Carrier

# Product Data

# 16JL/JLR Steam/Hot Water Single Effect, Hermetic Absorption Liquid Chiller

16JL: 150 to 1000 Nominal Tons (528 to 3516kW)
16JLR: 110 to 750 Nominal Tons (387 to 2637kW)

**16JL/JLR SERIES**

Carrier's 16JL/JLR steam/hot single-effect, hermetic absorption liquid chiller is an efficient and functional alternative to traditional electric driven chillers. By utilizing low-pressure steam or low-temperature hot water, 16JL/JLR chillers avoid high-cost electricity and qualify for utility rebates and incentives as a gas cooling product. The 16JL/JLR absorption chiller offers functional flexibility in a variety of installations:

- no CFCs; environmentally friendly
- single stage design for simple, dependable operation
- nominal full-load steam rate of 16.65 lb/hr-ton for 16JL; nominal coefficient of performance (COP) of 0.73 for 16JLR
- quiet, vibration-free operation
- high reliability with few moving parts

## Features/Benefits

**Single-effect absorption cycle provides efficient, economical water chilling and/or process cooling with minimal use of electricity.**

### Cost-effective cooling

**Alternative-energy chiller** — The 16JL/JLR offers an alternative to chillers driven by increasingly expensive electrical energy. The use of steam/hot water powered absorption chiller not only eliminates demand charges and high cost electrical usage, but also allows the owner to take advantage of gas cooling rebates and incentive programs offered by many local utility companies.

# Features/Benefits (cont)

**Simple, reliable operation** — The 16JL/JLR chiller's single generator provides one stage of solution reconcentration, which makes the 16JL/JLR chiller one of the most basic cycles currently available. The 16JL/JLR chiller's simple design, in addition to its other quality features, equates to inherently high reliability. Few moving parts and simple, dependable operation reduce downtime, as well as service and maintenance costs.

**Exceptional efficiency** — The 16JL chiller offers full-load steam rates of 16.65 lb/hr-ton and 16JLR chiller offers full-load COPs of 0.73 at standard ARI condition (Air Conditioning and Refrigeration Institute) and leads the single-effect chiller market in efficiency. Incorporated into the standard machine design is a solution heat exchanger, intended to preheat the weak lithium bromide solution being pumped to the generator by precooling the strong solution from the generator.

**Superior part-load performance** — The 16JL/JLR's standard concentration control system allows stable, part-load operation at cooling water temperatures as low as 59F (15C) without the need for a cooling tower bypass. For maximum efficiency, a variable frequency drive pump automatically maintains optimum solution flow to the generator at all operating conditions. This will result in improved part-load efficiency and eliminate the need for manual setup adjustments of the solution flow. A control valve integral to the machine guarantees stable, continuous refrigerant pump operation at part-load conditions. The 16JL/JLR chiller has a continuous operating range from 100% to 10% of rated machine capacity.

## Application versatility

**Designed for a variety of applications** — Specifically designed for use with low pressure steam/low temperature hot water, the 16JL/JLR chiller can be applied to a variety of cooling needs. Waste heat from industrial processes and/or cogeneration systems can be used to provide chilled water for process cooling, as well as comfort cooling, thus reducing the need for additional energy and contributing to greater overall energy savings.

**Ideal for new or retrofit applications** – From comfort cooling to providing chilled water for process applications, the 16JL/JLR single-effect absorption chiller offers versatility for almost any job where low pressure steam/low temperature hot water is available as the heat source. The 14 model sizes, with a capacity range of 150 to 1000 tons for 16JL and 14 model sizes, with a capacity range of 110 to 750 tons for 16JLR, make the 16JL/JLR single-effect, absorption chiller the ideal choice for comfort cooling and /or light industrial applications. Computerized performance ratings allow the appropriately sized machine to be selected in order to meet exact job requirements. All machine selections are rated in accordance with ARI Standard 560-2000.

**Combined use of absorption and electric-driven chillers** — Utilizing both absorption and electric chillers in a central plant offers the flexibility to base load one chiller, while using the other to handle peak load requirements. Hybrid chiller systems have proven to be an economical solution for many comfort cooling installations. In many geographical areas, operating the electric chiller as the base loaded machine, while using the absorption chiller during peak load conditions, reduces or avoids electric demand charges. Depending on utility rate structures, the 16JL/JLR absorption chiller used in conjunction with an electric-driven chiller may be the most efficient and cost-effective combination available.

## Location and installation

**Ease of installation** — All 16JL/JLR units are completely fabricated, assembled, and wired in the factory. Standard shipping configuration is one piece for 16JL/JLR011~100. Refer to the 16JL/JLR Standard Shipping Configuration table below.

# Table of contents



# Model number nomenclature

16 JL/JLR 018

16 — Absorption Chiller

018 — Unit Size

JL/JLR — 16JL: Steam chiller; 16JLR: Hot water chiller

# Features/Benefits (cont)

**16JL/JLR STANDARD SHIPPING CONFIGURATION**

| UNIT SIZE | 1-PIECE ASSEMBLY | 2-PIECE ASSEMBLY |
|---|---|---|
| 16JL/JLR 011-100 | X | |

The 16JL/JLR machines are shipped completely and assembled as a standard feature. Job-site reassembly and alignment of machines shipped in multiple sections is simplified by preassemble the machine in the factory and by incorporating weld-type assembly flanges on all interconnecting piping.

**Small footprint** – Compared to other chillers, the 16JL/JLR chiller is significantly smaller in overall physical size and weight, saving valuable space in the equipment room as well as reducing the rigging and installation cost of the machine.

**Flanged waterbox nozzles** – To simplify chiller installation and field piping, all water box nozzles on the evaporator, absorber, generator and condenser are factory-supplied GB raised face (RF) flanges and ANSI (American National Standards Institute) raised face (RF) flanges are available.

## PD5 control

**Reliable operation** – 16JL/JLR PD5 control system features automatic microprocessor control center continuously monitors machine operation, ensuring precise control. Each Carrier 16JL/JLR absorption chiller includes a factory mounted and wired microprocessor control center that is functionally tested prior to shipment. Continuous monitoring and control of machine operation are performed automatically. A multi-language display on the front of the control center identifies operational status and fault indication. Chiller monitoring and control is automatic and continuous, and the screen on the front panel displays chiller operational status and fault indications in English or metric units. All control center components and the assembly will meet local code of GB and include a main board, a NRCP2 board, tow Aux. boards, molded case circuit breaker, pump contactors, ambient compensated 3-phase pump overload protection, multi-tap control power transformer, and all other necessary safeties and controls. As part of the start-up sequence, the chiller PD5 control center initiate a self-diagnostic system check to verify that all sensors are in range. Other standard features include a remote start/stop switch and a key-locked control center door that protects against unauthorized access.

**Chilled water reset** – Reset can be accomplished manually or automatically from the building management system. Chilled water reset saves energy when warmer chilled water can be used.

**Ramp loading –** Ramp loading ensures a smooth pull down of water loop temperature and prevents a rapid increase in steam/hot water consumption.

**Variable Frequency Drive (VFD)** – PD5 provides VFD for solution pump control.

**Advanced crystallization protection** – Protects against crystallization by automatically sensing impending abnormalities in the absorption operating cycle and taking a series of actions to either self-correct and/or limit the chiller from approaching the cycle crystallization line.

**Absorption cycle state points** – Absorption cycle status points provide the operator with precise and dynamic cycle operating conditions at any time during chiller operation. They save time by eliminating the cumbersome task of taking solution samples and calculating state points and assist in both chiller operation and diagnostics.

**Refrigerant low temperature override** – The capacity control valve position is inhibited to prevent freeze-up and ensure continuous chiller operation.

**Extensive service menu** – Unauthorized access to the service menu can be password-protected. Built-in, enhanced, diagnostic capabilities assist in troubleshooting and recommend proper corrective action for pre-set alarms, resulting in more up time.

**Alarm history** – The last 25 alarms and/or alerts are retained in memory with date and time stamps. Alarm histories reduce trouble-shooting time and cost.

**Power Sequence Protector** – In order to prevent the incorrect power wiring in the site to make the pump and burner fan reversal, the Power Phase Sequence Protector is added in the control panel. Only when the connection of the power phase sequence protector is correct, the chiller can start up.

## Low maintenance

**Standard features allow simple maintenance procedures** – Every 16JL/JLR machine has numerous standard design features that are provided for convenient and simple maintenance. Hinged waterbox cover on the absorber and condenser facilitate tube and waterbox inspection. In addition, epoxy coating of the waterboxes and covers and standard coating on all machines, protect against corrosion and extends machine life. All moving parts are easily accessible for inspection or replacement, as required. Also, every machine is furnished with a rupture disk to protect against an overpressure condition on the shellside. These standard design and construction features mean that every 16JL/JLR single-effect chiller is built to withstand the most rigorous duty, whether applied for comfort cooling service or light process applications.

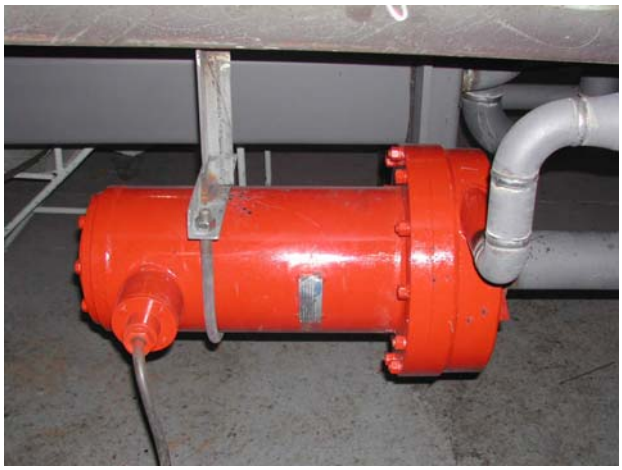
**Factory-trained service organization** – Carrier's extensive

# Features/Benefits (cont)

service organization offers trained and experienced service technicians in every major city. In addition to routine maintenance and repair services, Carrier also offers a wide array of preventative maintenance, full maintenance, and/or extended service contracts that can be custom tailored to any level of service.

**Leak-proof hermetic pumps/motors cut maintenance costs** — Carrier's proven solution and refrigerant pumps motors are leak-proof, completely self-contained, and hermetically sealed. The hermetic design eliminates the need for a separate, complicated, and possibly leak-prone seal water system while providing leak tightness and longer machine life. Specially designed bearings absorb both radial and axial thrusts to ensure correct fit at all times. There is no possibility of external contamination since the fluid being pumped lubricates and cools the pump and motor assemblies. In addition, both the rotor and the stator are separated by a stainless steel liner that protects the windings from the fluid being pumped. As an additional safety feature, thermal over-load switches are embedded in the stator to protect against high winding temperatures.

**VIEW OF TYPICAL HERMETIC PUMP/MOTOR ASSEMBLIES**



**16JL/JLR PD5 CONTROL CENTER**

**Superior corrosion protection** — Absorption chillers must be protected from the possibility of internal corrosion that is always present when lithium bromide solution is in contact with internal machine surfaces. The Carrier 16JL/JLR absorption chiller incorporates a highly effective corrosion inhibitor to provide an extra margin of protection against internal corrosion. Other inhibitors may require the use of exotic tube materials in certain heat exchangers since they are less effective and require frequent maintenance and analysis. The superior corrosion protection of the Carrier inhibitor allows for the use of standard copper tubes throughout the machine (except for the 16JL generator tubes that are made of 90-10 copper-nickel). This results in long machine life and dependable operation.

**Rugged machine construction** — Every Carrier 16JL/JLR chiller offers numerous standard features designed to provide reliable, trouble-free operation. The machine is fabricated to meet stringent manufacturing and design requirements and is Carrier-listed to ensure product safety and machine integrity. Non-clogging, corrosion proof spray nozzles protect the 16JL/JLR from corrosion and blockage for continuous, reliable operation. Horizontally-positioned tubes in the generator with steam/hot water on the inside and lithium bromide on the outside to allow the tube bundle to expand and adjust freely when subjected to rapid temperature changes.

The above standard features are evidence of Carrier's commitment to building a single effect chiller able to withstand the most rigorous comfort cooling or light industrial applications.

**Single-point box electrical connection** — Installation costs are further reduced by eliminating field wiring between machine components. On units shipped as a single assembly, all unit-mounted electrical items are factory-wired to the chiller microprocessor control center. Only a single-point electrical connection to the machine from the building's electrical service is required. A multi-tap transformer, mounted in the chiller control center, provides secondary, single-phase power for the 16JL/JLR controls.

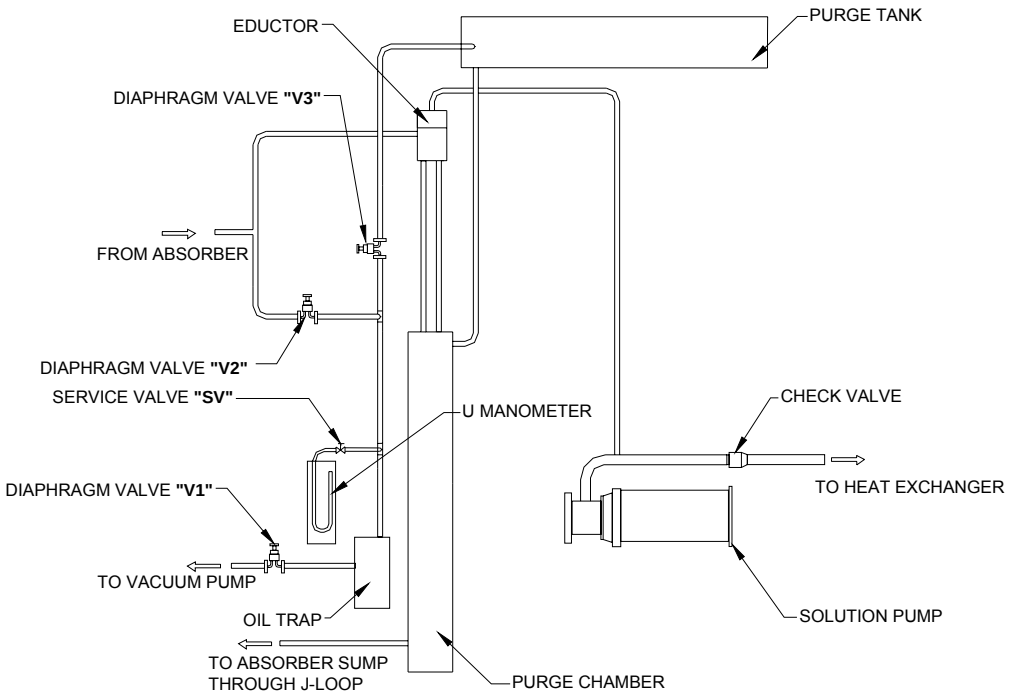
# Features/Benefits (cont)

**Low noise and vibration allows location flexibility** — Low sound and vibration levels are characteristic of absorption chillers, primarily due to the fact that the only rotating parts are the refrigerant and solution pumps. The overall sound level of a Carrier 16JL/JLR is typically 80dbA. This allows the machines to be installed near occupied spaces or in areas with strict sound requirements. Low vibration levels also make it possible to install the chiller on upper floors without special consideration for vibration dampening systems.

**Automatic, motorless purge system extends machine life and ensures optimum efficiency and performance** —
The purge system of an absorption chiller is essential to ensuring efficient operation and long machine life. Even when machines are vacuum tight or properly inhibited, all absorption chillers generate hydrogen and other non-condensable gases in small quantities. Since these gases are present in sufficient volume to interfere with proper machine operation, they must be removed to protect the unit from internal corrosion, lithium bromide solution crystallization, and/or a reduction in chiller capacity. Carrier's motorless purge system protects 16JL/JLR machines from these potential hazards by working continuously during machine operation.

**Motorless purge system operation** — During operation, non-condensables tend to accumulate in the absorber section, which operates at the lowest internal pressure. A slipstream of lithium bromide solution from the solution pump discharge flows through an eductor, creating suction that draws non-condensables from the absorber. The non-condensables are then entrained by the solution flowing through the eductor. The eductor discharges the solution and non-condensables into a separator in the purge chamber, where the non-condensables are separated from the solution. The non-condensables flow to a storage tank, while the solution returns to the absorber sump. Typically, most of the non-condensable gas is composed of hydrogen, which is automatically dissipated to the atmosphere through a heated palladium cell. As non-condensables accumulate in the external storage tank, they are isolated from the chiller and cannot reenter the machine (even during shutdown). These gases must periodically be exhausted (as required) from the storage tank by a simple procedure performed while the machine is running. Evacuation is performed by a unit-mounted vacuum pump that is connected to the purge evacuation valve. Therefore, pressurizing the purge tank above atmospheric pressure with lithium bromide solution is not permitted. The unit-mounted vacuum pump can also be used during chiller maintenance or service to remove noncondensables directly from the machine.

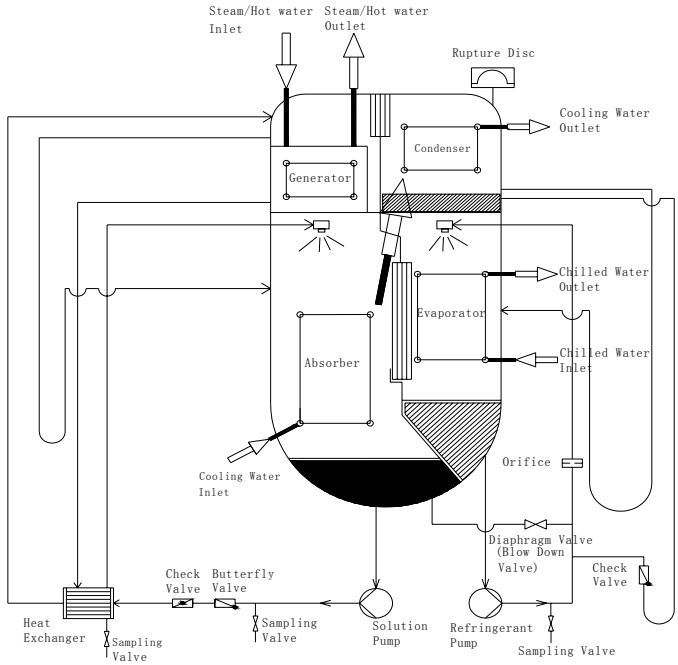
**TYPICAL MOTORLESS PURGE OPERATION SCHEMATIC**



# Features/Benefits (cont)

**Anti-crystallization controls maintain proper solution concentration –** The 16JL/JLR automatically limits solution concentration in several ways to avoid both crystallization and overdilution to provide dependable, trouble-free operation. Crystallization of the lithium bromide solution depends on the combination of temperature and concentration. The Carrier's concentration control system automatically monitors the refrigerant water level in the evaporator in conjunction with the strong solution temperature returning to the absorber. Because concentration varies with the amount of water in the lithium bromide solution, a rising evaporator level indicates less water in the solution and thus a higher solution concentration. When the refrigerant in the evaporator rises to a weir level, water is transferred from the evaporator to the absorber thus preventing overconcentration to ensure continuous, reliable operation even at cooling water temperature as low as 59F (15C). From the strong solution temperature, the microprocessor controls are able to determine the solution concentration and automatically limit the heat input to the chiller, if necessary, to prevent an overconcentration condition from occurring. Overdilution (and possible refrigerant pump cavitation) shall be controlled by transferring an additional amount of refrigerant from the condenser to the evaporator. In addition, the 16JL automatic dilution cycle ensures proper concentration after unit shutdown so that the unit will not crystallize when the machine cools to ambient or machine room temperature. The dilution cycle controls operation of the pumps for a set period of time after shutdown to dilute the solution to prevent an overconcentration condition.

**16JL/JLR ABSORPTION COOLING CYCLE**




## 16JL/JLR single effect absorption cooling cycle

The 16JL/JLR single effect absorption chiller consists of an evaporator, absorber, condenser, steam/hot water generator, solution heat exchanger, refrigerant/solution pumps, purge, controls and auxiliaries. Water is used as the refrigerant in vessels maintained under low absolute pressure (vacuum). In the cooling mode, the chiller operates on the principle that under vacuum, water boils at a low temperature. In this case water boils at approximately 40F (4.4C), thereby cooling the chilled water circulating through the evaporator tubes. A refrigerant pump is used to circulate the refrigerant water over the evaporator tubes to improve heat transfer. To make the cooling process continuous, the refrigerant vapor must be removed as it is produced. To accomplish this, a lithium bromide solution (which has a high affinity for water) is used to absorb the water vapor. As this process continues, the lithium bromide becomes diluted, reducing its absorption capacity. A solution pump then transfers this weak (diluted) solution to the generator,

# Features/Benefits (cont)

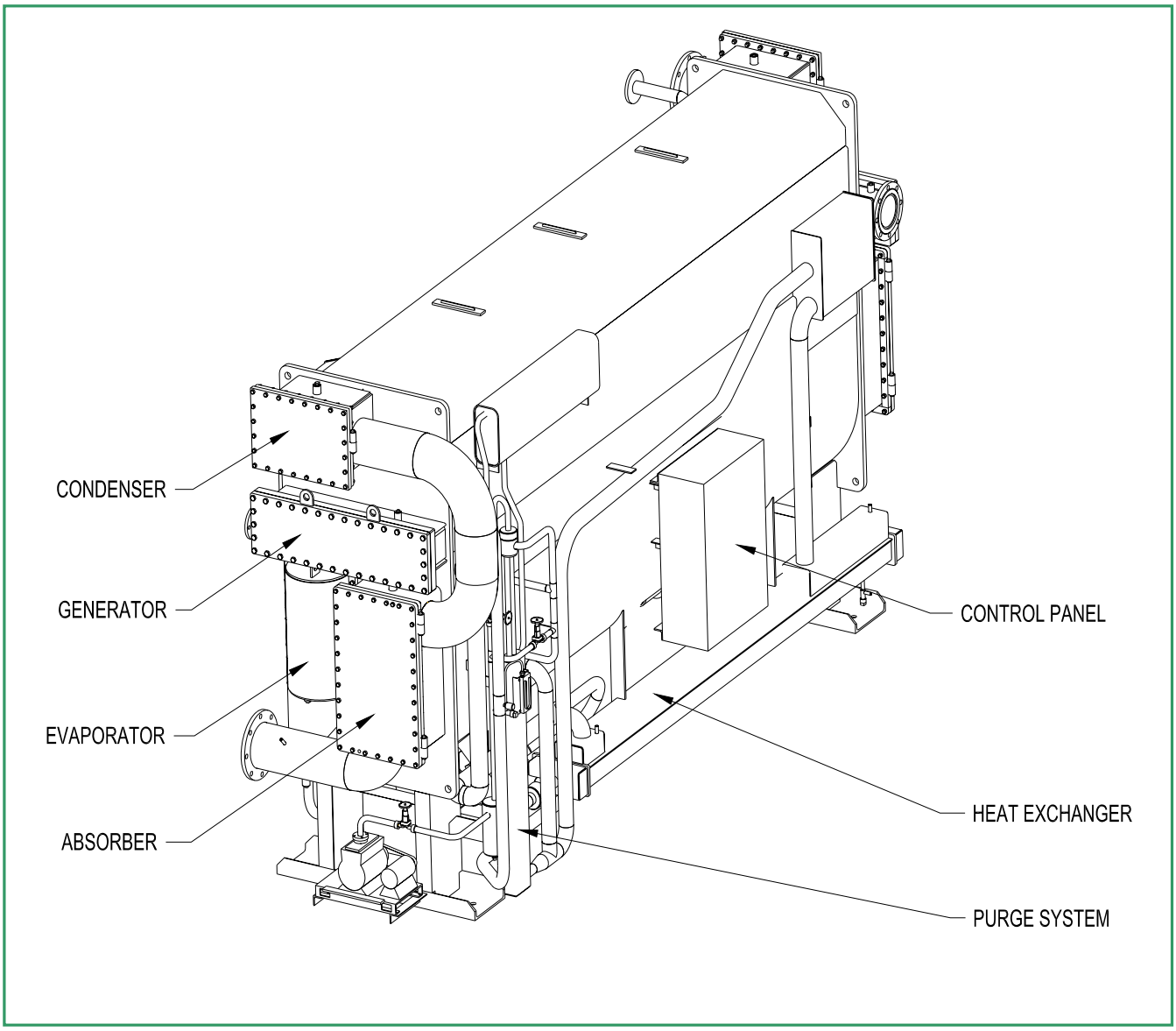
where it is reconcentrated by the introduction of low pressure steam or low temperature hot water in the tubes of the generator to boil off the previously absorbed water. A variable frequency drive pump automatically maintains optimum solution flow to the generator at all operating conditions for maximum efficiency. The water vapor released on the shellside of the generator enters the condenser to be cooled and returned to a liquid state. At this point, the refrigerant water returns to the evaporator to begin a new cycle. To remove heat from the machine, relatively cool water from a cooling tower or other source is first circulated through the tubes of the absorber to remove the heat of vaporization. The water is then circulated through the tubes of the condenser. The strong (reconcentrated) solution from the generator flows back to the absorber to begin a new cycle. For efficiency reasons, the strong solution from the generator is passed through a solution heat exchanger to preheat the weak solution, while precooling the strong solution before returning to the absorber.

# Options and accessories

| ITEM | FACTORY-INSTALLED OPTION | FIELD-INSTALLED ACCESSORY |
|---|---|---|
| Cooling Water Flow Switch | X | |
| High-pressure Vaterboxes, 300psig (2068kPa) | X | |
| Isolation Package | | X |
| Special Tubing | X | |
| Unit Voltage (400, 460-3-60/50) | X | |
| Condenser Water Flow Switch | X | |

For more information, contact Carrier or your local representative with your specific application requirements.

# Machine components



# Physical data

ENGLISH

| Unit 16JL – Steam | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (ton) | 150 | 180 | 210 | 240 | 280 | 330 | 360 |
| RIGGING WEIGHT (lb) | 10,766 | 11,091 | 13,647 | 14,556 | 17,971 | 18,563 | 19,848 |
| OPERATING WEIGHT (lb) | 13,478 | 14,001 | 16,733 | 17,642 | 21,388 | 21,980 | 25,166 |
| LITHIUM BROMIDE SOLUTION CHARGE (lb) | 1,499 | 1,609 | 1,830 | 1,984 | 2,491 | 2,778 | 3,373 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (in.) | 4 | 4 | 5 | 5 | 6 | 6 | 6 |
| No. Passes | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (in.) | 5 | 5 | 6 | 6 | 8 | 8 | 8 |
| No. Passes | | | | | | | |
| Absorber | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| STEAM | | | | | | | |
| Pipe Connection Size (in.) | | | | | | | |
| Steam Inlet | 5 | 5 | 5 | 5 | 6 | 6 | 6 |
| Drain Outlet | 1.5 | 1.5 | 1.5 | 1.5 | 2 | 2 | 2 |

| Unit 16JL – Steam | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (ton) | 400 | 450 | 500 | 600 | 660 | 800 | 1,000 |
| RIGGING WEIGHT (lb) | 20,433 | 22,566 | 23,255 | 35,704 | 37,895 | 39,683 | 45,635 |
| OPERATING WEIGHT (lb) | 25,750 | 28,907 | 29,595 | 43,707 | 46,339 | 57,761 | 66,358 |
| LITHIUM BROMIDE SOLUTION CHARGE (lb) | 3,616 | 4,167 | 4,056 | 5,489 | 5,952 | 5,974 | 7,143 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (in.) | 6 | 8 | 8 | 8 | 8 | 10 | 10 |
| No. Passes | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (in.) | 8 | 10 | 10 | 12 | 12 | 14 | 14 |
| No. Passes | | | | | | | |
| Absorber | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| STEAM | | | | | | | |
| Pipe Connection Size (in.) | | | | | | | |
| Steam Inlet | 6 | 8 | 8 | 8 | 8 | 10 | 10 |
| Drain Outlet | 2 | 2.5 | 2.5 | 2.5 | 2.5 | 3 | 3 |

# Physical data (cont)

ENGLISH

| Unit 16JLR – Hot water | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (ton) | 110 | 135 | 155 | 180 | 210 | 245 | 270 |
| RIGGING WEIGHT (lb) | 10,766 | 11,091 | 13,647 | 14,556 | 17,971 | 18,563 | 19,848 |
| OPERATING WEIGHT (lb) | 13,478 | 14,001 | 16,733 | 17,642 | 21,388 | 21,980 | 25,166 |
| LITHIUM BROMIDE SOLUTION CHARGE (lb) | 1,389 | 1,499 | 1,720 | 1,852 | 2,337 | 2,601 | 3,131 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (in.) | 4 | 4 | 5 | 5 | 6 | 6 | 6 |
| No. Passes | 4 | 4 | 4 | 4 | 3 | 3 | 3 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (in.) | 5 | 5 | 6 | 6 | 8 | 8 | 8 |
| No. Passes | | | | | | | |
| Absorber | 4 | 4 | 4 | 4 | 3 | 3 | 3 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| HOT WATER | | | | | | | |
| Pipe Connection Size (in.) | 4 | 4 | 5 | 5 | 6 | 6 | 6 |
| No. Passes | 4 | 4 | 4 | 4 | 3 | 3 | 3 |

| Unit 16JLR – Hot water | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (ton) | 300 | 335 | 375 | 450 | 500 | 600 | 750 |
| RIGGING WEIGHT (lb) | 20,433 | 22,566 | 23,255 | 35,704 | 37,895 | 39,683 | 45,635 |
| OPERATING WEIGHT (lb) | 25,750 | 28,907 | 29,595 | 43,707 | 46,339 | 57,761 | 66,358 |
| LITHIUM BROMIDE SOLUTION CHARGE (lb) | 3,373 | 3,880 | 3,792 | 5,115 | 5,556 | 5,578 | 6,680 |
| CHILLED/HOT WATER | | | | | | | |
| Pipe Connection Size (in.) | 6 | 8 | 8 | 8 | 8 | 10 | 10 |
| No. Passes | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (in.) | 8 | 10 | 10 | 12 | 12 | 14 | 14 |
| No. Passes | | | | | | | |
| Absorber | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| HOT WATER | | | | | | | |
| Pipe Connection Size (in.) | 6 | 8 | 8 | 8 | 8 | 8 | 8 |
| No. Passes | 3 | 3 | 3 | 3 | 3 | 2 | 2 |

# Physical data (cont)

SI

| Unit 16JL – Steam | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (kW) | 528 | 633 | 738 | 844 | 984 | 1,160 | 1,266 |
| RIGGING WEIGHT (kg) | 4,884 | 5,031 | 6,190 | 6,602 | 8,152 | 8,420 | 9,003 |
| OPERATING WEIGHT (kg) | 6,114 | 6,351 | 7,590 | 8,002 | 9,702 | 9,970 | 11,415 |
| LITHIUM BROMIDE SOLUTION CHARGE (kg) | 680 | 730 | 830 | 900 | 1,130 | 1,260 | 1,530 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (mm) | 100 | 100 | 125 | 125 | 150 | 150 | 150 |
| No. Passes | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (mm) | 125 | 125 | 150 | 150 | 200 | 200 | 200 |
| No. Passes | | | | | | | |
| Absorber | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| STEAM | | | | | | | |
| Pipe Connection Size (mm) | | | | | | | |
| Inlet | 125 | 125 | 125 | 125 | 150 | 150 | 150 |
| Outlet | 40 | 40 | 40 | 40 | 50 | 50 | 50 |

| Unit 16JL – Steam | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (kW) | 1,406 | 1,582 | 1,758 | 2,110 | 2,321 | 2,813 | 3,516 |
| RIGGING WEIGHT (kg) | 9,268 | 10,236 | 10,548 | 16,195 | 17,189 | 18,000 | 20,700 |
| OPERATING WEIGHT (kg) | 11,680 | 13,112 | 13,424 | 19,825 | 21,019 | 26,200 | 30,100 |
| LITHIUM BROMIDE SOLUTION CHARGE (kg) | 1,640 | 1,890 | 1,840 | 2,490 | 2,700 | 2,710 | 3,240 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (mm) | 150 | 200 | 200 | 200 | 200 | 250 | 250 |
| No. Passes | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (mm) | 200 | 250 | 250 | 300 | 300 | 350 | 350 |
| No. Passes | | | | | | | |
| Absorber | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| STEAM | | | | | | | |
| Pipe Connection Size (mm) | | | | | | | |
| Steam Inlet | 150 | 200 | 200 | 200 | 200 | 250 | 250 |
| Drain Outlet | 50 | 65 | 65 | 65 | 65 | 80 | 80 |

# Physical data (cont)

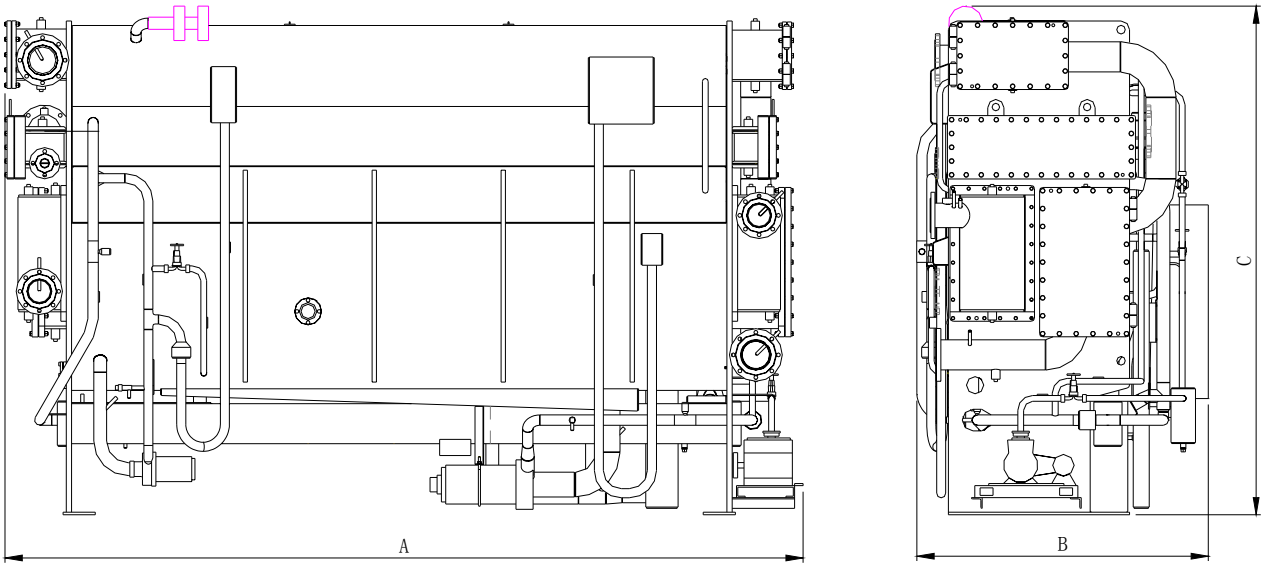
SI

| Unit 16JLR – Hot water | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (kW) | 387 | 475 | 545 | 633 | 739 | 862 | 950 |
| RIGGING WEIGHT (kg) | 4,884 | 5,031 | 6,190 | 6,602 | 8,152 | 8,420 | 9,003 |
| OPERATING WEIGHT (kg) | 6,114 | 6,351 | 7,590 | 8,002 | 9,702 | 9,970 | 11,415 |
| LITHIUM BROMIDE SOLUTION CHARGE (kg) | 630 | 680 | 780 | 840 | 1,060 | 1,180 | 1,420 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (mm) | 100 | 100 | 125 | 125 | 150 | 150 | 150 |
| No. Passes | 4 | 4 | 4 | 4 | 3 | 3 | 3 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (mm) | 125 | 125 | 150 | 150 | 200 | 200 | 200 |
| No. Passes | | | | | | | |
| Absorber | 4 | 4 | 4 | 4 | 3 | 3 | 3 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| HOT WATER | | | | | | | |
| Pipe Connection Size (mm) | 100 | 100 | 125 | 125 | 150 | 150 | 150 |
| No. Passes | 4 | 4 | 4 | 4 | 3 | 3 | 3 |

| Unit 16JLR – Hot water | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| NOMINAL COOLING CAPACITY (kW) | 1,055 | 1,178 | 1,319 | 1,583 | 1,759 | 2,110 | 2,637 |
| RIGGING WEIGHT (kg) | 9,268 | 10,236 | 10,548 | 16,195 | 17,189 | 18,000 | 20,700 |
| OPERATING WEIGHT (kg) | 11,680 | 13,112 | 13,424 | 19,825 | 21,019 | 26,200 | 30,100 |
| LITHIUM BROMIDE SOLUTION CHARGE (kg) | 1,530 | 1,760 | 1,720 | 2,320 | 2,520 | 2,530 | 3,030 |
| CHILLED WATER | | | | | | | |
| Pipe Connection Size (mm) | 150 | 200 | 200 | 200 | 200 | 250 | 250 |
| No. Passes | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| COOLING WATER | | | | | | | |
| Pipe Connection Size (mm) | 200 | 250 | 250 | 300 | 300 | 350 | 350 |
| No. Passes | | | | | | | |
| Absorber | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Condenser | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| HOT WATER | | | | | | | |
| Pipe Connection Size (mm) | 150 | 200 | 200 | 200 | 200 | 200 | 200 |
| No. Passes | 3 | 3 | 3 | 3 | 3 | 2 | 2 |

# Dimensions

**16JL/JLR SIZES**



# Dimensions (cont)

### DIMENSIONS (ft-in)

| UNIT 16JL | 011 | 013 | 015 | 018 | 021 | 024 | 027 | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overall Length A | 12-2 | 12-2 | 12-5 | 12-5 | 15-8 | 15-8 | 15-11 | 15-11 | 16-2 | 16-2 | 18-6 | 20-2 | 20-6 | 23-10 |
| Overall Width B | 4-5 | 4-5 | 4-9 | 4-9 | 5-1 | 5-1 | 5-4 | 5-4 | 5-9 | 5-9 | 6-5 | 6-7 | 7-2 | 7-2 |
| Overall Height C | 7-9 | 7-9 | 8-8 | 8-8 | 8-8 | 8-8 | 9-9 | 9-9 | 10-5 | 10-5 | 11-6 | 11-6 | 12-6 | 12-6 |

### DIMENSIONS (mm)

| UNIT 16JL | 011 | 013 | 015 | 018 | 021 | 024 | 027 | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overall Length A | 3,713 | 3,713 | 3,779 | 3,779 | 4,774 | 4,774 | 4,854 | 4,854 | 4,928 | 4,928 | 5,643 | 6,142 | 6,244 | 7,259 |
| Overall Width B | 1,356 | 1,356 | 1,456 | 1,456 | 1,542 | 1,542 | 1,629 | 1,629 | 1,762 | 1,762 | 1,962 | 2,004 | 2,183 | 2,183 |
| Overall Height C | 2,374 | 2,374 | 2,634 | 2,634 | 2,639 | 2,639 | 2,983 | 2,983 | 3,178 | 3,178 | 3,494 | 3,494 | 3,815 | 3,815 |

### DIMENSIONS (ft-in)

| UNIT 16JLR | 011 | 013 | 015 | 018 | 021 | 024 | 027 | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overall Length A | 12-2 | 12-2 | 12-5 | 12-5 | 15-8 | 15-8 | 15-11 | 15-11 | 16-2 | 16-2 | 18-6 | 20-2 | 20-6 | 23-10 |
| Overall Width B | 4-5 | 4-5 | 4-9 | 4-9 | 5-1 | 5-1 | 5-4 | 5-4 | 5-9 | 5-9 | 6-5 | 6-7 | 7-2 | 7-2 |
| Overall Height C | 7-9 | 7-9 | 8-8 | 8-8 | 8-8 | 8-8 | 9-9 | 9-9 | 10-5 | 10-5 | 11-6 | 11-6 | 12-6 | 12-6 |

### DIMENSIONS (mm)

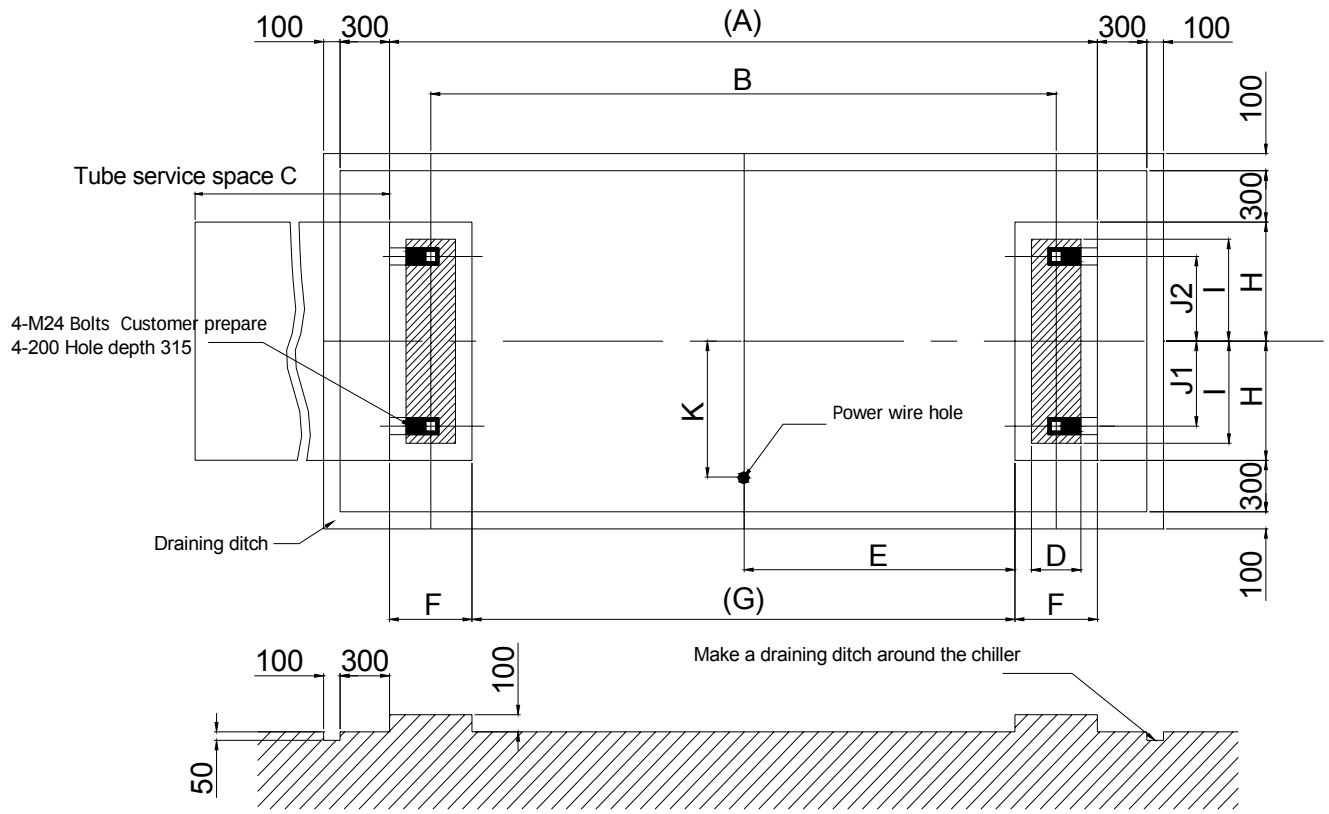
| UNIT 16JLR | 011 | 013 | 015 | 018 | 021 | 024 | 027 | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overall Length A | 3,713 | 3,713 | 3,734 | 3,734 | 4,772 | 4,772 | 4,854 | 4,854 | 4,958 | 4,958 | 5,669 | 6,142 | 6,244 | 7,259 |
| Overall Width B | 1,356 | 1,356 | 1,456 | 1,456 | 1,487 | 1,487 | 1,606 | 1,606 | 1,762 | 1,762 | 1,962 | 2,004 | 2,183 | 2,183 |
| Overall Height C | 2,374 | 2,374 | 2,634 | 2,634 | 2,651 | 2,651 | 2,983 | 2,983 | 3,178 | 3,178 | 3,494 | 3,494 | 3,815 | 3,815 |

*Standard shipping configuration is 1-piece for sizes 16JL/JLR011-100.

NOTES:
1 All dimensions in mm are accurate and take into account absorber-condenser crossover piping.
2 For routine maintenance, allow 3 ft (1 m) clearance on all sides and 6 in. (150 mm) above chiller.
3 For service access, allow clearance as follows:
  a For tube removal, allow space equal to “A” dimension (length) at either end of the chiller.
  b To open waterbox cover, allow clearance space equal to half of “B” dimension (width) on the waterbox end of the chiller.

# Dimensions (cont)

## 16JL/JLR FOUNDATION




### DIMENSIONS (in.)

| UNIT | A | B | C | D | E | F | G | H | I | J1 | J2 | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **16JL/JLR011/013** | 131 | 114 3/8 | 137 3/4 | 5 7/8 | 36 7/8 | 13 3/4 | 103 1/2 | 20 1/2 | 16 5/8 | 14 5/8 | 14 5/8 | 20 1/8 |
| **16JL/JLR015/018** | 131 1/2 | 114 7/8 | 137 3/4 | 5 7/8 | 39 7/8 | 13 3/4 | 103 7/8 | 23 5/8 | 19 5/8 | 17 3/4 | 17 3/4 | 23 3/4 |
| **16JL/JLR021/024** | 169 1/2 | 149 3/4 | 177 1/8 | 11 3/4 | 58 1/2 | 19 5/8 | 130 1/8 | 27 3/8 | 23 3/8 | 19 1/2 | 19 1/2 | 23 1/4 |
| **16JL/JLR027/030** | 169 1/4 | 149 1/2 | 177 1/8 | 11 3/4 | 70 1/8 | 19 5/8 | 129 7/8 | 35 3/8 | 31 1/2 | 25 5/8 | 25 5/8 | 24 7/8 |
| **16JL/JLR034/038** | 169 1/4 | 149 1/2 | 177 1/8 | 11 3/4 | 59 3/4 | 19 5/8 | 129 7/8 | 35 3/8 | 31 1/2 | 17 6/8 | 25 5/8 | 27 |
| **16JL/JLR047** | 190 7/8 | 171 1/8 | 204 3/4 | 11 3/4 | 77 7/8 | 19 5/8 | 151 1/2 | 39 3/8 | 35 3/8 | 31 1/2 | 31 1/2 | 31 5/8 |
| **16JL/JLR052** | 210 1/2 | 190 3/4 | 224 3/8 | 11 3/4 | 83 1/8 | 19 5/8 | 171 1/8 | 39 3/8 | 35 3/8 | 31 1/2 | 31 1/2 | 29 2/8 |
| **16JL/JLR080** | 210 1/2 | 188 3/8 | 203 1/8 | 14 1/8 | 70 7/8 | 22 | 166 3/8 | 39 3/8 | 35 3/8 | 31 1/2 | 31 1/2 | 39 3/8 |
| **16JL/JLR100** | 250 3/8 | 228 3/8 | 242 7/8 | 14 1/8 | 86 5/8 | 22 | 206 3/8 | 39 3/8 | 35 3/8 | 31 1/2 | 31 1/2 | 39 3/8 |

### DIMENSIONS (mm)

| UNIT | A | B | C | D | E | F | G | H | I | J1 | J2 | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **16JL/JLR011/013** | 3328 | 2905 | 3500 | 150 | 936 | 350 | 2628 | 521.5 | 421.5 | 371.5 | 371.5 | 510 |
| **16JL/JLR015/018** | 3340 | 2918 | 3500 | 150 | 1012 | 350 | 2640 | 600 | 500 | 450 | 450 | 602.5 |
| **16JL/JLR021/024** | 4304 | 3804 | 4500 | 300 | 1485 | 500 | 3304 | 695 | 595 | 495 | 495 | 590 |
| **16JL/JLR027/030** | 4298 | 3798 | 4500 | 300 | 1782 | 500 | 3298 | 900 | 800 | 650 | 650 | 633 |
| **16JL/JLR034/038** | 4298 | 3798 | 4500 | 300 | 1518 | 500 | 3298 | 900 | 800 | 450 | 650 | 687 |
| **16JL/JLR047** | 4848 | 4348 | 5200 | 300 | 1977 | 500 | 3848 | 1000 | 900 | 800 | 800 | 803 |
| **16JL/JLR052** | 5346 | 4846 | 5700 | 300 | 2110 | 500 | 4346 | 1000 | 900 | 800 | 800 | 743 |
| **16JL/JLR080** | 5346 | 4786 | 5160 | 360 | 1800 | 560 | 4226 | 1000 | 900 | 800 | 800 | 1000 |
| **16JL/JLR100** | 6361 | 5801 | 6170 | 360 | 2200 | 560 | 5241 | 1000 | 900 | 800 | 800 | 1000 |

NOTES:
1. The foundation load should be designed according to the operating weight of chiller.
2. The base must be smooth and horizontal (the level should be below 1mm for 1000mm).
3. The function of hole based on the foundation is to fix the chiller by bolts, and cement could be fit from the slant cut of the holes.
4. Tube space could be saved at either side.
5. Anchor bolts, washers and nuts are supplied by customer.

# Performance data

ENGLISH

| UNIT 16JL – Steam | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (ton) | 150 | 180 | 210 | 240 | 280 | 330 | 360 |
| CHILLED WATER | | | | | | | |
| Flow Rate (gpm) | 360 | 432 | 504 | 576 | 672 | 792 | 864 |
| Pressure Drop (ft) | 24.5 | 26.8 | 24.6 | 25.1 | 16.6 | 17.4 | 17.4 |
| COOLING WATER | | | | | | | |
| Flow Rate (gpm) | 540 | 648 | 756 | 864 | 1,008 | 1,188 | 1,296 |
| Pressure Drop (ft) | 33.2 | 36.4 | 28.0 | 29.9 | 21.8 | 23.1 | 25.5 |
| STEAM (lb/hr-ton) | 16.65 | 16.65 | 16.65 | 16.65 | 16.65 | 16.65 | 16.65 |
| (lb/hr) | 2,497 | 2,997 | 3,496 | 3,996 | 4,662 | 5,494 | 5,994 |

| UNIT 16JL – Steam | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (ton) | 400 | 450 | 500 | 600 | 660 | 800 | 1,000 |
| CHILLED WATER | | | | | | | |
| Flow Rate (gpm) | 960 | 1,080 | 1,200 | 1,440 | 1,584 | 1,920 | 2,400 |
| Pressure Drop (ft) | 17.7 | 17.1 | 17.3 | 19.7 | 25.4 | 20.3 | 35.4 |
| COOLING WATER | | | | | | | |
| Flow Rate (gpm) | 1,440 | 1,620 | 1,800 | 2,160 | 2,376 | 2,880 | 3,600 |
| Pressure Drop (ft) | 26.8 | 23.4 | 24.2 | 19.6 | 25.2 | 19.2 | 33.2 |
| STEAM (lb/hr-ton) | 16.65 | 16.65 | 16.65 | 16.65 | 16.65 | 16.65 | 16.65 |
| (lb/hr) | 6,660 | 7,492 | 8,325 | 9,990 | 10,989 | 13,319 | 16,649 |

**ARI** – Air Conditioning and Refrigeration Institute

**Note:** Ratings are based on ARI 560, latest edition;

54/44 F (2.4gpm/ton) chilled water, fouling factor 0.0001 $ft^2$-hr-$^oF$/Btu for evaporator;

85 F (3.6gpm/ton) cooling water, fouling factor 0.00025 $ft^2$-hr-$^oF$/Btu for absorber and condenser;

15 psig steam supply pressure

SI

| UNIT 16JL – Steam | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (kW) | 528 | 633 | 738 | 844 | 984 | 1,160 | 1,266 |
| CHILLED WATER | | | | | | | |
| Flow Rate (L/s) | 22.7 | 27.3 | 31.8 | 36.3 | 42.4 | 50.0 | 54.5 |
| Pressure Drop (kPa) | 73.3 | 80.0 | 73.4 | 75.0 | 49.6 | 51.9 | 52.1 |
| COOLING WATER | | | | | | | |
| Flow Rate (L/s) | 34.1 | 40.9 | 47.7 | 54.5 | 63.6 | 75.0 | 81.8 |
| Pressure Drop (kPa) | 99.1 | 108.8 | 83.8 | 89.3 | 65.0 | 69.0 | 76.2 |
| STEAM (kg/hr-kW) | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 |
| (kg/hr) | 1,134 | 1,359 | 1,585 | 1,812 | 2,113 | 2,491 | 2,718 |

| UNIT 16JL – Steam | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (kW) | 1,406 | 1,582 | 1,758 | 2,110 | 2,321 | 2,813 | 3,516 |
| CHILLED WATER | | | | | | | |
| Flow Rate (L/s) | 60.6 | 68.1 | 75.7 | 90.9 | 99.9 | 121.1 | 151.4 |
| Pressure Drop (kPa) | 52.9 | 51.2 | 51.6 | 58.9 | 75.9 | 60.7 | 105.8 |
| COOLING WATER | | | | | | | |
| Flow Rate (L/s) | 90.9 | 102.2 | 113.6 | 136.3 | 149.9 | 181.7 | 227.1 |
| Pressure Drop (kPa) | 80.1 | 69.8 | 72.3 | 58.6 | 75.3 | 57.4 | 99.2 |
| STEAM (kg/hr-kW) | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 | 2.15 |
| (kg/hr) | 3,019 | 3,397 | 3,775 | 4,531 | 4,984 | 6,040 | 7,550 |

**ARI** – Air Conditioning and Refrigeration Institute

Note: Ratings are based on ARI 560, latest edition;

12.2/6.7 C (.043 L/s-kW) chilled water, fouling factor 0.0000176 $m^2$-hr-$^oC$/W for evaporator;

29.4 C (.065 L/s-kW) cooling water; fouling factor 0.000044 $m^2$-hr-$^oC$/W for absorber and condenser;

0.098MPa steam supply pressure.

# Performance data (cont)

English

| UNIT 16JLR – Hot water | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (ton) | 110 | 135 | 155 | 180 | 210 | 245 | 270 |
| CHILLED WATER | | | | | | | |
| Flow Rate (gpm) | 264 | 324 | 372 | 432 | 504 | 588 | 648 |
| Pressure Drop (ft) | 29.5 | 32.9 | 30.6 | 31.8 | 29.1 | 29.3 | 29.5 |
| COOLING WATER | | | | | | | |
| Flow Rate (gpm) | 396 | 486 | 558 | 648 | 756 | 882 | 972 |
| Pressure Drop (ft) | 33.9 | 37.3 | 29.9 | 31.9 | 28.6 | 29.0 | 32.8 |
| HOT WATER | | | | | | | |
| Flow Rate (gpm) | 200 | 246 | 282 | 328 | 383 | 446 | 492 |
| Pressure Drop (ft) | 23.1 | 26.0 | 27.0 | 20.3 | 21.8 | 24.6 | 26.8 |

| UNIT 16JLR – Hot water | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (ton) | 300 | 335 | 375 | 450 | 500 | 600 | 750 |
| CHILLED WATER | | | | | | | |
| Flow Rate (gpm) | 720 | 804 | 900 | 1,080 | 1,200 | 1,440 | 1,800 |
| Pressure Drop (ft) | 29.5 | 30.1 | 30.4 | 34.2 | 45.1 | 36.0 | 21.2 |
| COOLING WATER | | | | | | | |
| Flow Rate (gpm) | 1,080 | 1,206 | 1,350 | 1,620 | 1,800 | 2,160 | 2,700 |
| Pressure Drop (ft) | 33.6 | 31.1 | 32.0 | 30.5 | 40.2 | 39.0 | 19.8 |
| HOT WATER | | | | | | | |
| Flow Rate (gpm) | 546 | 610 | 683 | 820 | 911 | 1,093 | 1,366 |
| Pressure Drop (ft) | 28.2 | 23.4 | 24.0 | 21.2 | 27.9 | 8.0 | 13.6 |

**ARI** – Air Conditioning and Refrigeration Institute

**Note:** Ratings are based on ARI 560, latest edition;

54/44F (2.4gpm/ton) chilled water, fouling factor 0.0001 $ft^2$-hr-$^oF$/Btu for evaporator;

85F (3.6gpm/ton) cooling water, fouling factor 0.00025 $ft^2$-hr-$^oF$/Btu for absorber and condenser;

203/185F hot water, fouling factor 0.0001 $ft^2$-hr-$^oF$/Btu for generator.

SI

| UNIT 16JLR – Hot water | 011 | 013 | 015 | 018 | 021 | 024 | 027 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (kW) | 387 | 475 | 545 | 633 | 739 | 862 | 950 |
| CHILLED WATER | | | | | | | |
| Flow Rate (L/s) | 16.7 | 20.4 | 23.5 | 27.3 | 31.8 | 37.1 | 40.9 |
| Pressure Drop (kPa) | 88.2 | 98.3 | 91.6 | 95.2 | 86.9 | 87.7 | 88.3 |
| COOLING WATER | | | | | | | |
| Flow Rate (L/s) | 25.0 | 30.7 | 35.2 | 40.9 | 47.7 | 55.6 | 61.3 |
| Pressure Drop (kPa) | 101.2 | 111.4 | 89.5 | 95.3 | 85.6 | 86.5 | 98.1 |
| HOT WATER | | | | | | | |
| Flow Rate (L/s) | 12.6 | 15.5 | 17.8 | 20.7 | 24.1 | 28.2 | 31.0 |
| Pressure Drop (kPa) | 69.3 | 77.7 | 80.6 | 60.5 | 65.2 | 73.7 | 80.2 |

| UNIT 16JLR – Hot water | 030 | 034 | 038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|
| COOLING CAPACITY (kW) | 1,055 | 1,178 | 1,319 | 1,583 | 1,759 | 2,110 | 2,637 |
| CHILLED WATER | | | | | | | |
| Flow Rate (L/s) | 45.4 | 50.7 | 56.8 | 68.1 | 75.7 | 90.8 | 113.6 |
| Pressure Drop (kPa) | 88.0 | 89.9 | 90.9 | 102.3 | 134.9 | 107.7 | 63.3 |
| COOLING WATER | | | | | | | |
| Flow Rate (L/s) | 68.1 | 76.1 | 85.2 | 102.2 | 113.6 | 136.3 | 170.3 |
| Pressure Drop (kPa) | 100.5 | 92.9 | 95.8 | 91.3 | 120.1 | 116.5 | 59.2 |
| HOT WATER | | | | | | | |
| Flow Rate (L/s) | 34.5 | 38.5 | 43.1 | 51.7 | 57.5 | 68.9 | 86.2 |
| Pressure Drop (kPa) | 84.2 | 69.8 | 71.7 | 63.3 | 83.4 | 23.8 | 40.6 |

**ARI** – Air Conditioning and Refrigeration Institute

Note: Ratings are based on ARI 560, latest edition;

12.2/6.7C (.043L/s-kW) chilled water, fouling factor 0.0176 $m^2$-hr-$^oC$/W for evaporator;

29.4C (.065L/s-kW) cooling water; fouling factor 0.044 $m^2$-hr-$^oC$/W for absorber and condenser;

95/85C hot water, fouling factor 0.0176 $m^2$-hr-$^oC$/W for generator.

# Application data

**Vent and drain connections**
All vents and drain connections are found on the waterbox covers. Connection size is 3/4-in. PT.
Provide high points of the machine piping system with vents and the low points with drains. If shut off valves are provided in the main water pipes near the unit, a minimum amount of the system water is lost when the heat exchangers are drained.
It is recommended that pressure gages be provided at points of entering and leaving water to measure pressure drop through the heat exchanger. Gages may be installed as shown in the table below. Pressure gages installed at the vent and drain connections do not include nozzle pressure losses.
Use a reliable manometer to measure pressure differential when determining water flow. Regular gages are insensitive and do not provide accurate measurement of flow conditions.

| NUMBER OF PASSES | GAGE LOCATION |
|---|---|
| 1, 3 | One gage in each waterbox |
| 2, 4 | Two gages in waterbox with nozzles |

**Range of application**
The 16JL absorption chiller is designed for standard water chilling applications of 150 to 1000 tons (528 to 3516kW) and 16JLR is 110 to 750 tons (387 to 2637kW) at standard ARI rating conditions. In most applications, the minimum leaving chilled water temperature is limited to 41F (5C). The minimum continuous inlet water temperature to the absorber-condenser circuit is 59F (15C), although lower temperatures are permitted during machine start-up. Use of a cooling tower bypass is required if water temperatures are anticipated to be less than this value. Steam supply of 16JL chiller to the generator should be dry and saturated and at a maximum pressure of 15psig.

**Rupture disk piping**
The 16JL/JLR is equipped with a rupture disk on the generator. It is recommended that piping from these devices be routed to appropriate areas away from the machine in accordance with Carrier's written installation instructions, and any local jurisdictional requirements that may apply. One side of Rupture disk's connective tube is connected with protected recipient and another side is leaded to safe place such as atmosphere or where there is no person. Piping should be adequately supported and the proper fittings should be provided to allow periodic inspection of the disk.

| UNIT SIZE | RUPTURE DISK CONNECTION SIZE |
|---|---|
| All | 2 in. RF flange |

LEGEND
RF – Raised Face

**MATERIAL SPECIFICATIONS**

| ITEM | | MATERIAL | SPECIFICATIONS |
|---|---|---|---|
| **SHELL:** | | | |
| | **Evaporator** | Steel | Equivalent to ASTM A283 |
| | **Absorber** | Steel | Equivalent to ASTM A283 |
| | **Condenser** | Steel | Equivalent to ASTM A283 |
| | **Generator** | Steel | Equivalent to ASTM A283 |
| **TUBESHEET:** | | | |
| | **Evaporator** | Steel | Equivalent to ASTM A283 |
| | **Absorber** | Steel | Equivalent to ASTM A283 |
| | **Condenser** | Steel | Equivalent to ASTM A283 |
| | **Generator** | Steel | Equivalent to ASTM A283 |
| **WATERBOX:** | | | |
| | **Evaporator** | Steel | Equivalent to ASTM A283 |
| | **Absorber** | Steel | Equivalent to ASTM A283 |
| | **Condenser** | Steel | Equivalent to ASTM A283 |
| | **Generator** | Steel | Equivalent to ASTM A283 |
| **TUBES:** | | | |
| | **Evaporator** | Copper | Equivalent to ASME SB359 |
| | **Absorber** | Copper | Equivalent to ASME SB359 |
| | **Condenser** | Copper | Equivalent to ASME SB359 |
| | **Generator** | 90-10 Cu-Ni(16JL) Copper (16JLR) | C7060T-OL Equivalent to ASME SB75 or 359 |
| **PIPING** | | Steel | Equivalent to ASTM A53 |

**Service access**
To perform routine service of maintenance, allow 3ft (1m) clearance on all sides of the machine and 6in. (150mm) above the chiller. Tube removal space equal to the overall length of the unit should be provided on at least one end of the 16JL/JLR chiller. The absorber and condenser waterbox covers are hinged to permit easy openinig and access for routine tube cleaning.

**Thermal insulation**
Application of cold/hot surface thermal insulation should be done after final installation at jobsite and machine leak integrity has been verified. Take care that cold surface insulation does not interfere with removal or reinstallation of flange and waterbox. Refer to Carrier certified drawings for material specifications and recommended chiller insulation requirements.

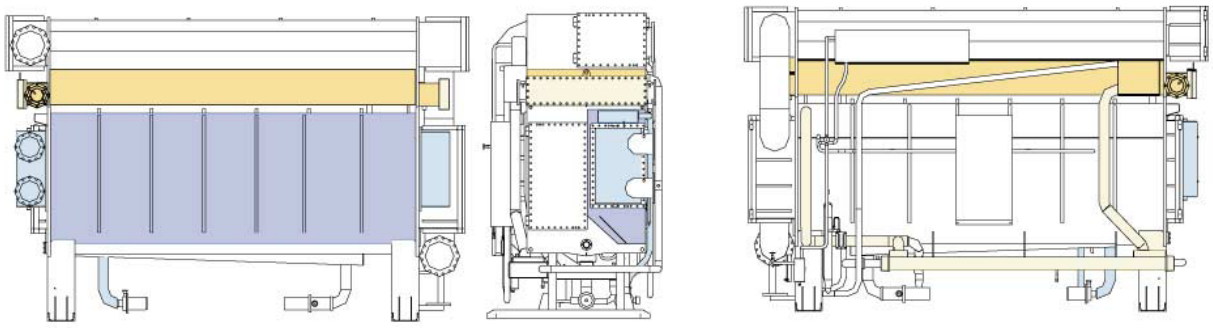
# Application data (cont)

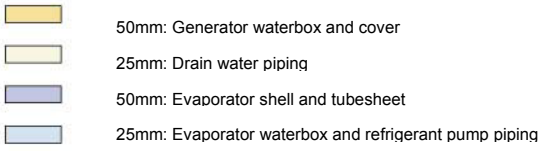
**THERMAL INSULATION SURFACE AREA REQUIREMENTS – ENGLISH ($FT^2$)**

| UNIT SIZE | 011/013 | 015/018 | 021/024 | 027/030 | 034/038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| HOT SURFACE | 76.4 | 88.3 | 96.9 | 107.6 | 119.5 | 134.5 | 143.2 | 99.0 | 107.6 |
| COLD SURFACE | 61.4 | 67.8 | 86.1 | 91.5 | 107.6 | 156.1 | 172.2 | 203.4 | 236.8 |

**THERMAL INSULATION SURFACE AREA REQUIREMENTS – SI ($m^2$)**

| UNIT SIZE | 011/013 | 015/018 | 021/024 | 027/030 | 034/038 | 047 | 052 | 080 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| HOT SURFACE | 7.1 | 8.2 | 9.0 | 10.0 | 11.1 | 12.5 | 13.3 | 9.2 | 10.0 |
| COLD SURFACE | 5.7 | 6.3 | 8.0 | 8.5 | 10.0 | 14.5 | 16.0 | 18.9 | 22.0 |






Cold surface: Non-flammable material, polyethylene rubber or equivalent. Thermal conductivity of material is 0.03 Kcal/m.h.℃ below.
Hot surface: Glass wool/Rock wool or equivalent.

**STANDARD WATERBOX AND CROSSOVER PIPE CONFIGURATION**

| UNIT | EVAPORATOR | | ABSORBER | | CONDENSER | | CROSS-OVER PIPE |
|---|---|---|---|---|---|---|---|
| | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | |
| **16JL/JLR011- 100** | N | N | M | M | M | M | Included |

LEGEND
**M** -- Marine Waterbox
**N** -- Nozzle In Head

**HEAT EXCHANGER STANDARD PASS AND NOZZLE ARRANGEMENT**

| UNIT | EVAPORATOR | | ABSORBER | | CONDENSER | |
|---|---|---|---|---|---|---|
| | Pass | Inlet | Pass | Inlet | Pass | Inlet |
| **16JL011-018** | 3 | R | 3 | L | 1 | R |
| **16JL021-100** | 2 | R | 2 | L | 1 | L |
| **16JLR011-018** | 4 | R | 4 | L | 1 | L |
| **16JLR021-052** | 3 | R | 3 | L | 1 | R |
| **16JLR080** | 3 | R | 3 | L | 2 | R |
| **16JLR100** | 2 | R | 2 | L | 1 | L |

LEGEND
**L** -- Left End Inlet (when facing control panel)
**R** -- Right End Inlet (when facing control panel)

# Application data (cont)

## HEAT EXCHANGER MINIMUM/MAXIMUM FLOW RATES* -- ENGLISH (gpm)

| SIZE | EVAPORATOR | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1-Pass | | 2-Pass | | 3-Pass | | 4-Pass | |
| | Min | Max | Min | Max | Min | Max | Min | Max |
| 011 | – | – | 253 | 1012 | 169 | 675 | 127 | 506 |
| 013 | – | – | 295 | 1181 | 197 | 787 | 148 | 590 |
| 015 | – | – | 346 | 1382 | 230 | 921 | 173 | 691 |
| 018 | – | – | 395 | 1579 | 263 | 1053 | 197 | 789 |
| 021 | 703 | 2811 | 351 | 1406 | 234 | 937 | – | – |
| 024 | 820 | 3280 | 410 | 1640 | 273 | 1093 | – | – |
| 027 | 904 | 3617 | 452 | 1809 | 301 | 1206 | – | – |
| 030 | 1012 | 4048 | 506 | 2024 | 337 | 1349 | – | – |
| 034 | 1096 | 4385 | 548 | 2193 | 365 | 1462 | – | – |
| 038 | 1223 | 4891 | 611 | 2446 | 408 | 1630 | – | – |
| 047 | 1466 | 5866 | 733 | 2933 | 489 | 1955 | – | – |
| 052 | 1466 | 5866 | 733 | 2933 | 489 | 1955 | – | – |
| 080 | 1970 | 7881 | 985 | 3940 | 657 | 2627 | – | – |
| 100 | 1970 | 7881 | 985 | 3940 | 657 | 2627 | – | – |

| SIZE | ABSORBER-CONDENSER | | | |
|---|---|---|---|---|
| | 2-Pass/1-Pass | | 3-Pass/1-Pass | |
| | Min | Max | Min | Max |
| 011 | 290 | 1454 | – | – |
| 013 | 350 | 1734 | – | – |
| 015 | 518 | 2144 | – | – |
| 018 | 593 | 2448 | – | – |
| 021 | 500 | 2212 | – | – |
| 024 | 593 | 2598 | – | – |
| 027 | 657 | 2661 | – | – |
| 030 | 732 | 2950 | – | – |
| 034 | 821 | 3337 | – | – |
| 038 | 914 | 3699 | – | – |
| 047 | 1138 | 4554 | – | – |
| 052 | 1138 | 4554 | – | – |
| 080 | 1560 | 7688 | – | – |
| 100 | 1560 | 7688 | – | – |

*Flow rates based on standard tubes. Minimum flow based on tube velocity of 3 ft/sec; maximum flow based on 12 ft/sec.

## HEAT EXCHANGER MINIMUM/MAXIMUM FLOW RATES* -- SI (L/s)

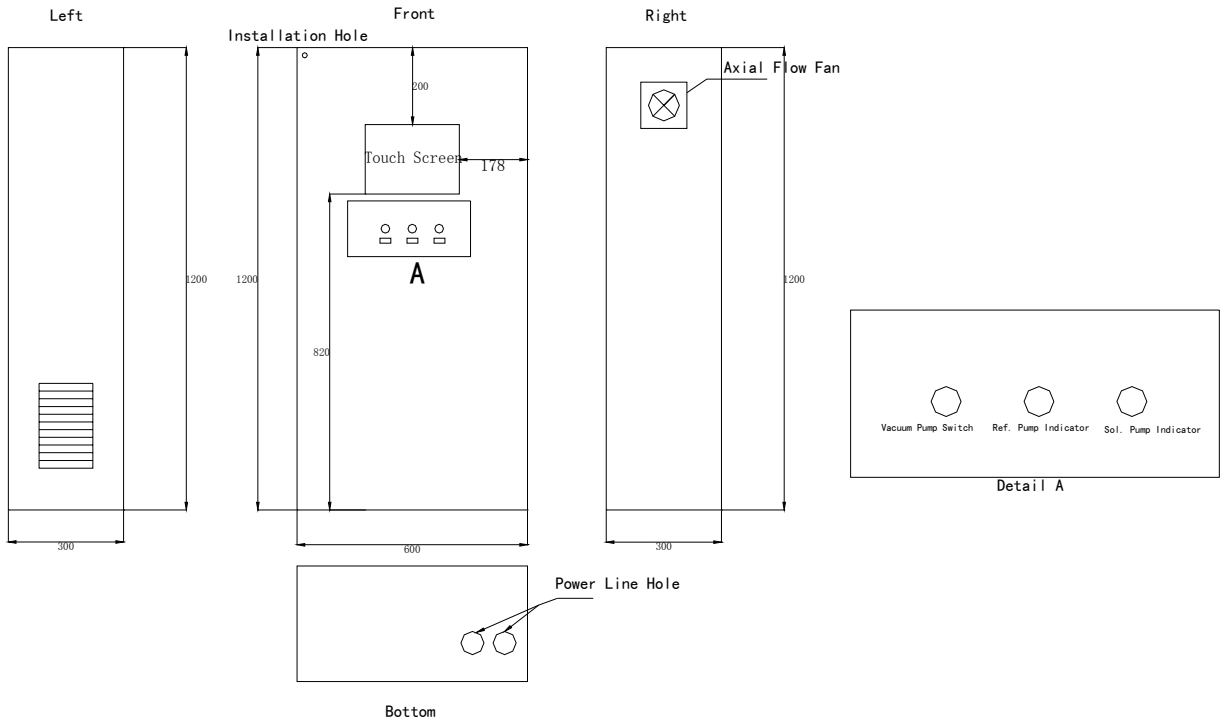
| SIZE | EVAPORATOR | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1-Pass | | 2-Pass | | 3-Pass | | 4-Pass | |
| | Min | Max | Min | Max | Min | Max | Min | Max |
| 011 | – | – | 16 | 64 | 11 | 43 | 8 | 32 |
| 013 | – | – | 19 | 74 | 12 | 50 | 9 | 37 |
| 015 | – | – | 22 | 87 | 15 | 58 | 11 | 44 |
| 018 | – | – | 25 | 100 | 17 | 66 | 12 | 50 |
| 021 | 44 | 177 | 22 | 89 | 15 | 59 | – | – |
| 024 | 52 | 207 | 26 | 103 | 17 | 69 | – | – |
| 027 | 57 | 228 | 29 | 114 | 19 | 76 | – | – |
| 030 | 64 | 255 | 32 | 128 | 21 | 85 | – | – |
| 034 | 69 | 277 | 35 | 138 | 23 | 92 | – | – |
| 038 | 77 | 309 | 39 | 154 | 26 | 103 | – | – |
| 047 | 93 | 370 | 46 | 185 | 31 | 123 | – | – |
| 052 | 93 | 370 | 46 | 185 | 31 | 123 | – | – |
| 080 | 124 | 497 | 62 | 249 | 41 | 166 | – | – |
| 100 | 124 | 497 | 62 | 249 | 41 | 166 | – | – |

| SIZE | ABSORBER-CONDENSER | | | |
|---|---|---|---|---|
| | 2-Pass/1-Pass | | 3-Pass/1-Pass | |
| | Min | Max | Min | Max |
| 011 | 18 | 92 | – | – |
| 013 | 22 | 109 | – | – |
| 015 | 33 | 135 | – | – |
| 018 | 37 | 154 | – | – |
| 021 | 32 | 140 | – | – |
| 024 | 37 | 164 | – | – |
| 027 | 41 | 168 | – | – |
| 030 | 46 | 186 | – | – |
| 034 | 52 | 211 | – | – |
| 038 | 58 | 233 | – | – |
| 047 | 72 | 362 | – | – |
| 052 | 72 | 362 | – | – |
| 080 | 98 | 485 | – | – |
| 100 | 98 | 485 | – | – |

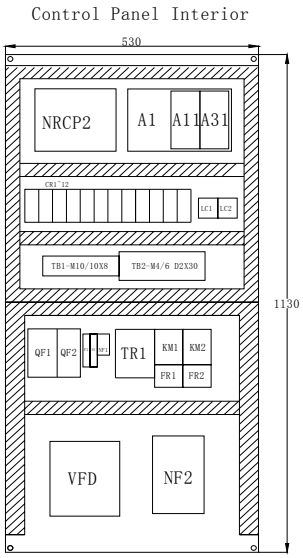
*Flow rates based on standard tubes. Minimum flow based on tube velocity of 0.9 m/sec; maximum flow based on 3.6 m/sec.

# Application data (cont)

## Control Panel




PD5 control Panel outline

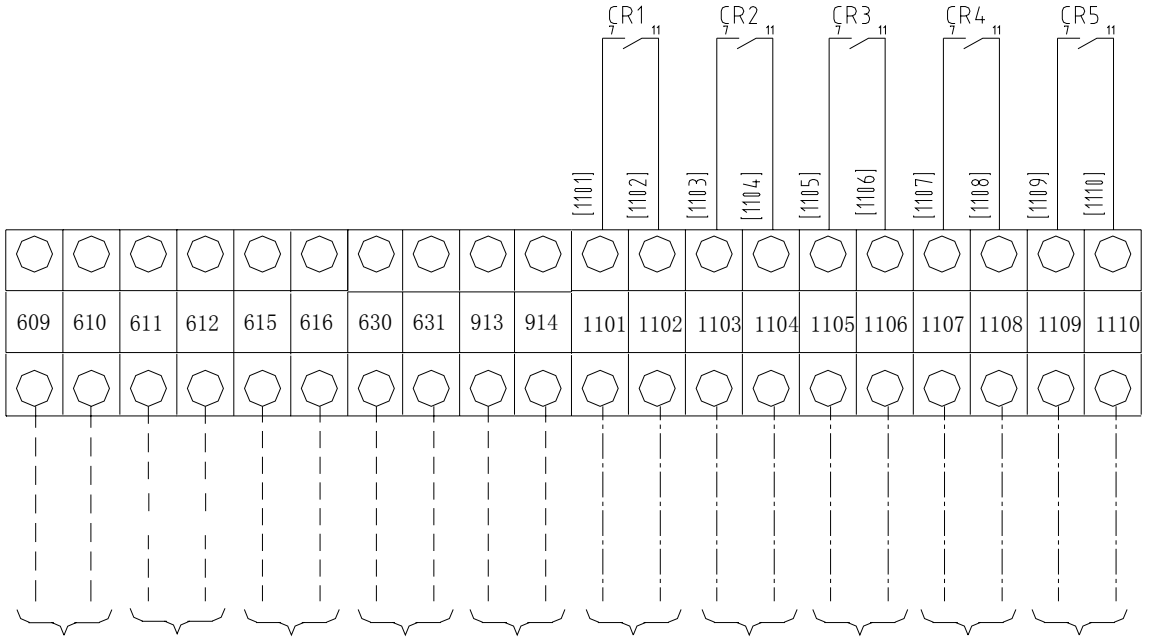



Note: 1. Power Line inlet and outlet are both at the bottom of the control panel.
2. The signal line and power line are in the separate hole.
3. At least 20mm clearance should be allowed above and under the VFD.
4. AUX1 and AUX2 are installed parallelly above A1.
5. Electrical components installation should meet the requirements of GB 4706.1-1992.

Control Panel Interior components

# Application data (cont)

**Typical electrical field connection**




: Fielding wiring

: Factory wiring

: Optional wiring

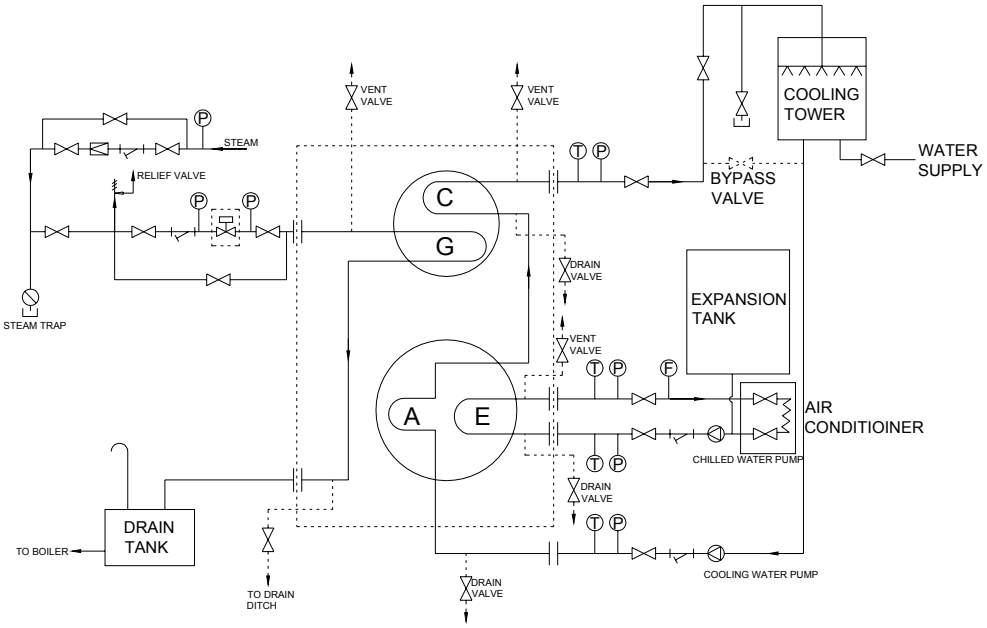
| | |
|---|---|
| CR1 | CHILLED WATER PUMP RELAY |
| CR2 | COOLING WATER PUMP RELAY |
| CR3 | COOLING TOWER FAN RELAY |
| CR4 | CHILLER ALARM RELAY |
| CR5 | CHILLER RUNNING RELAY |

# Application data (cont)

**Water management**

| Item | | Cooling water | | | Chilled water | | tendency | |
|---|---|---|---|---|---|---|---|---|
| | | Circulation flow | | Direct flow | | | | |
| | | Circulate water | Supply water | Direct flow water | Circulate water ≤20C | Supply water | corrosion | scale |
| Basic | PH (25C) | 6.5~8.2 | 6.0~8.0 | 6.8~8.0 | 6.0~8.0 | 6.8~8.0 | √ | √ |
| | Electrical conductivity (mS/m) (25C) [μS/cm] (25C) | ≤80 [≤800] | ≤30 [≤300] | ≤40 [≤400] | ≤40 [≤400] | ≤30 [≤300] | √ | √ |
| | Chroride ion (mg $Cl^-$/l) | ≤200 | ≤50 | ≤50 | ≤50 | ≤50 | √ | |
| | Sulfate ion (mg $SO_4^{2-}$/l) | ≤200 | ≤50 | ≤50 | ≤50 | ≤50 | √ | |
| | Acid consumption (PH4.8) (mg $CaCO_3$/l) | ≤100 | ≤50 | ≤50 | ≤50 | ≤50 | | √ |
| | Total hardness (mg $CaCO_3$/l) | ≤200 | ≤70 | ≤70 | ≤70 | ≤70 | | √ |
| | Calcium hardness (mg $CaCO_3$/l) | ≤150 | ≤50 | ≤50 | ≤50 | ≤50 | | √ |
| | Ionic silica (mg $SiO_2$/l) | ≤50 | ≤30 | ≤30 | ≤30 | ≤30 | | √ |
| Reference | Iron (mg Fe/l) | ≤1.0 | ≤0.3 | ≤1.0 | ≤1.0 | ≤0.3 | √ | √ |
| | Copper (mg Cu/l) | ≤0.3 | ≤0.1 | ≤1.0 | ≤1.0 | ≤0.1 | √ | |
| | Sulfide ion (mg $S^{2-}$/l) | Not include | | | | | √ | |
| | Ammonium ion (mg $NH_4^+$/l) | ≤1.0 | ≤0.1 | ≤1.0 | ≤1.0 | ≤0.1 | √ | |
| | Residual chlorine (mg Cl/l) | ≤0.3 | ≤0.3 | ≤0.3 | ≤0.3 | ≤0.3 | √ | |
| | Free carbone dioxide (mg $CO_2$/l) | ≤4.0 | ≤4.0 | ≤4.0 | ≤4.0 | ≤4.0 | √ | |
| | Ryzner stability index | 6.0~7.0 | - | - | - | - | √ | √ |

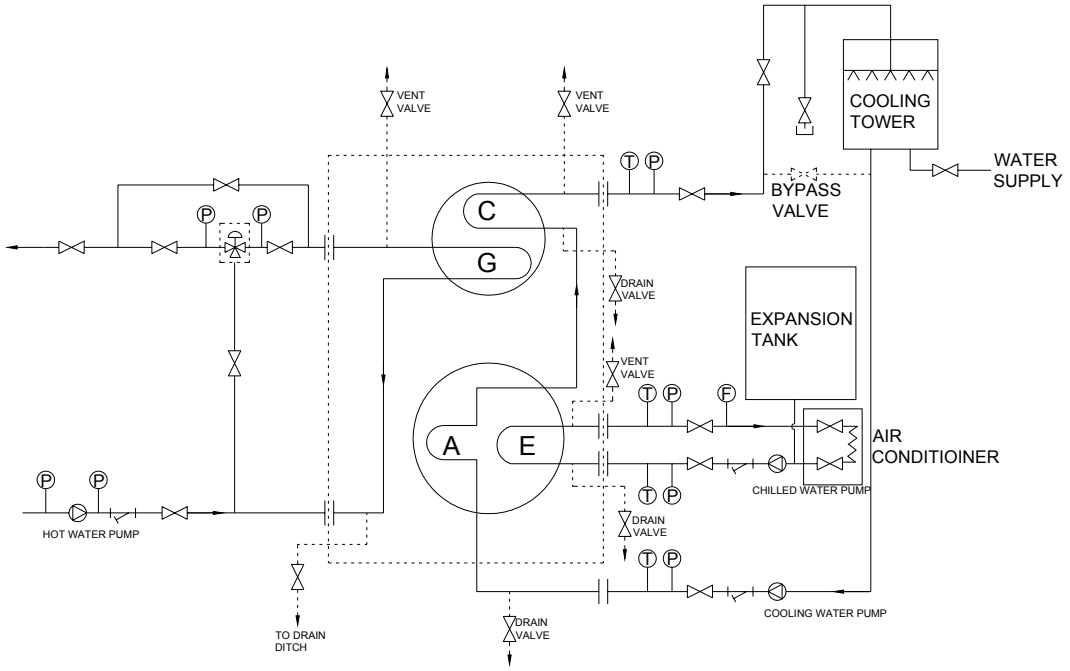
# 16JL Typical piping




| | | |
|---|---|---|
| STEAM CONTROL VALVE | THERMOMETER | STRAINER |
| PUMP | PRESSURE GAGE | VALVE |
| PRESSURE REDUCING VALVE | FLOWMETER | |

NOTE: 1. All items external to the dotted line in the above diagram are to be field-supplied.
2. Piping and components shown are typical to indicate general point-of-connection only and are not intended to show details for a specific installation. Installation and piping should be done in accordance with 16JL Installation Instructions.
3. Install thermometers and pressure gages at locations convenient for serving in the inlet and outlet water lines to the chiller.
4. Location of the chilled water and cooling water pumps as well as the expansion tank must take into account the hydrostatic head to ensure that the waterbox design pressure is not exceeded.(0.8MPa)
5. Provide vent and drain valves in each waterbox.
6. Provide a tower bypass valve if the temperature of the cooling water returning from the tower can fall below 59 F.
7. Standard steam supply pressure is 15 psig. If the supply pressure is significantly greater than 15 psig, a pressure reducing valve and safety relief valve should be located in the piping as indicated. The safety relief valve should be set at 15 psig. Pipe the discharge of the relief valve in accordance with local code requirements.
8. A strainer, pressure gage (0~0.2MPa), drip leg and drain trap should be provided near the steam inlet. A bypass around the steam control valve is recommended for inspection and maintenance purposes.
9. The flowrate of chilled water and cooling water should be in accordance with the value as specified. A flowmeter can be installed on chilled water piping for convenient operation.
10. The flanges of chilled water, cooling water and steam inlet piping of chiller are supplied by Carrier and the other flanges of water piping are supplied by customers.
11. Measure should be taken to reduce the temperature if the steam temperature exceeds 130℃.

# 16JLR Typical piping

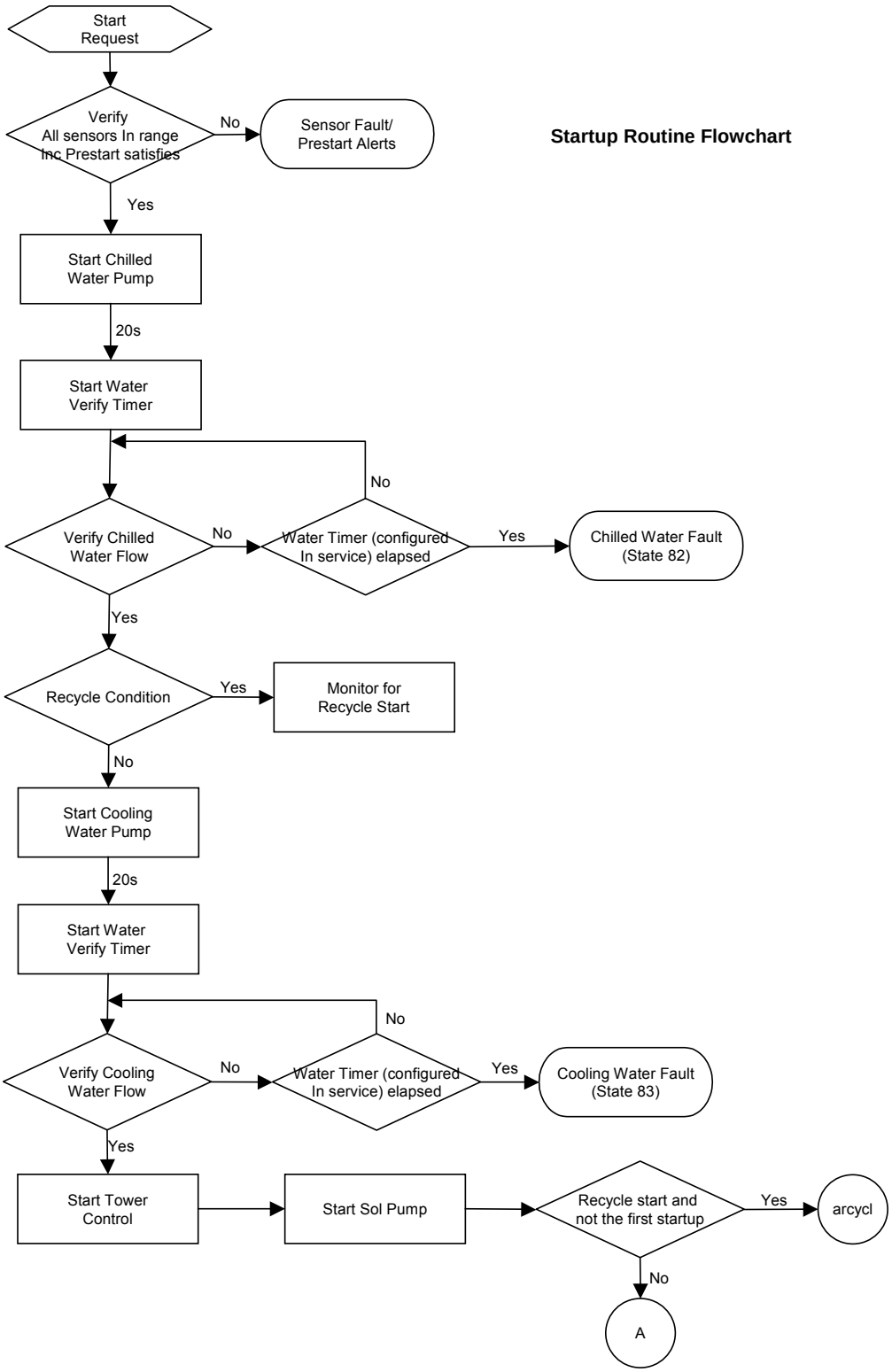



| | | |
|---|---|---|
| HOT WATER CONTROL VALVE | THERMOMETER | STRAINER |
| PUMP | PRESSURE GAGE | VALVE |
| PRESSURE REDUCING VALVE | FLOWMETER | |

NOTE: 1. All items external to the dotted line in the above diagram are to be field-supplied.
2. Piping and components shown are typical to indicate general point-of-connection only and are not intended to show details for a specific installation. Installation and piping should be done in accordance with 16JLR Installation Instructions.
3. Install thermometers and pressure gages at locations convenient for serving in the inlet and outlet water lines to the chiller.
4. Location of the chilled water and cooling water pumps as well as the expansion tank must take into account the hydrostatic head to ensure that the waterbox design pressure is not exceeded.(0.8MPa)
5. Provide vent and drain valves in each waterbox.
6. Provide a tower bypass valve if the temperature of the cooling water returning from the tower can fall below 59 F.
7. Measure should be taken to reduce the temperature if hot water temperature exceeds 130℃.
8. A pressure gage (0~0.8MPa) should be provided near the hot water control valve inlet and outlet respectively. A bypass around the hot water control valve is recommended for inspection and maintenance purposes.
9. The flowrate of chilled water and cooling water should be in accordance with the value as specified. A flowmeter can be installed on chilled water piping for convenient operation.
10. The flanges of chilled water, cooling water and steam inlet piping of chiller are supplied by Carrier and the other flanges of water piping are supplied by customers.

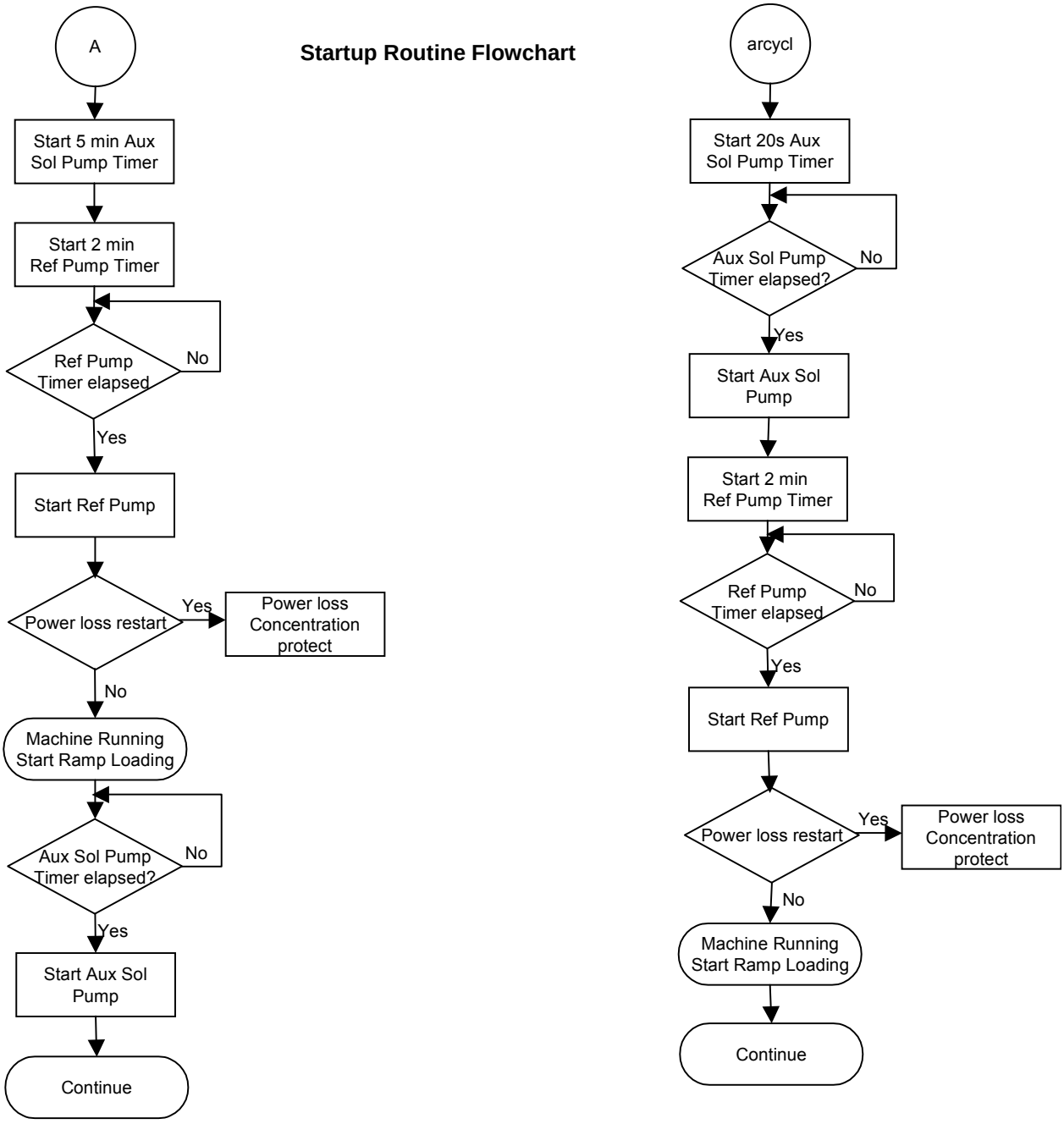
# Typical control sequence

**NORMAL START FLOW CHART (PART 1)**



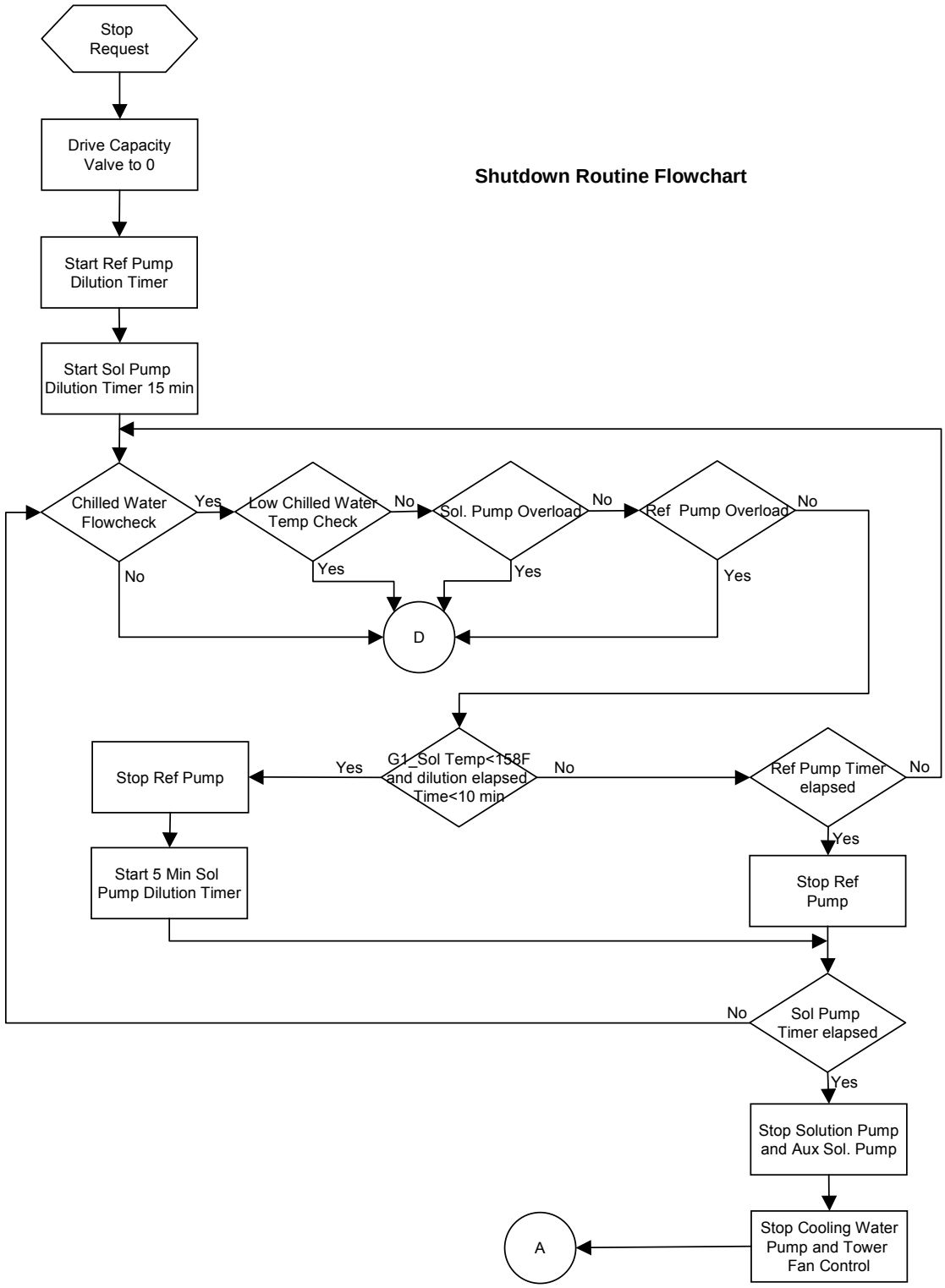

**Startup Routine Flowchart**

## NORMAL COOLING START FLOW CHART (PART 2)



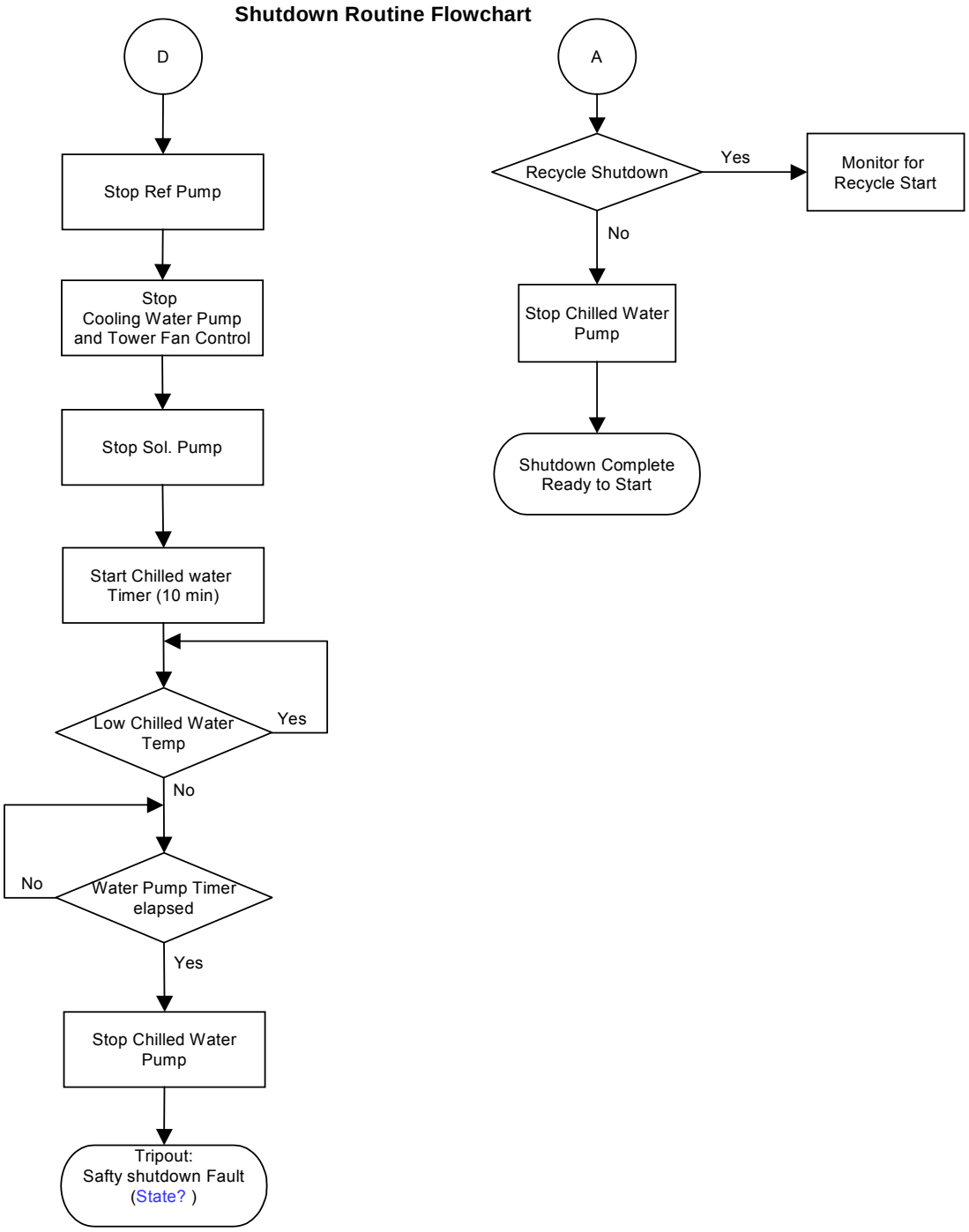

Note: When the chilled water pump, the cooling water pump, the cooling tower fan and the chiller are not interlocked, start up the auxiliary equipment first and press Start/Stop button of the chiller.

## NORMAL SHUTDOWN FLOW CHART (PART 1)




**Shutdown Routine Flowchart**

## NORMAL SHUTDOWN FLOW CHART (PART 2)




Note:

1. When the chilled water pump, the cooling water pump, the cooling tower fan and the chiller are not interlocked, wait till the dilution process stops and switch off these auxiliary equipments.
2. When the chilled water and cooling water system are in abnormal condition or the shield pump alarms, the chiller stops immediately. When the generator alarms, the chiller stops after the dilution process runs for 10 minutes

## Hermetic Absorption Liquid Chiller

Size Range:
16JL: 150 to 1000 tons (528 to 3516 kW)
16JLR: 110 to 750 tons (387 to 2637 kW)
Carrier Model Number: **16JL/16JLR**

## Part 1 — General

1.01 SYSTEM DESCRIPTION

Electronic controlled single-effect (one-stage) absorption liquid chiller utilizing hermetic refrigerant and solution pumps, lithium bromide solution as the absorbent, and water as the refrigerant. Low pressure steam/low temperature hot water shall be supplied to the generator as the heat source.

1.02 QUALITY ASSURANCE

A. Chiller performance shall be rated in accordance with ARI Standard 560 (latest edition).
B. Chiller shall be manufactured in accordance with ANSI/ASHRAE 15 (latest edition), Safety Code for Mechanical Refrigeration.
C. Chiller shall be designed and constructed to meet applicable GB requirements.
D. Each chiller shall undergo a series of standard factory tests to ensure that the unit is leak tight, that all electrical components operate as intended, and that every aspect of the unit fabrication meets stringent quality standards in accordance with good practice and the manufacturer's quality assurance requirements.
   1. The shell side of each chiller shall be leak tested by pressurizing to 11.0psig (76kPa) with nitrogen and then checked by spraying a soap/water mixture on all welds, tube joints, and/or gasketed joints to identify any major leaks. Afterward, a mass spectrometer test shall be performed by evacuating the unit to 0.5mmHg absolute, covering the machine with a vinyl tent, and introducing helium gas under the tent. Any remaining leaks will allow the helium to be drawn into the shell side of the machine. The acceptable leak rate as measured by the mass spectrometer test shall not exceed $1*10^{-6}$cc/sec standard air.
   2. The tube side of the evaporator, absorber, and condenser shall be hydrostatically tested at 1.5 times rated design pressure and held for 30 minutes.
   3. The refrigerant and solution pump/motors shall undergo standard factory tests to ensure proper head flow, and motor output characteristics.
   4. All machine wiring shall undergo an insulation resistance test. The chiller control center and all electrical components shall also be functionally tested to verify continuity and proper electrical operation.
   5. Final assembly inspection shall consist of verifying that all valves, controls, instrumentation, pumps, purge components, and all other machine components have been properly installed on the machine.
   6. Each unit shall then be checked for overall appearance and dimensional accuracy.
   7. Final inspection shall be performed on each unit to check that painting of the unit is as specified, nameplate data is correct, and that all accessories are furnished as required.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be stored and handled in accordance with the manufacturer's recommendations.
B. Unit shall not be factory-charged with lithium bromide solution to prevent possible internal corrosion damage from occurring should the inside of the machine be accidentally exposed to air during shipment and/or installation and performance tested before shipping.
C. 1-piece shipped machines shall be pressurized to 4.35psig (0.03MPa) with dry nitrogen gas on the shell side.
D. Chiller shall be shipped with nameplates indicating name of manufacturer, model size, serial number, and all other pertinent machine data.

1.04 WARRANTY

Manufacturer shall guarantee the chiller against defects in materials or workmanship for a period of one year from date of initial operation or 18 months from date of shipment, whichever occurs first. Manufacturer shall provide the labor to repair or replace any part found to be defective in material or workmanship within the warranty period.

## Part 2 —Products

2.01 EQUIPMENT

A. General:

Absorption liquid chiller shall include evaporator, absorber, condenser, generator, solution heat exchanger, refrigerant/solution pumps, purge system, piping, wiring, controls and auxiliaries. Shipment of the machine shall be in 1-piece for 16JL/JLR011-100. Initial charge of lithium bromide shall be included with the chiller for charging at the jobsite. Generator shall be designed for operation on low pressure steam/low temperature hot water as specified on the equipment schedule.

B. Operating Characteristics:
   1. Chiller operation shall be characteristic of a single effect absorption cycle. The weak solution pumped from the absorber to the generator shall initially pass through a solution heat exchanger to improve operating efficiency by pre-heating the weak solution on the tube side with the strong solution returning from the generator on the shellside.

# Guide Specifications (cont)

2. Unit shall be capable of continuous operation from 100% to 10% capacity, with entering condenser water temperatures as low as 59F (15C), without the need for a cooling tower bypass valve. Thermostat on/off control of the cooling tower fan is recommended when cooling water temperature falls below 59F (15C).

C. Heat Exchangers:

1. All heat exchangers shall be of shell and tube construction with shells, tubesheets, tube support sheets and waterboxes fabricated of carbon steel. All heat exchangers shall incorporate straight tubes. All tubes shall be rolled into tubesheets and expanded into tube support sheets, and shall be individually replaceable.
2. The evaporator, absorber, and condenser waterboxes shall be designed for 150psig (1034kPa) working pressure. Evaporator waterboxes shall be nozzle-in-head type and absorber-condenser waterboxes shall be marine type. All waterboxes shall be provided with vent and drain connections. Epoxy painting of the waterboxes and tube sheets shall be provided for corrosion protection. All waterboxes shall be provided with vent and drain connections. GB raised face flanges shall be furnished on all waterbox nozzle connections.
3. The tube side of the 16JL generator shall be designed for 15psig (103kPa) working pressure for steam applications. For steam applications, a rupture disk shall be factory supplied on the machine. The tube side of the 16JLR generator shall be designed for 150psig (1034kPa) working pressure for standard; or 300psig (2068kPa) for option working pressure for low temperature hot water applications. All hot water generators shall be designed, constructed and stamped in accordance with GB requirements on the tube side.
4. A solution heat exchanger shall be an integral part of the machine to increase efficiency by preheating weak solution on the tube side with strong solution on the shell side. Tube material for this heat exchanger shall be copper.
5. Spray heads for the evaporator, absorber shall be of a non-clogging design, specifically designed for the intended duty. Spray heads shall be fabricated of a corrosion-proof material to ensure continuous, high efficiency operation.
6. Heat exchanger tube material and minimum wall thickness shall be contingent on the type of corrosion inhibitor used in the machine. The following tube specifications shall apply to ensure long machine life and continuous operation:
   Evaporator……..….copper, externally fin tube
   Absorber……..copper, corrugated tube
   Condenser……..……copper, corrugated tube
   Generator 16JL…..... CuNi, bare tube
   16JLR..... copper, externally turbo-chill tube

D. Pump/Motors:

Refrigerant and solution pump/motors shall be self-contained, leakproof, hermetic type, without pump seals, isolation valves or external seal water system to minimize air leakage into the machine. Each pump casing shall be welded into suction and discharge lines and factory installed and shall include spring-loaded, wear-compensating tapered carbon bearings. Lubrication and cooling shall be accomplished by the fluid being pumped; auxiliary water piping for cooling and lubrication shall not be acceptable. Pump/motor assemblies shall be designed for a minimum 20,000 hours of normal operation between inspections. If pump/motor assemblies are furnished with less than a design of 20,000 hours between inspections, they must be provided with isolation valves and a bearing monitoring system to aid in diagnosing and performing on-going maintenance.

E. Purge System:

An automatic, motorless purge system shall be furnished to provide a continuous purging action whenever the chiller is in operation to assure long machine life and efficient performance. Noncondensables shall be removed from the absorber by a liquid eductor, which shall use flow from the solution pump to create a suction. Noncondensables shall be stored external to the unit and shall be prevented from diffusing back into the machine when the unit is not operating. Evacuation of the external storage tank shall be accomplished by the use of a unit-mounted vacuum pump. The vacuum pump shall be factory mounted on the chiller and wired to the control center by the chiller manufacturer.

F. Controls, Safeties and Diagnostics:

1. Controls:

a The 16JL/JLR series chiller shall be provided with a factory installed and wired PD5 control system with individually replaceable modular component construction. The system shall include a PD5-BASE board, two PD-AUX boards and an NRCP-BASE board, power supply, temperature (thermistor) and pressure (transducer) sensors, and all necessary auxiliary devices required for proper operation. The chiller operation system shall have the ability to interface and communicate directly to the building control system without the use of additional field-installed hardware or software. Additional hardware will be necessary if the building control system is not a Carrier Comfort Network (CCN). The user interface is a touch screen. It is connected to the main basic board and gives access to a full array of control

# Guide Specifications (cont)

parameters. The PD5 shall be configurable to display either English or SI metric units.

b The default standard display screen shall simultaneously indicate the following minimum information:
- date and time of day
- primary system status message
- secondary system status message
- entering chilled water temperature
- leaving chilled water temperature
- evaporator refrigerant temperature
- entering absorber water temperature
- leaving absorber water temperature
- leaving condenser water temperature
- strong solution temperature leaving generator
- weak solution temperature leaving absorber
- steam condensate water temperature
- output signal to steam/hot water control valve
- The default screen shall be displayed if there is no manual activity at the control console for 15 minutes.

c PD5 Operation Button.

| DESCRIPTION OF THE MAIN NAVIGATION AND OPERATION BUTTONS | |
|---|---|
|  | Returns to the previous screen |
|  | Displays the default screen (“Group Display” screen) |
|  | Displays the main screen |
|  | Displays the next screen |
|  | Displays the previous screen |
|  | Accepts the current action |
|  | Rejects the current action |
|  | Cancels the current action |
|  | Removes the data in the value modification dialog box |
|  | Adds a point to one of the “Group Display” screens |
|  | Removes a point from one of the “Group Display” screens |
|  | Reduces/increases the value |
|  | Displays the previous/following item |
|  | Displays the previous/following page |
|  | Forces a point |
|  | Cancels the forcing of a point |
|  | Displays the value modification dialog box for a point |
|  | Alarm indication light |
|  | Start/stop control button |

d Network Window Function:
Each Chiller LID (Local Interface Device) shall be capable of viewing multiple point values and statuses from other connected on a common network, including controller maintenance data. The operator shall be able to alter the remote controller’s set points or time schedule and to force point values or statuses that are operator forcible. The LID shall also have access to the alarm history file of all like controllers connected on the network.

e Capacity control shall be by means of electronically modulating the steam/hot water control valve actuator to maintain the temperature of the leaving chilled water. Load modulation shall be from 100% to 10% of machine full load under normal ARI conditions.

# Guide Specifications (cont)

The steam/hot water control valve shall be precisely positioned by a PID (Proportional Integral Derivative) control algorithm to ensure precise control (± .5F [±.3C]) of desired chilled water temperature without hunting or overshooting the set point.

f The PD5 control system shall include a programmed sequence to ensure machine readiness prior to machine start-up. The PD5 shall automatically activate and interlock the chilled water pump, cooling water pump, cooling tower fans upon chiller activation.

g Upon request to start the chiller, the control system shall start the chilled water pump and verify chilled water flow. The controller shall then compare the entering or leaving chilled water temperature with the chilled water set point. If the chilled water temperature is less than the chilled water set point, the control system shall enter the recycle mode until a cooling load has been established. Once a cooling load has been established the control system shall start the cooling water pump and verify flow, before starting tower fan(s), solution pump(s) and refrigerant pump. Once the refrigerant pump is started the control system shall initiate the ramp loading routine.

h The control system shall automatically sense impending abnormalities in the absorption operating cycle and take one or all of the following actions to either self-correct and/or limit the machine from approaching cycle crystallization line:
- inhibit steam/hot water control valve position until concentration drops below preset threshold*
- drive steam/hot water valve to closed position until concentration drops below preset threshold. Message will be displayed: ‘‘run capacity limited, high concentration.’’
- initiate non-recycle shutdown of the chiller if safety shutdown threshold exceeded. Message will be displayed: ‘‘shutdown in progress, dilution cycle.’’

i A user-configurable ramp loading rate, effective during the chilled water temperature pulldown period, shall control the rate of steam/hot water control valve opening to limit start-up steam/hot water demand. The controls shall allow configuration of the ramp loading rate in degrees per minute of chilled water temperature pulldown. During the ramp loading period, a message shall be displayed informing the operator that the chiller is operating in ramp loading mode.

j The control system shall automatically cycle the machine to minimize energy usage whenever the leaving chilled water temperature is 3F (1.7C) below the desired chilled water set point. The chilled water pump shall remain on, and when the leaving chilled water temperature rises above the set point by a user-configured amount, the chiller shall automatically restart. During the shutdown period, a message shall be displayed informing the operator a recycle restart is pending.

k The control center shall allow reset of the chilled water temperature set point based on any one of the following criteria:
- Chilled water reset based on a remote temperature (such as outdoor air).
- Chilled water reset based on water temperature rise across the evaporator.

When reset is active, a message shall be displayed indicating the type of reset in effect.

l The control center shall limit the opening of the steam/hot water control valve to 50% (user-configurable) open at start-up until the warm-up period has been completed and ramp loading is enabled.

m When the stop button is pressed, or remote contacts open the control center shall immediately drive the steam/hot water control valve to the closed position and initiate the normal shut-down sequence including dilution cycle. The display shall indicate ‘‘dilution cycle shutdown’’

2. Safeties:

a Unit shall automatically shut down when any of the following conditions occur: (Each of these protective limits shall require manual reset and cause an alarm message to be displayed on the screen, informing the operator of the shutdown cause.)
- solution pump motor overload/high temperature
- refrigerant pump motor overload/high temperature
- low chilled water temperature
- low evaporator refrigerant temperature
- generator high solution temperature
- loss of evaporator water flow
- loss of cooling water flow (option)

b The control system shall detect conditions which approach protective limits and take self-corrective action prior to an alarm occurring. The system shall automatically reduce chiller capacity when any of the following parameters are outside their normal operating range:
- low evaporator refrigerant temperature.
- generator high saturation temperature
- generator high solution temperature
- high solution concentration

During the capacity override period, a pre-

alarm (alert) message shall be displayed informing the operator which condition is causing the capacity override. Once the condition is again within acceptable limits, the override condition shall terminate and the chiller shall revert to normal chilled water control. If during condition the protective limit is reached, the chiller shall shut down, an alarm shall be generated, and a text message shall be displayed informing the operator which condition caused the shut down and alarm.

3. Diagnostics and Service:

a The control system shall execute a series of pre-start checks whenever a start command is received to determine if pressures, temperatures, and timers are within pre-start limits, thereby allowing start-up to proceed. If any of the limits are exceeded a text alert message will be displayed informing the operator of the cause of the pre-start alert.

b The control system shall provide a manual test which permits selection and test of individual control components and inputs. The screen will show the actual reading of each transducer and each thermistor installed on the chiller.

A test shall automatically energize the refrigerant pump, solution pump, tower fan relay, alarm relay, chilled water and cooling water pumps and chiller run relay, and the control system shall confirm water flows have been established and require operator confirmation prior to proceeding to the next test.

A steam control valve test shall allow the operator to test the control valve travel range by manually increasing or decreasing valve travel limit. Upon completion of the steam/hot water control valve test the control valve shall revert to the closed position.

c All sensors shall have quick disconnects to allow replacement of the sensor without replacement of the entire sensor wire.

4. Building Control System Interface:

The chiller control system shall have the ability to interface and communicate directly to the building control system with the use of additional field installed hardware and software. The building control system and the absorption chiller must be supplied by the same manufacturer. If different building control and chiller suppliers are chosen the chiller shall be supplied with a dataport module which shall translate the information in the chiller microprocessor to an ASCII stream of data which can be read by any manufacturer's building management control system.

G. Electrical Requirements:

1. Power supply to the unit shall be 3-ph, 60/50Hz with voltages of 380v, 400v, 460v as specified on the equipment schedule. A multitap transformer shall provide 110 v single-phase secondary power for the control panel.
2. Contractor shall supply and install the electrical power line and all auxiliary electrical protection devices per local code requirements and as indicated necessary by the chiller manufacturer.
3. Contractor shall supply and install electrical wiring and devices required to interface the chiller controls with the building controls system if applicable.

H. Piping Requirements:

1. Piping and instrumentation for the chilled water, cooling water, steam/hot water supply and return piping shall be supplied and installed by the contractor/owner.
2. Absorber-condenser crossover piping shall be furnished by chiller manufacturer as specified on the equipment schedule.
3. Chilled water flow switch shall be factory supplied and factory installed in the evaporator water nozzle. Cooling water flow switch shall be field installed or factory installed if customer requires and supplied by either the chiller manufacturer or the contractor/owner.
4. Piping from the rupture disk shall be provided and installed by the contractor/owner and piped in accordance with the chiller manufacturer's written instructions and any local jurisdictional requirements.

I. Thermal Insulation:

Insulation of evaporator, refrigerant pump, sump, piping, and chilled water headers, in addition to any hot surfaces shall be field supplied and installed on the machine. Chiller manufacturer shall recommend the material and specify surface area to be insulated.

J. Sound Level:

The overall sound pressure level of the chiller shall not exceed 80dbA when measured per ARI Standard 575 (latest edition).

K. Start-up:

1. Unit manufacturer shall provide a factory-trained service representative, employed by carrier, to perform and/or supervise chiller pressure test (when required), charge chiller with refrigerant (water) and lithium bromide solution, place unit into operation, and calibrate all controls in accordance with the manufacturer's written start-up, operating, and maintenance instructions.
2. After unit start-up has been performed, the same factory representative shall be available for a period of instruction not to exceed 4 hours to instruct the owner's personnel in the proper start-

# Guide Specifications (cont)

up, operating and maintenance procedures. Manufacturer shall provide the following literature:

a Installation Operation and Maintenance Instructions

b Field Wiring Diagrams

L. Options and Accessories:

1. High-Pressure Waterboxes:
   Waterboxes rated for 300psig (2068kPa) working pressure with removable covers shall be furnished when specified on the equipment schedule.
2. Hot Water Generator:
   A generator designed, built and stamped in accordance with GB requirements with a design working pressure of 150psig (1034kPa) for standard and 300psi (2068kPa) for option shall be furnished for hot water applications when specified on the equipment schedule.
3. Special Tubing:
   Tubing of non-standard materials shall be provided when specified on the equipment schedule.
4. Shipping Configuration:
   Chiller shall ship in one piece as specified on the equipment schedule.
5. Flanged Nozzle Connections:
   ANSI 150psig (1034kPa) R.F. (raised face) flanges shall be furnished on all waterbox nozzle connections when specified on the equipment schedule.
6. Thermometer Set:
   A package of 5 adjustable angle thermometers shall be factory supplied for field installation when specified on the equipment schedule. Each shall have a 9-in. scale with a working range of 0 to 120F (-18 to 49C) and shall be equipped with a 3/4 -in. NPT brass well.
7. Cooling Water Flow Switches:
   Cooling water flow switches, rated for either for 150psig (1034kPa) or 300psig (2068kPa), shall be contractor/owner supplied for field installation when specified on the equipment schedule.
8. Steam (electric or pneumatic):
   A steam valve shall be provided for 16JL chiller when specified on the equipment schedule.
9. Hot Water Valve (electric or pneumatic):
   A hot water valve shall be provided for 16JLR chiller when specified on the equipment schedule.
10. Unit Voltage:
    Unit shall be capable of operating on 3 phases, 50/60Hz, 380/400/460v, when specified on equipment schedule.
11. Isolation Package:
    A vibration isolation package consisting of soleplates and neoprene isolation pads shall be furnished when specified on the equipment schedule.