or low solution temperature. Unit operation is automatically terminated if the crystallization guard activity does not correct the condition.

Flue Access Duct

The exhaust gas duct must be constructed to provide an exhaust gas pressure of 0 to -0.2″ water at the chiller outlet. All units ship with either a flue access duct or an exhaust hood. This is bolted directly to the unit outlet and is used as an inspection port, for flue gas sampling and for cleaning if necessary. This section must be bolted to the unit before the exhaust gas duct is connected. Barometric dampers are required if the drafting ability of the stack exceeds 0.05″ water/foot of stack height. Exhaust gas temperatures can reach 360 F at full heating conditions. Exhaust gas duct and stack should be heat resistant to 675 F.

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