Carrier

turn to the experts

16DN

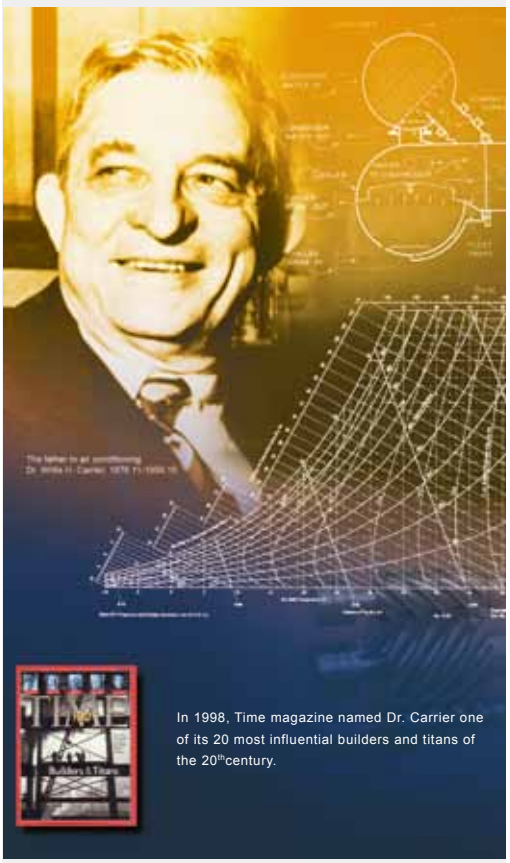
Direct-Fired,Double Effect, Hermetic Absorption Liquid Chiller/Heater

Cooling Capacity: 150 to 660 Nominal Tons (528 to 2321 kW)

Carrier China

Carrier Corporation is a subsidiary of the United Technologies Corp. (UTC), which ranks the 150th in Fortune Top 500 in 2011 and has its operations in aerospace and building systems industries all over the world. From the time the founder Dr. Carrier invented the first system of modern air conditioning in 1902, Carrier has been the world leader in the air conditioning industry with its products and system solutions supplied to numerous famous buildings, and up to now, the network of distribution cover more than 170 countries all over the world. In 2011, Carrier ranked top in the HVAC industry field with its sales revenue of US $12 billion.

In China, there are 6 Carrier factories which have more than 2500 employees. As the world-class factory, Carrier has a number of technically advanced production lines, manufacturing commercial and residential chillers, compressors and air-side products. A wide range of products are able to meet diversified requirements of different customers. The global R&D center located in Shanghai has the capability of developing several major projects in the same time, with many advanced technical patents awarded to support Carrier stay most competitive in terms of technology advantage in the HVAC industry.



In 1998, Time magazine named Dr. Carrier one of its 20 most influential builders and titans of the 20th century.

Product Data

16DN
Direct-Fired, Double Effect, Hermetic Absorption Liquid Chiller/Heater

150 to 660 Nominal Tons (528 to 2321 kW)

16DN SERIES

Carrier's 16DN direct-fired, double effect, hermetic absorption liquid chiller/heater offers a viable alternative to traditional electric driven chillers. Fired by natural gas or No.2 oil, the 16DN reduces costly electricity bills and qualifies for utility rebates and incentives as a gas cooling product. The 16DN can operate in the heating mode to provide hot water, thereby reducing the size of the required boiler or even eliminating the need for a boiler.

- no CFCs; environmentally friendly
- two-stage high efficiency design reduces energy costs
- fired by clean burning natural gas, N0.2 oil.
- operates as a chiller or heater
- quiet, vibration-free operation
- few moving parts equates to high reliability

Features/Benefits

Direct-fired, double effect absorption provides efficient, economical water chilling or heating with minimal use of electricity.

Cost-effective cooling and heating

Alternative-energy chiller/heater – The 16DN offers an alternative for building owners who want to avoid the high operating costs associated with electric-driven chillers. Fired by natural gas or N0.2 oil, the Carrier 16DN direct-fired, double effect, absorption chiller/heater not only reduces or eliminates electric demand and/or rachet charges, but also allows the owner to take advantage of gas cooling rebates and incentive programs offered by many utility companies. Several configurations of heating mode

Features/Benefits (cont)

operation provide hot water for a variety of applications.

High-efficiency, double effect, Absorption cooling cycle – The 16DN design incorporates a high-temperature generator and a low-stage generator (double effect) that provide two stages of solution reconcentration. As a result of this double-effect cycle, the 16DN has lower operating costs than single-effect machines. When using natural gas, full load cooling operation results in a COP (coefficient of performance) of 1.04 at standard ARI (Heating valve based on HHV) operating conditions.

Superior part-load performance – The 16DN'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 high- and low-stage generators at all operating conditions. This will result in improved part-load efficiency and eliminate the need for manual setup adjustments of the solution flow. The 16DN has a continuous operating range from 100% to 20% capacity for gas-fired series and 100% to 30% for oil-fired series, based on minimum fire requirements for the burner.

Operates in the heating mode for additional savings – In the heating mode, the 16DN can deliver hot water for space heating or other applications to reduce or eliminate dependency on existing or supplemental boilers. Operation in the heating mode can be done instead of cooling mode operation. When operated as a heater, hot water temperatures of 140F (60C) are standard and do not require additional components. In the heating mode, the evaporator is used as the heating bundle and the machine is configured as a 2-pipe system with the chilled water nozzles serving as hot water nozzles. Quick changeover from cooling to heating is accomplished by switching the positions of two hand valves, draining the absorber-condenser water circuit, and putting the machine into heating mode by selecting a heating mode operation from the control panel.

Application versatility Ideal for new or retrofit applications – Whether intended for replacement of existing chiller and/or boiler systems or for new construction purposes, the 16DN is well suited to meet the needs of most cooling/heating applications for which a supply of natural gas or No. 2 oil is available. The 16DN's 12 model sizes, spanning a capacity range of 150 to 660 tons, make the 16DN direct-fired, double effect, absorption chiller/heater the ideal choice for comfort cooling and/or light industrial applications. Carrier's computerized performance ratings assist in the selection of the correct size machine to meet exact job requirements. Dependable operation, as well as low sound and vibration levels, ensures occupant comfort, even when the machine is installed on upper floors.

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 16DN direct-fired absorption chiller/heater used in conjunction with an electric-driven chiller may be the most efficient and cost-effective combination available.

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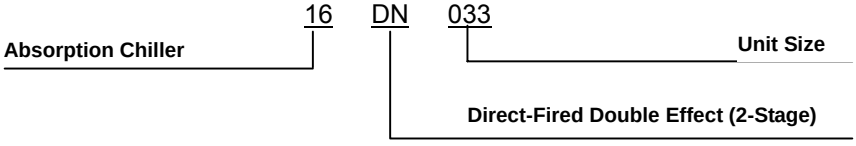
Model number nomenclature



Features/Benefits (cont)

Location and installation savings

Ease of installation – All 16DN units are completely fabricated, assembled, and wired in the factory as single-piece units. Standard shipping configuration is 1 piece. Refer to the 16DN Standard Shipping Configuration table below.

16DN STANDARD SHIPPING CONFIGURATION

UNIT SIZE	1-PIECE ASSEMBLY	2-PIECE ASSEMBLY	BURNER/GAS TRAIN ASSEMBLY
015-066	X		Factory Installed

The 16DN015-066 machines are shipped completely for 1-piece shipment. On 16DN015-066 machines, the burner and gas train are installed at the factory to minimize field assembly. Job-site reassembly and alignment of machines shipped in multiple sections is simplified by pre-erecting the machine in the factory and by incorporating weld-type assembly flanges on all interconnecting piping.

Factory-installed burner – Every 16DN machine through 660 tons is shipped from the factory with the burner, refractory assembly, and gas train installed in the high-stage generator to simplify the chiller/heater installation. This facilitates easier and quicker installation and reduces jobsite costs. It also ensures that all burner-related components are properly installed and wired to the main chiller center for proper control.

Flanged water box nozzles – To simplify chiller installation and field piping, all water box nozzles on the evaporator, absorber, generator and condenser are factory-supplied with GB raised face (RF) flanges. ANSI raised face (RF) flanges are optional.

16DN BURNER ASSEMBLY

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, including the burner control center, 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. When units are shipped in multiple pieces, a wiring harness is provided for interconnection between the burner control center and chiller control center. A multi-tap transformer, mounted in the chiller control center, provides secondary, single-phase power for the 16DN controls.

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 16DN is typically 85dbA. 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/heater on upper floors without special consideration for vibration dampening systems.

Low maintenance

Standard features allow simple maintenance procedures – Every 16DN machine has numerous standard design features that provide for convenient and simple maintenance. Hinged waterboxes cover on the absorber and condenser facilitate tube and waterbox inspection. A flange type refractory door on the high-stage generator simplifies inspection and cleaning of the combustion chamber and fire tubes. In addition, epoxy coating of the waterboxes and covers, standard on all machines, protects against corrosion and extends machine life. All moving parts are easily accessible for inspection or replacement, as required.

Factory-trained service organization – Carrier's extensive 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

Features/Benefits (cont)

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 overload switches are embedded in the stator to protect against high winding temperatures. The pumps are field serviceable.

VIEW OF TYPICAL HERMETIC PUMP/MOTOR ASSEMBLIES

Reliable operation

PD5 control center continuously monitors machine operation, ensuring precise control – Each Carrier 16DN direct-fired chiller/heater includes a factory mounted and wired PD5 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. All control center components and the assembly will meet local codes of GB where appropriate 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 and the burner combustion controller 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.

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.

16DN 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 16DN absorption chiller/heater 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 high-temperature generator fire tubes that are made of carbon steel and the high temperature solution heat exchanger tubes made of cupronickel). This results in long machine life and dependable operation.

Rugged machine construction – Every Carrier 16DN chiller/heater 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 16DN from corrosion and blockage for continuous, reliable operation. Horizontally-positioned, carbon steel fire tubes with flue gas on the inside and lithium bromide on the outside are located above the combustion chamber to allow easy soot removal and tube cleaning. This design feature also prevents the flame inside the combustion chamber from direct contact with the fire tubes to ensure maximum life and reliability. The above standard features are evidence of Carrier's commitment to building a direct-fired, double effect chiller/heater able to withstand the most rigorous comfort cooling or light industrial applications.

Features/Benefits (cont)

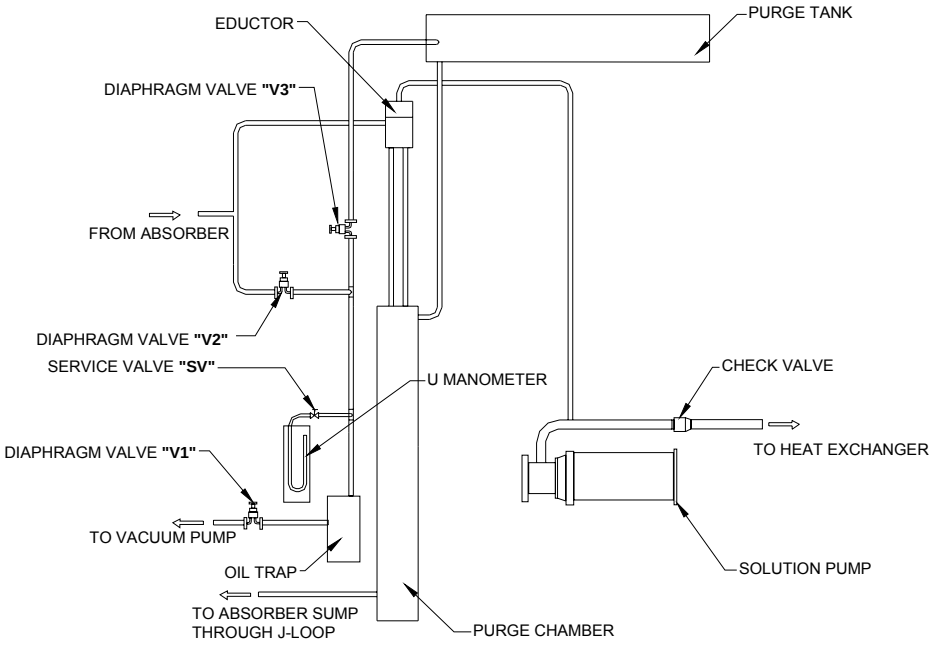
Automatic, motorless purge system extends machine life and ensures optimum efficiency and performance – The purge system of an absorption chiller is critical to ensuring efficient operation and long machine life. Even when machines are vacuum tight or properly inhibited, all absorption chillers generate 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 16DN machines from these potential hazards by working continuously during machine operation.

Motorless purge system operation – During operation, noncondensables tend to accumulate in the absorber section, which operates at the lowest internal pressure. A slip-stream of lithium bromide solution from the solution pump discharge flows through an eductor, creating a suction that draws noncondensables from the absorber. The noncondensables are then entrained by the solution flowing through the eductor. The eductor discharges the solution and noncondensables into a separator in a purge chamber, where the noncondensables are separated from the solution. The noncondensables flow to a storage tank, while the solution returns to the absorber sump. Typically, most of the noncondensable gas is composed of hydrogen, which is automatically dissipated to the atmosphere through a heated palladium cell. As noncondensables 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. Evacuation through the vacuum pump is necessary because the palladium cell will be damaged if wetted by the lithium bromide solution. 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.

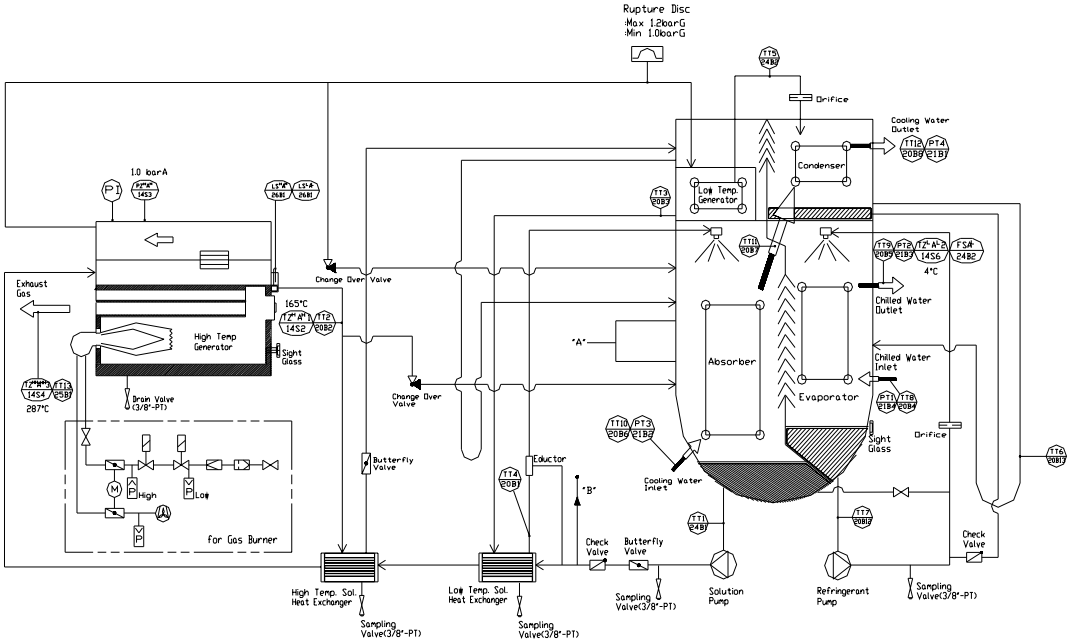
Anti-crystallization controls maintain proper solution concentration – The 16DN automatically limits solution concentration in several ways to avoid both crystallization and overdilution to provide dependable, trouble-free operation. Crystallization of the lithium bromide solution depends on the combination of temperature and concentration. Carrier's concentration control system automatically monitors the refrigerant water level in the evaporator in conjunction with the 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). Overdilution (and possible refrigerant pump cavitation) shall be controlled by transferring an additional amount of refrigerant from the condenser to the evaporator.

Features/Benefits (cont)

TYPICAL MOTORLESS PURGE OPERATION SCHEMATIC



16DN ABSORPTION COOLING & HEATING CYCLE (140F [60C])



Features/Benefits (cont)

The 16DN also incorporates a simple, passive method of control to correct any crystallization that would typically start to occur on the shellside of the low temperature solution heat exchanger under abnormal conditions. As the hot solution begins to back up in the generator, as a result of any shellside blockage, it rises above the overflow pipe and returns directly to the absorber. It is subsequently pumped through the tubeside (heating the shellside) to restore proper operation.

In addition, the 16DN 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.

16DN direct-fired, double effect, absorption cooling cycle – The 16DN direct-fired double effect, absorption chiller/heater consists of an evaporator, absorber, condenser, high- and low-temperature generators, solution heat exchangers, refrigerant/solution pumps, burner and gas train assembly, 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 generators where it is reconcentrated in 2 stages to boil off the previously absorbed water. A variable frequency drive pump automatically maintains optimum solution flow to the generators at all operating conditions for maximum efficiency. The diluted solution is pumped to the high-temperature generator where it is heated and reconcentrated to a medium concentration solution by the heat from the combustion of natural gas or No.2 oil. The medium concentration solution from the high-stage generator flows to the low-stage generator where it is heated and reconcentrated to a strong solution by the high temperature water vapor released from the solution in the high-temperature generator.

Since the low-stage generator acts as the condenser for the high-temperature generator, the heat energy first applied in the high-temperature generator is used again in the low-temperature generator thus reducing the heat input by approximately 45% as compared to an absorption chiller with a single stage of reconcentration. The water vapor released in the shellside of the low-temperature generator, in addition to the now condensed water vapor from the tubeside of the low-temperature generator, enters the condenser to be cooled and returned to a liquid state. The refrigerant water then 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 low-temperature generator flows back to the absorber to begin a new cycle. For efficiency reasons, the medium concentration solution from the high-temperature generator is passed through the high-temperature solution heat exchanger to pre-heat the weak solution, while pre-cooling the medium concentration solution. The strong solution from the low-temperature generator is passed through the low-temperature solution heat exchanger to preheat/precool the solution before being returned to the absorber.

16DN direct-fired, double effect, absorption heating cycle – The 16DN direct-fired, double effect, absorption chiller/heater can also be operated in a non-simultaneous heating (only) mode to provide 140F (60C) hot water for space heating or other purposes without any additional components. In this mode, the cycle follows a different vapor flow path than that undertaken for cooling and does not use the absorption process. In addition, the absorber-condenser cooling water circuit is drained, and thus not operated, since all heat rejection from the machine is designed to take place through the evaporator (now the heating bundle) in a classic 2-pipe system which utilizes only the evaporator nozzles. High temperature water vapor produced in the high-temperature generator section is passed directly to the evaporator via absorber where it condenses and transfers its heat to the water circulating through the evaporator tubes. This condensed water then flows to the absorber section where it mixes with the concentrated solution returning from the high-temperature generator. The diluted solution is then pumped back to the high-temperature generator to repeat the vapor generation phase for the heating function.

Options and accessories

ITEM	OPTION*	ACCESSORY+
300psig (2068kPa) Waterboxes	X	
Special Tubing	X	
Unit Voltage (400, 460-3-60/50)	X	
Dual-Fuel Burner	X	
Low NO_X Burner	X	
Shipping Configuration (1 or 2-piece)	X	
Isolation Package		X
Condenser Water Flow Switch	X	

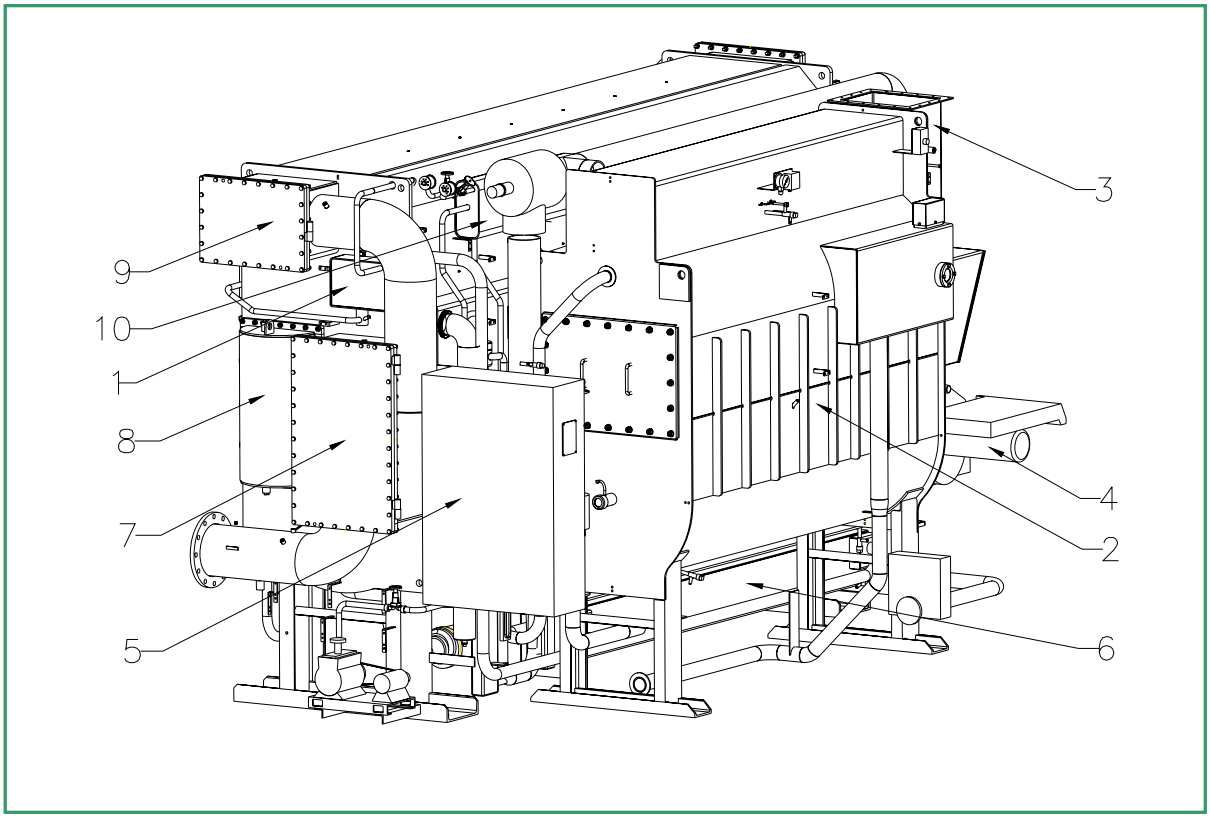
LEGEND

*Factory installed.
+Field installed.

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

Machine components

TYPICAL 16DNH



LEGEND

1 – Low-Temperature Generator
2 – High-Temperature Generator
3 – Exhaust Gas Outlet
4 – Burner Assembly and Control Center
5 – Chiller/Heater Control Center
6 – Solution Heat Exchanger
7 – Absorber
8 – Evaporator
9 – Condenser
10 – Purge System

Physical data

ENGLISH

Unit 16DN	015	018	021	024	028	033
NOMINAL COOLING CAPACITY (ton)	150	180	021	024	280	330
RIGGING WEIGHT* (lb)						
Absorber/Evaporator/G2/Condenser	8,311	8,840	10,185	10,869	12,941	13,448
G1 (Includes Burner)	2,844	2,954	3,197	3,660	4,012	4,541
Total	11,155	11,795	13,382	14,528	16,953	17,990
OPERATING WEIGHT (lb)	14,947	15,939	18,166	19,621	24,096	25,684
LITHIUM BROMIDE SOLUTION CHARGE (lb)	1,940	2,138	2,579	2,734	3,807	4,012
REFRIGERANT (WATER) CHARGE (lb)	882	860	838	794	1,455	1,433
CHILLED/HOT WATER (Evap)						
Pipe Connection Size (in.)	4	4	5	5	6	6
No. Passes	3	3	3	3	2	2
COOLING WATER						
Pipe Connection Size (in.)	5	5	6	6	8	8
No. Passes						
Absorber	2	2	2	2	2	2
Condenser	1	1	1	1	1	1
GAS-TRAIN INLET						
Standard Pipe Connection Size, NPT (in.)	1.0	1.0	1.0	1.0	1.5	1.5
EXHAUST GAS OUTLET						
Nominal Flange Connection Size (in.)	11 x 8	11 x 8	12 x 12	12 x 12	12 x 12	12 x 12
Unit 16DN	036	040	045	050	060	066
NOMINAL COOLING CAPACITY (ton)	360	400	450	500	600	660
RIGGING WEIGHT* (lb)						
Absorber/Evaporator/G2/Condenser	14,374	15,476	19,136	19,511	27,601	30,291
G1 (Includes Burner)	5,225	5,930	7,143	7,937	10,295	10,825
Total	19,599	21,407	26,279	27,447	37,897	41,116
OPERATING WEIGHT (lb)	26,940	29,189	33,201	34,833	52,469	56,879
LITHIUM BROMIDE SOLUTION CHARGE (lb)	4,034	4,277	5,655	5,952	8,157	8,422
REFRIGERANT (WATER) CHARGE (lb)	1,367	1,323	1,389	1,367	2,183	2,359
CHILLED/HOT WATER (Evap)						
Pipe Connection Size (in.)	6	6	8	8	8	8
No. Passes	2	2	2	2	2	2
COOLING WATER						
Pipe Connection Size (in.)	8	8	10	10	12	12
No. Passes						
Absorber	2	2	2	2	2	2
Condenser	1	1	1	1	1	1
GAS-TRAIN INLET						
Standard Pipe Connection Size, NPT (in.)	1.5	1.5	1.5	2	2.5	2.5
EXHAUST GAS OUTLET						
Nominal Flange Connection Size (in.)	14 x 12	14 x 12	16 x 12	16 x 12	20 x 14	20 x 14

G1 – High-Temperature Generator

G2 – Low-Temperature Generator

*Standard shipping configuration is 1-piece for sizes 015-066.

Physical data (cont)

SI

Unit 16DN	015	018	021	024	028	033
NOMINAL COOLING CAPACITY (kW)	528	633	739	844	985	1161
RIGGING WEIGHT* (kg)						
Absorber/Evaporator/G2/Condenser	3,770	4,010	4,620	4,930	5,870	6,100
G1 (Includes Burner)	1,290	1,340	1,450	1,660	1,820	2,060
Total	5,060	5,350	6,070	6,590	7,690	8,160
OPERATING WEIGHT (kg)	6,780	7,230	8,240	8,900	10,930	11,650
LITHIUM BROMIDE SOLUTION CHARGE (kg)	880	970	1,170	1,240	1,727	1,820
REFRIGERANT (WATER) CHARGE (kg)	400	390	380	360	660	650
CHILLED/HOT WATER (Evap)						
Pipe Connection Size (mm)	100	100	125	125	150	150
No. Passes	3	3	3	3	2	2
COOLING WATER						
Pipe Connection Size (mm)	125	125	150	150	200	200
No. Passes						
Absorber	2	2	2	2	2	2
Condenser	1	1	1	1	1	1
GAS-TRAIN INLET						
Standard Pipe Connection Size, NPT (mm)	25	25	25	25	40	40
EXHAUST GAS OUTLET						
Nominal Flange Connection Size (mm)	280 x 210	280 x 210	310 x 310	310 x 310	310 x 310	310 x 310

Unit 16DN	036	040	045	050	060	066
NOMINAL COOLING CAPACITY (kW)	1266	1407	1583	1758	2,110	2,321
RIGGING WEIGHT* (kg)						
Absorber/Evaporator/G2/Condenser	6,520	7,020	8,680	8,850	12,520	13,740
G1 (Includes Burner)	2,370	2,690	3,240	3,600	4,670	4,910
Total	8,890	9,710	11,920	12,450	17,190	18,650
OPERATING WEIGHT (kg)	12,220	13,240	15,060	15,800	23,800	25,800
LITHIUM BROMIDE SOLUTION CHARGE (kg)	1,830	1,940	2,565	2,700	3,700	3,820
REFRIGERANT (WATER) CHARGE (kg)	620	600	630	620	990	1,070
CHILLED/HOT WATER (Evap)						
Pipe Connection Size (mm)	150	150	200	200	200	200
No. Passes	2	2	2	2	2	2
COOLING WATER						
Pipe Connection Size (mm)	200	200	250	250	300	300
No. Passes						
Absorber	2	2	2	2	2	2
Condenser	1	1	1	1	1	1
GAS-TRAIN INLET						
Standard Pipe Connection Size, NPT (mm)	40	40	40	50	65	65
EXHAUST GAS OUTLET						
Nominal Flange Connection Size (mm)	360 x 310	360 x 310	410 x 310	410 x 310	500 x 350	500 x 350

G1 – High-Temperature Generator

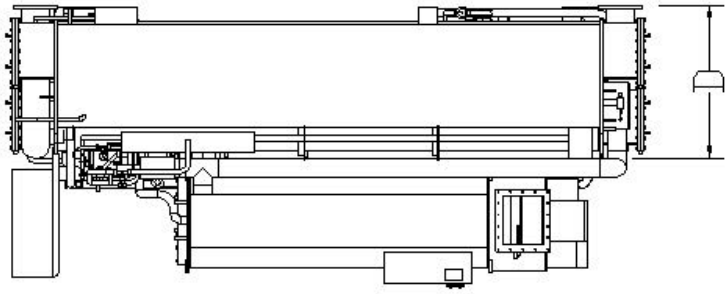
G2 – Low-Temperature Generator

*Standard shipping configuration is 1-piece for sizes 015-066.

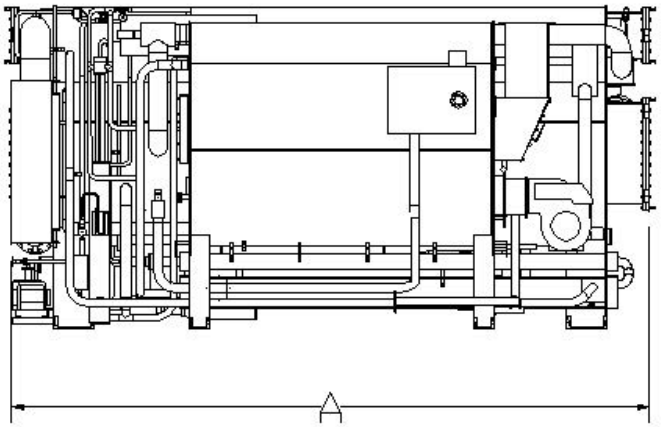
Dimensions

16DN SIZES 015-066

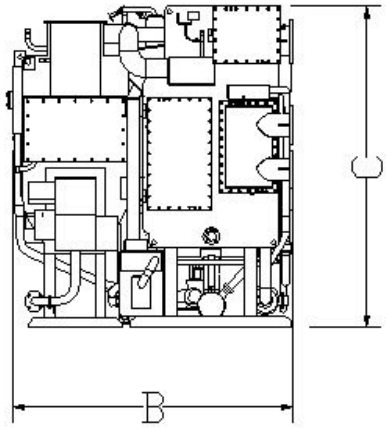
TOP VIEW



SIDE VIEW



TYPICAL END VIEW



DIMENSIONS (ft-in.)

UNIT 16DN	015	018	021	024	028	033	036	040	045	050	060	066
Overall Length A	11-11	11-11	12-1	12-1	15-8	15-8	15-9	15-9	16-0	16-0	18-6	20-2
Overall Width B	6-1	6-1	6-9	6-9	6-11	6-11	7-9	7-9	8-2	8-2	9-6	9-6
Overall Height C	6-9	6-9	7-7	7-7	7-10	7-10	8-8	8-8	9-3	9-3	10-2	10-2
Width D*	4-0	4-0	4-4	4-4	4-8	4-8	4-9	4-9	5-4	5-4	6-1	6-1

DIMENSIONS (mm)

UNIT 16DN	015	018	021	024	028	033	036	040	045	050	060	066
Overall Length A	3,631	3,631	3,679	3,679	4,774	4,774	4,791	4,791	4,867	4,867	5,640	6,142
Overall Width B	1,866	1,866	2,070	2,070	2,113	2,113	2,350	2,350	2,496	2,496	2,905	2,905
Overall Height C	2,059	2,056	2,313	2,313	2,381	2,381	2,630	2,630	2,820	2,820	3,102	3,102
Width D*	1,209	1,209	1,328	1,328	1,413	1,413	1,456	1,456	1,614	1,614	1,854	1,854

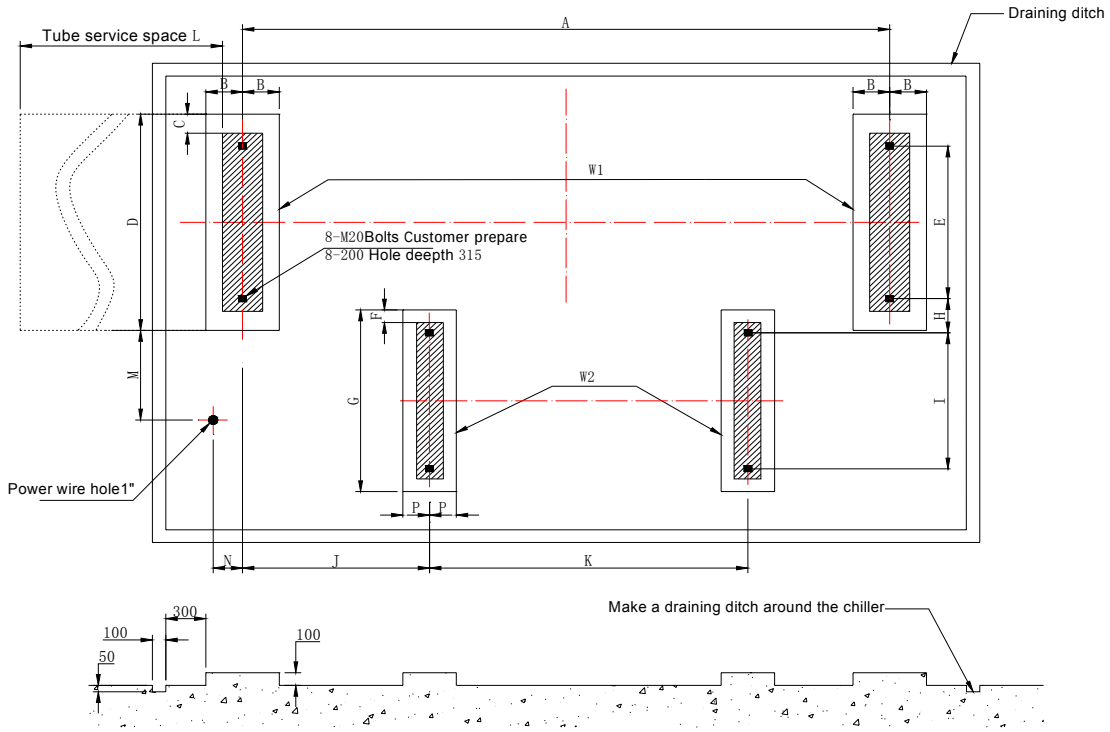
*Standard shipping configuration is 1-piece for sizes 015-066.

Dimension “D” is width of absorber, evaporator, condenser, G2 section for
2-piece shipment. The G1 assembly is shipped separately.

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 “D” dimension (width) on the waterbox end of the chiller.

Dimensions (cont)

16DN FOUNDATION 015-066



DIMENSIONS (in.)

UNIT 16DN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
015/018	114 3/8	7 1/8	5 7/8	41 1/8	29 1/4	7 1/8	35 3/8	9 5/8	21 1/4	33 1/8	43 1/8 51	118 1/8	28 5/8	10 1/4	5 7/8
021/024	114 3/4	7 1/8	5 7/8	43 1/2	31 5/8	7 1/8	35 3/8	13 3/4	21 1/4	26	52 7/8 60 3/4	122	29 1/8	7 1/2	6 7/8
028/033	149 1/4	10 7/8	7 7/8	54 3/4	39	7 1/8	35 3/8	9 3/8	21 1/4	36 5/8	72 5/8 82 1/2	157 1/2	24 7/8	9 7/8	6 7/8
036/040	149 1/2	10 7/8	7 7/8	57 7/8	42 1/8	7 1/8	43 1/2	8 1/4	29 1/4	42 1/4	70 5/8 78 1/2	169 1/4	24 3/4	9 7/8	6 7/8
045/050	149 1/2	10 7/8	7 7/8	59	43 1/4	7 1/8	47 1/4	7 7/8	33 1/8	27 7/8	82 1/2 90 3/8	169 1/4	29 3/8	10 1/4	6 7/8
060	171 1/8	10 7/8	9 7/8	66 7/8	47 1/4	7 1/8	56 1/4	10 1/2	42	51 3/4	86	224 3/8	27 3/4	8 5/8	7 7/8
066	190 3/4	10 7/8	9 7/8	66 7/8	47 1/4	7 1/8	56 1/4	10 1/2	42	55 1/8	93 7/8	224 3/8	27 3/4	8 5/8	7 7/8

DIMENSIONS (mm)

UNIT 16DN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
015/018	2905	180	150	1043	743	180	900	243	540	842	1094/1294	3000	728	260	150
021/024	2911	180	150	1104	804	180	900	350	540	660	1344/1544	3100	740	190	175
028/033	3792	275	200	1390	990	180	900	238	540	929	1844/2096	4000	632	250	175
036/040	3798	275	200	1470	1070	180	1104	210	744	1074	1794/1994	4300	628	250	175
045/050	3798	275	200	1500	1100	180	1200	201	840	709	2094/2294	4300	745	260	175
060	4348	275	250	1700	1200	180	1428	268	1068	1315	2184	5700	704	220	200
066	4846	275	250	1700	1200	180	1428	268	1068	1400	2384	5700	704	220	200

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 16DN	**015**	**018**	**021**	**024**	**028**	**033**
COOLONG CAPACITY (ton)	150	180	210	240	280	330
HEATING CAPACITY (MBh)	1,512	1,814	2,117	2,419	2,822	3,326
CHILLED WATER						
Flow Rate (gpm)	360	432	504	576	672	792
Pressure Drop (ft)	26.3	29.5	24.4	25.0	16.4	17.2
COOLING WATER						
Flow Rate (gpm)	600	720	840	960	1,120	1,320
Pressure Drop (ft)	22.3	25.9	18.1	20.3	26.0	27.8
HOT WATER						
Flow Rate (gpm)	360	432	504	576	672	792
Pressure Drop (ft)	22.8	25.7	20.8	21.3	13.9	14.6
FUEL CONSUMPTION						
Natural Gas (ft^3/min)	28.7	34.5	40.2	46.0	53.6	63.2
No. 2 Oil (gph)	12.4	14.8	17.3	19.7	23.0	27.1
COEFFICIENT OF PERFORMANCE (COP)						
Natural Gas	1.04	1.04	1.04	1.04	1.04	1.04
No. 2 Oil	1.04	1.04	1.04	1.04	1.04	1.04
UNIT 16DN	**036**	**040**	**045**	**050**	**060**	**066**
COOLONG CAPACITY (ton)	360	400	450	500	600	660
HEATING CAPACITY (MBh)	3,629	4,032	4,536	5,040	6,048	6,652
CHILLED WATER						
Flow Rate (gpm)	864	960	1,080	1,200	1,440	1,584
Pressure Drop (ft)	17.2	17.5	16.9	17.1	19.4	25.1
COOLING WATER						
Flow Rate (gpm)	1,440	1,600	1,800	2,000	2,400	2,640
Pressure Drop (ft)	30.8	32.1	28.2	29.2	24.5	31.5
HOT WATER						
Flow Rate (gpm)	864	960	1,080	1,200	1,440	1,584
Pressure Drop (ft)	14.7	15.0	14.3	14.4	16.4	21.2
FUEL CONSUMPTION						
Natural Gas (ft^3/min)	69.0	76.6	86.2	95.8	114.9	126.4
No. 2 Oil (gph)	29.6	32.9	37.0	41.1	49.3	54.2
COEFFICIENT OF PERFORMANCE (COP)						
Natural Gas	1.04	1.04	1.04	1.04	1.04	1.04
No. 2 Oil	1.04	1.04	1.04	1.04	1.04	1.04

LEGEND
ARI – Air Conditioning and Refrigeration Institute
HHV – Higher Heating Value
MBh – Btuh in thousands

Note: Ratings are based on ARI 560, latest edition
54/44 F (2.4 gpm/ton) chilled water fouling factor .0001 ft^2-hr-^oF/Btu for evaporator;
85 F (4.0 gpm/ton) cooling water, fouling factor .00025 ft^2-hr-^oF/Btu for absorber and condenser;
132/140 F hot water;
natural gas heating value 1,000 Btu/ft^3 (HHV); No. 2 oil heating value 140,000 Btu/gal.

Performance data (cont)

SI						
UNIT 16DN	**015**	**018**	**021**	**024**	**028**	**033**
COOLONG CAPACITY (kW)	528	633	739	844	985	1161
HEATING CAPACITY (kW)	443	532	620	709	827	975
CHILLED WATER						
Flow Rate (L/s)	22.7	27.3	31.8	36.3	42.4	50.0
Pressure Drop (kPa)	78.7	88.1	72.9	74.6	49.1	51.4
COOLING WATER						
Flow Rate (L/s)	37.9	45.4	53.0	60.6	70.7	83.3
Pressure Drop (kPa)	66.6	77.3	54.0	60.7	77.7	83.0
HOT WATER						
Flow Rate (L/s)	22.7	27.3	31.8	36.3	42.4	50.0
Pressure Drop (kPa)	68.1	76.9	62.0	63.6	41.5	43.6
FUEL CONSUMPTION						
Natural Gas (M^3/hr)	48.8	58.6	68.4	78.1	91.2	107.5
No. 2 Oil (L/hr)	46.9	56.0	65.3	74.6	87.1	102.6
COEFFICIENT OF PERFORMANCE (COP)						
Natural Gas	1.04	1.04	1.04	1.04	1.04	1.04
No. 2 Oil	1.04	1.04	1.04	1.04	1.04	1.04
UNIT 16DN	**036**	**040**	**045**	**050**	**060**	**066**
COOLONG CAPACITY (kW)	1,266	1,407	1,583	1,758	2,110	2,321
HEATING CAPACITY (kW)	1,064	1,182	1,329	1,477	1,773	1,950
CHILLED WATER						
Flow Rate (L/s)	54.5	60.6	68.1	75.7	90.9	99.9
Pressure Drop (kPa)	51.5	52.4	50.7	51.0	58.1	75.1
COOLING WATER						
Flow Rate (L/s)	90.9	100.9	113.6	126.2	151.4	166.6
Pressure Drop (kPa)	91.9	95.8	84.2	87.2	73.3	94.1
HOT WATER						
Flow Rate (L/s)	54.5	60.6	68.1	75.7	90.9	99.9
Pressure Drop (kPa)	43.9	44.8	42.7	43.1	49.1	63.3
FUEL CONSUMPTION						
Natural Gas (M^3/hr)	117.2	130.2	146.5	162.8	195.4	214.9
No. 2 Oil (L/hr)	111.9	124.4	139.9	155.5	186.6	205.2
COEFFICIENT OF PERFORMANCE (COP)						
Natural Gas	1.04	1.04	1.04	1.04	1.04	1.04
No. 2 Oil	1.04	1.04	1.04	1.04	1.04	1.04

LEGEND
ARI – Air Conditioning and Refrigeration Institute
HHV – Higher Heating Value

Note: Ratings are based on ARI 560, latest edition;
12.2/6.7 C (.043 L/s-kW) chilled water, fouling factor .0000176 m^2-hr-^oC/W for evaporator;
29.4 C (.072 L/s-kW) cooling water, fouling factor .000044 m^2-hr-^oC/W for absorber and condenser;
55.6/60 C hot water;
natural gas heating value 8899 kcal/m^3 (HHV); No. 2 oil heating value 9320 kcal/L

Performance data (cont)

Fuel heating values

In accordance with ARI 560, latest edition, performance ratings of the Carrier 16DN are based on the gross or higher heating value (HHV) of the fuel employed which accounts for condensation of water vapor formed during the combustion process. In comparison, the net or lower heating value (LHV) is approximately 90% of the higher heating value, since it does not account for the latent heat of vaporization of water formed during combustion. The use of higher heating value is a customary practice in North America. Typical HHVs are 1,000Btu/ft^3 (8,889kcal/m^3) for natural gas and 140,000Btu/gal (9,320kcal/L) for No. 2 oil. Actual HHV may differ and will directly impact the required volumetric flow rate of the fuel. The required MBh (Btuh in thousands) input to the burner remains unchanged.

Part-load performance

To determine part-load performance, refer to the 16DN Part-Load Performance curve shown below. This curve depicts Fuel Consumption Ratio (FCR) versus Percent Capacity at several cooling water temperatures and in accordance with the ARI load line which is based on a 2.5F (1.4C) reduction in cooling water temperature for every 10% reduction in load.

Fuel requirements at part-load can be calculated with one of the following equations:

Gas: Fuel Consumption MBh = Full Load Consumption (MBh) x FCR x Percent Capacity

Oil: Fuel Consumption (gph) = Full Load Oil Consumption (gph) x FCR x Percent Capacity

Fuel consumption for natural gas, expressed as a volumetric flow rate (ft^3/min), is determined by dividing the fuel consumption (in units of Btuh) by the higher heating value of the natural gas (in units of Btu/ft^3).

As shown on the part-load performance curve, the continuous operating range for the 16DN is approximately 25% to 100% of full load when operated on either natural gas or No. 2 oil, based on minimum fire requirements of the burner. Below 25% the burner will cycle on and off to meet the required load and water temperature.

ARI 560, latest version, defines Integrated Part Load Value (IPLV) as a measure of part-load efficiency representing the weighted average of overall chiller performance calculated by the following equation:

IPLV = .01A + .42B + .45C + .12D

Where A = COP at 100%
B = COP at 75%
C = COP at 50%
D = COP at 25% or minimum load

NOTE: COP is the Coefficient of Performance.

Therefore,

IPLV = .01 (1.04) + .42 (1.14) + .45 (1.21) + .12 (1.15)
= 1.172

Application data

Vent and drain connections

All vents and drain connections are found on the waterbox covers. Connection size is 3/4-in. NPT. Provide high points of the machine piping system with vents and the low points with drains. If shutoff 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 16DN absorption chiller/heater is designed for standard water chilling applications of 150 to 660 tons (5 28 to 2321 kW) at standard ARI rating conditions.

Fusible plug drain piping

The 16DNH is equipped with a fusible plug on the low-temperature 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. Piping should be adequately supported and the proper fittings should be provided to allow periodic inspection of the disk. Refer to Carrier certified drawings for exact location of the fusible plug on the chiller.

MATERIAL SPECIFICATIONS

ITEM	MATERIAL	SPECIFICATIONS
SHELL:		
Evaporator	Steel/Q235B	Equivalent to ASTM A283
Absorber	Steel/Q235B	Equivalent to ASTM A283
Condenser	Steel/Q235B	Equivalent to ASTM A283
G1	Steel/Q235B	Equivalent to ASTM A283
G2	Steel/Q235B	Equivalent to ASTM A283
TUBESHEET:		
Evaporator	Steel/Q235B	Equivalent to ASTM A283
Absorber	Steel/Q235B	Equivalent to ASTM A283
Condenser	Steel/Q235B	Equivalent to ASTM A283
G1	Steel/Q235B	Equivalent to ASTM A283
G2	Steel/Q235B	Equivalent to ASTM A283
WATERBOX:		
Evaporator	Steel/Q235B	Equivalent to ASTM A283
Absorber	Steel/Q235B	Equivalent to ASTM A283
Condenser	Steel/Q235B	Equivalent to ASTM A283
G1	Steel/Q235B	Equivalent to ASTM A283
G2	Steel/Q235B	Equivalent to ASTM A283
TUBES:		
Evaporator	Copper/C1220-1/2H	Equivalent to ASME SB359
Absorber	Copper/C1220-1/2H	Equivalent to ASME SB359
Condenser	Copper/C1220-1/2H	Equivalent to ASME SB359
G1	Steel/20#	Equivalent to ASTM A53
G2	Copper/C1220-OL	Equivalent to ASME SB75
PIPING	Steel	Steel/20#

LEGEND
G1 -- High-Temperature Generator
G2 -- Low-Temperature Generator

Application data (cont)

Thermal insulation

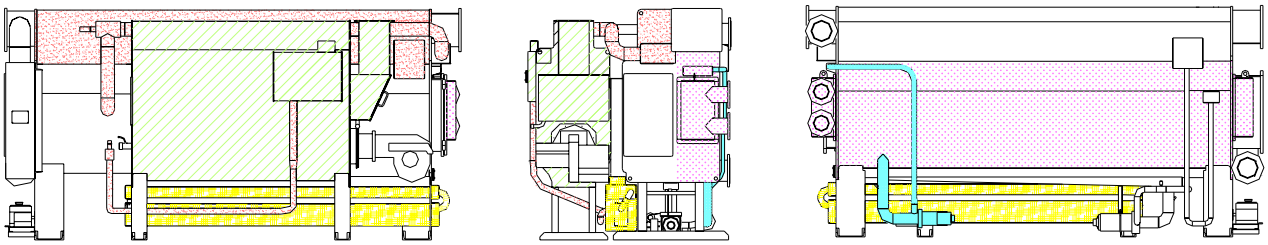
Application of cold/hot surface thermal insulation should be done after final installation at jobsite and machine leak integrity has been verified. Refer to Carrier certified drawings for material specifications and recommended chiller/heater insulation requirements.

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

UNIT SIZE	THICKNESS	015, 018	021, 024	028, 033	036, 040	045, 050	060	066
HOT SURFACE	75mm	105.5/114.1	113.0/120.6	130.2/139.9	159.3/169.0	185.1/194.8	241.1	251.9
	50mm	52.7	62.4	79.7	91.5	101.2	151.8	160.4
	25mm	59.2	65.7	80.7	88.3	102.3	108.7	117.3
COLD SURFACE	50mm	61.4	70.0	90.4	105.5	106.6	159.3	174.4
	25mm	6.5	7.5	10.8	11.8	12.9	14.0	14.0

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

UNIT SIZE	THICKNESS	015, 018	021, 024	028, 033	036, 040	045, 050	060	066
HOT SURFACE	75mm	9.8/10.6	10.5/11.2	12.1/13.0	14.8/15.7	17.2/18.1	22.4	23.4
	50mm	4.9	5.8	7.4	8.5	9.4	14.1	14.9
	25mm	5.5	6.1	7.5	8.2	9.5	10.1	10.9
COLD SURFACE	50mm	5.7	6.5	8.4	9.8	9.9	14.8	16.2
	25mm	0.6	0.7	1.0	1.1	1.2	1.3	1.3



16DN

Hot surface
- 75mm — High temperature generator
- 50mm — Low temperature generator & steam piping
- 25mm — Heat exchanger

Cold surface
- 50mm — Evaporator
- 25mm — Refrigerant pump and piping

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

16DN UNIT	EVAPORATOR		ABSORBER		CONDENSER		CROSS-OVER PIPE
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	
015- 066	N	N	M	M	M	M	Included

LEGEND
M -- Marine Water box
N -- Nozzle in Head

Application data (cont)

HEAT EXCHANGER STANDARD PASS AND NOZZLE ARRANGEMENT

16DN UNIT	EVAPORATOR		ABSORBER		CONDENSER	
	Pass	Inlet	Pass	Inlet	Pass	Inlet
015-024	3	L or R	2	L	1	L
028-066	2	L or R	2	L	1	L

LEGEND

L -- Left End Inlet (when facing control panel)

R -- Right End Inlet (when facing control panel)

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

16DN SIZE	EVAPORATOR							
	1-Pass		2-Pass		3-Pass		4-Pass	
	Min	Max	Min	Max	Min	Max	Min	Max
015	–	–	218	868	145	578	114	453
018	–	–	260	1043	175	694	136	529
021	–	–	316	1264	211	844	159	632
024	–	–	348	1393	232	929	175	697
028	619	2472	310	1242	207	827	–	–
033	722	2888	362	1447	161	965	–	–
036	779	3132	390	1553	260	1043	–	–
040	861	3463	432	1731	287	1154	–	–
045	969	3894	486	1946	333	1298	–	–
050	1075	4326	538	2162	359	1440	–	–
060	1290	5160	645	2580	430	1720	–	–
066	1419	5676	709	2838	473	1892	–	–

16DN SIZE	ABSORBER-CONDENSER			
	2-Pass/1-Pass		3-Pass/1-Pass	
	Min	Max	Min	Max
015	362	1169	–	–
018	409	1401	–	–
021	536	2073	–	–
024	611	2373	–	–
028	576	2044	–	–
033	674	2387	–	–
036	666	2631	–	–
040	746	2931	–	–
045	830	3301	–	–
050	922	3660	–	–
060	1106	4426	–	–
066	1217	4869	–	–

*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)

16DN SIZE	EVAPORATOR							
	1-Pass		2-Pass		3-Pass		4-Pass	
	Min	Max	Min	Max	Min	Max	Min	Max
015	–	–	14	54	9	36	7	27
018	–	–	17	65	11	43	9	32
021	–	–	20	79	14	53	10	39
024	–	–	22	87	15	59	11	44
028	39	156	20	78	13	52	–	–
033	46	182	23	91	10	60	–	–
036	50	197	25	98	17	65	–	–
040	55	218	28	109	19	72	–	–
045	62	245	31	122	21	81	–	–
050	68	272	34	136	23	90	–	–
060	82	327	41	164	27	109	–	–
066	90	360	45	180	30	120	–	–

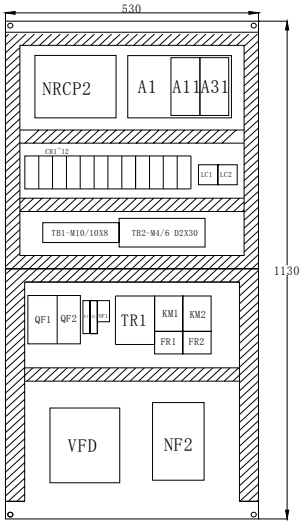
16DN SIZE	ABSORBER-CONDENSER			
	2-Pass/1-Pass		3-Pass/1-Pass	
	Min	Max	Min	Max
015	23	73	–	–
018	26	88	–	–
021	34	130	–	–
024	38	149	–	–
028	37	129	–	–
033	43	150	–	–
036	42	166	–	–
040	47	184	–	–
045	53	208	–	–
050	59	230	–	–
060	71	284	–	–
066	78	311	–	–

*Flow rates based on standard tubes. Minimum flow based on tube velocity of .9 m/sec; maximum flow based on 3.6 m/sec.

Application data (cont)

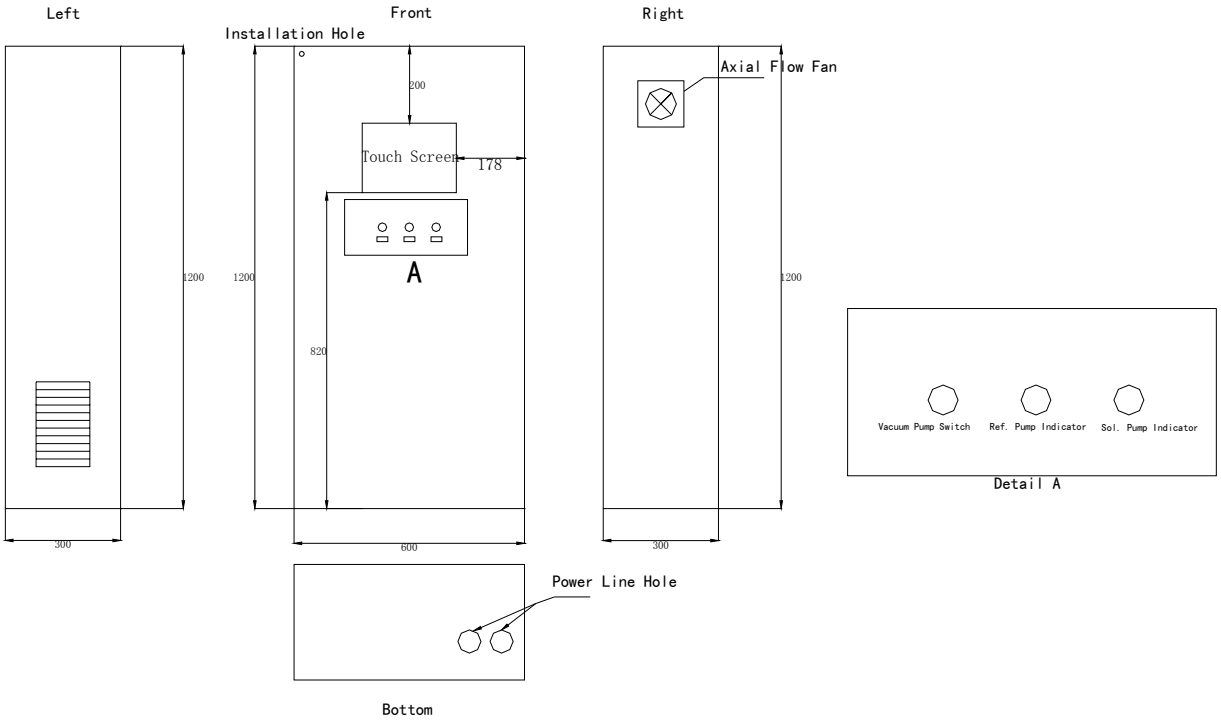
Control Panel

Control Panel Interior



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.

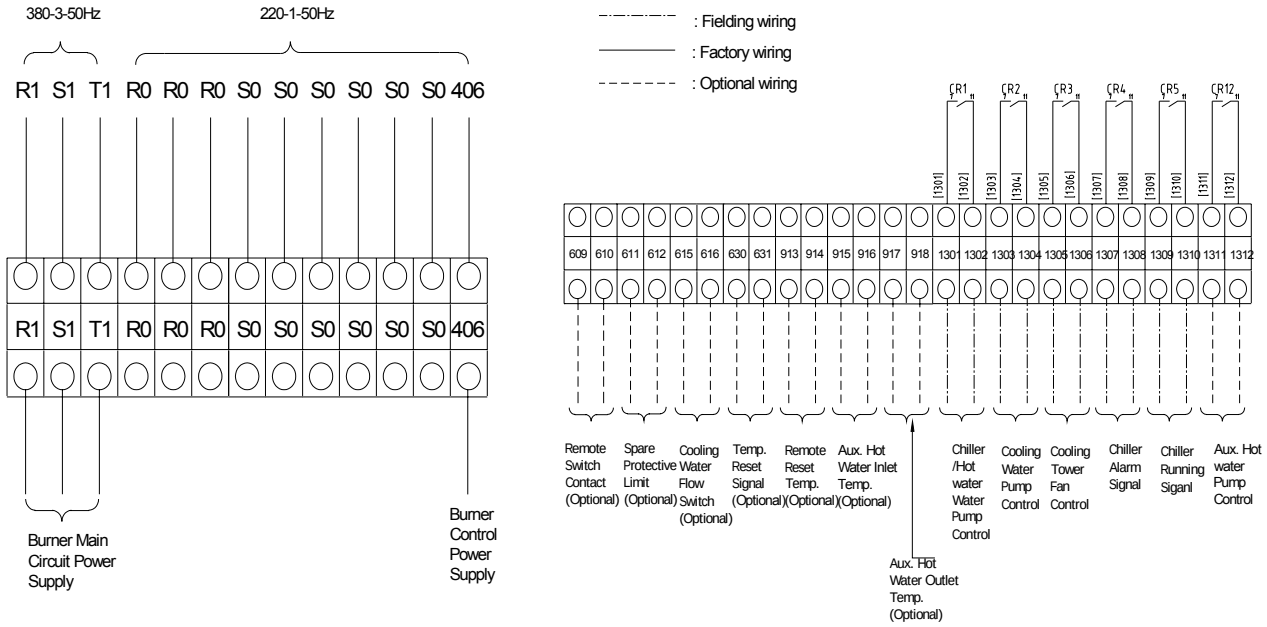
Control Panel Interior components



PD5 control Panel outline

Application data (cont)

Typical electrical field connection diagram



Terminal Block 1

Terminal Block 2

CR1	CHILLED WATER PUMP RELAY
CR2	COOLING WATER PUMP RELAY
CR3	COOLING TOWER FAN RELAY
CR4	CHILLER ALARM RELAY
CR5	CHILLER RUNNING RELAY
CR12	AUX. HOT WATER PUMP CONTROL 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	√	√
	Conductivity (mS/m) (25C) [uS/m] (25C)	≤80 [≤800]	≤30 [≤300]	≤40 [≤400]	≤40 [≤400]	≤30 [≤300]	√	√
	Chlorin ($mgCl^-/l$)	≤200	≤50	≤50	≤50	≤50	√	
	sulfate ($mgSO_4^{2-}/l$)	≤200	≤50	≤50	≤50	≤50	√	
	Acid consumption(PH4.8) (mg $CaCO_3/l$)	≤100	≤50	≤50	≤50	≤50		√
	Rigidity ($mgCaCO_3/l$)	≤200	≤70	≤70	≤70	≤70		√
	Calcium carbonate Rigidity ($mgCaCO_3/l$)	≤150	≤50	≤50	≤50	≤50		√
	Ionic silicon dioxide ($mgSiO_2/l$)	≤50	≤30	≤30	≤30	≤30		√
Reference	Iron (mgFe/l)	≤1.0	≤0.3	≤1.0	≤1.0	≤0.3	√	√
	Copper (mgCu/l)	≤0.3	≤0.1	≤1.0	≤1.0	≤0.1	√	
	Sulfur ion (mgS^{2-}/l)	Not include					√	
	Ammoniac ion ($mgNH_4^+/l$)	≤1.0	≤0.1	≤1.0	≤1.0	≤0.1	√	
	rudimental chlorine (mgCl/l)	≤0.3	≤0.3	≤0.3	≤0.3	≤0.3	√	
	Dissociative carbonate ($mgCO_2/l$)	≤4.0	≤4.0	≤4.0	≤4.0	≤4.0	√	
	Stable degree	6.0~7.0	-	-	-	-	√	√

Application data (cont)

Burner mounting

Depending on unit size, burner assemblies on the 16DN are either factory-installed as an integral part of the chiller or shipped as a separate component for field installation. The 16DN015-066 models are shipped with the burner factory-installed in the high-stage generator.

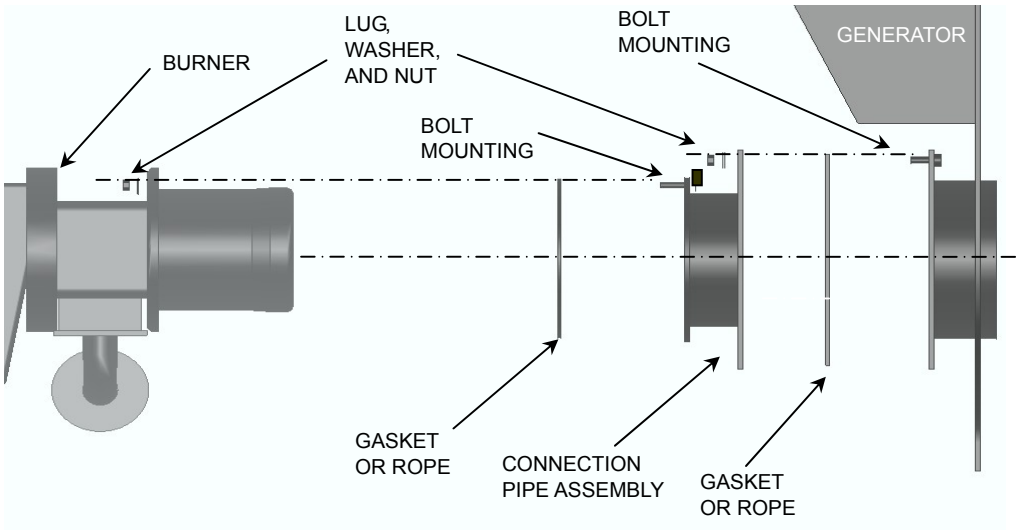
STANDARD BURNER CONFIGURATION

UNIT 16DN	WEISHAUPT BURNER MODEL NO.	STANDARD GAS SUPPLY PRESSURE RANGE	MAXIMUM FIRING RATE GAS (ft^3ph)	MINIMUM FIRING RATE GAS (ft^3ph)
015	WMG10/2	7.0-30kPa	1723.8	344.8
018	WMG10/3	7.0-30kPa	2068.6	413.7
021	WMG10/3	7.0-30kPa	2413.4	482.7
024	WMG10/3	7.0-30kPa	2758.1	551.6
028	WMG10/4	7.0-30kPa	3217.8	643.6
033	WMG20/2	7.0-30kPa	3792.4	758.5
036	WMG20/2	7.0-30kPa	4137.2	827.4
040	WMG20/2	7.0-30kPa	4596.9	919.4
045	WMG20/2	7.0-30kPa	5171.5	1034.3
050	WMG20/2	7.0-30kPa	5746.1	1149.2
060	G9/1-D	7.0-30kPa	6895.3	1379.1
066	G9/1-D	7.0-30kPa	7584.9	1517.0

LEGEND

NOTE: Actual gas train size is dependent on gas pressure, agency approvals, gas specifications, burner input and the required burner manifold gas pressure. Higher gas pressures than those listed above are available.

TYPICAL BURNER MOUNTING



On models where field-installation is required, rigging should be used to position both the front plate assembly and the burner assembly because of their heavy weights. For the front plate, either webbed strapping placed around the re-factory or a lifting bar in the center opening may be used.

For burner assemblies that do not have lifting lugs, place webbed strapping around a central balance area of the burner.

Rig burner assemblies that have lifting lugs in accordance with standard rigging procedures.

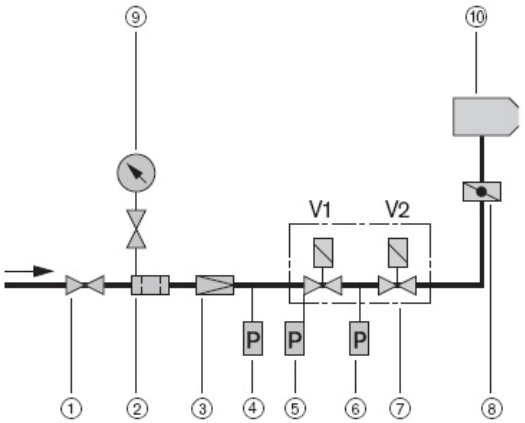
Application data (cont)

Fuel systems

The gas train and oil supply systems are supplied pre-assembled and with pre-installed interconnection fittings.

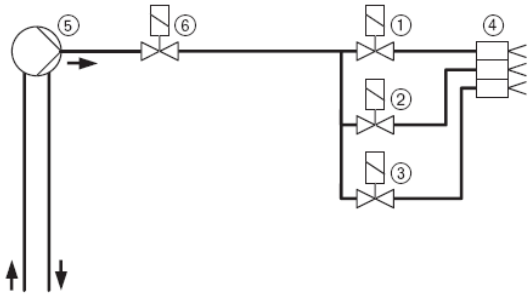
Specific fuel system components and instrumentation will vary depending on local regulations, codes, and ordinances and on the particular job requirements.

Gas Burner System



1—Ball Valve
2—Gas Strainer
3—Regulator Valve
4—High-Pressure Protect Switch
5—Low-Pressure Protect Switch
6—Pressure Switch (for leak test)
7—Dual Solenoid Valve (DMV)
8—Gas Butterfly Valve
9—Pressure Gauge
10—Burner

Oil Burner System



1—Solenoid Valve stage 1
2—Solenoid Valve stage 2
3—Solenoid Valve stage 3
4—Nozzle Head with 3 Oil Atomising Nozzles
5—Oil Pump on Burner
6—Safety Solenoid Valve

Application data (cont)

Combustion air supply

An adequate supply of combustion air is required by the burner for proper, efficient operation and to ensure complete combustion. It is recommended that excess air be provided to the burner to account for variations in fuel properties and air/fuel supply rates. As a general rule, 12cu ft of combustion air should be supplied for every 1000 Btu of fuel provided to the burner. This equates to approximately 20% excess air for natural gas and ensures complete combustion and efficient operation while minimizing smoke, soot, and the formation of carbon monoxide (CO) and nitrogen oxides (No_x). The source of combustion air to the burner should be in accordance with all local codes and regulations.

Exhaust gas flue and stack recommendations

Design and construction of the flue stack should comply with all municipal, state, and federal codes and regulations, as applicable. Typical exhaust gas temperature for the 16DN is 375F (190C). However, the stack design temperature should be no less than 675F (360C). It is recommended that insulated, double-wall, round ducting be used in all applications. Flat-sided ducting should not be used since it has a tendency to flex. Flexing causes pulsations in the flue stack, inefficient combustion, and possibly erratic chiller/heater operation. Proper stack design should allow continuous flow by avoiding sharp bends and should be sized to maintain a static pressure between 0 to –0.20 in. wg (0 to –5 mm) at the stack entrance. Use of a barometric damper or sequential motorized draft control is required to properly regulate exhaust gas static pressure and maintain optimum performance. A vent cap, lighting arrestor, and provisions for a condensate drain are also required.

Cross-sectional area of the stack is determined by calculating the volumetric flow rate of the exhaust gases and then selecting a diameter that results in an exhaust gas velocity of no greater that 12 to 15ft/sec (3.6 to 4.6m/sec).

Height of the stack is determined by the length of the horizontal run and the number of 90 degree bends. As a general rule, provide 7in. (180mm) of stack height for every 1ft (300mm) of horizontal length and 4ft (1.20m) for every 90 degree bend. The location, height, and positioning of the stack outside the building should consider roof patterns, projections, ancillary equipment, aesthetics, and wind flow.

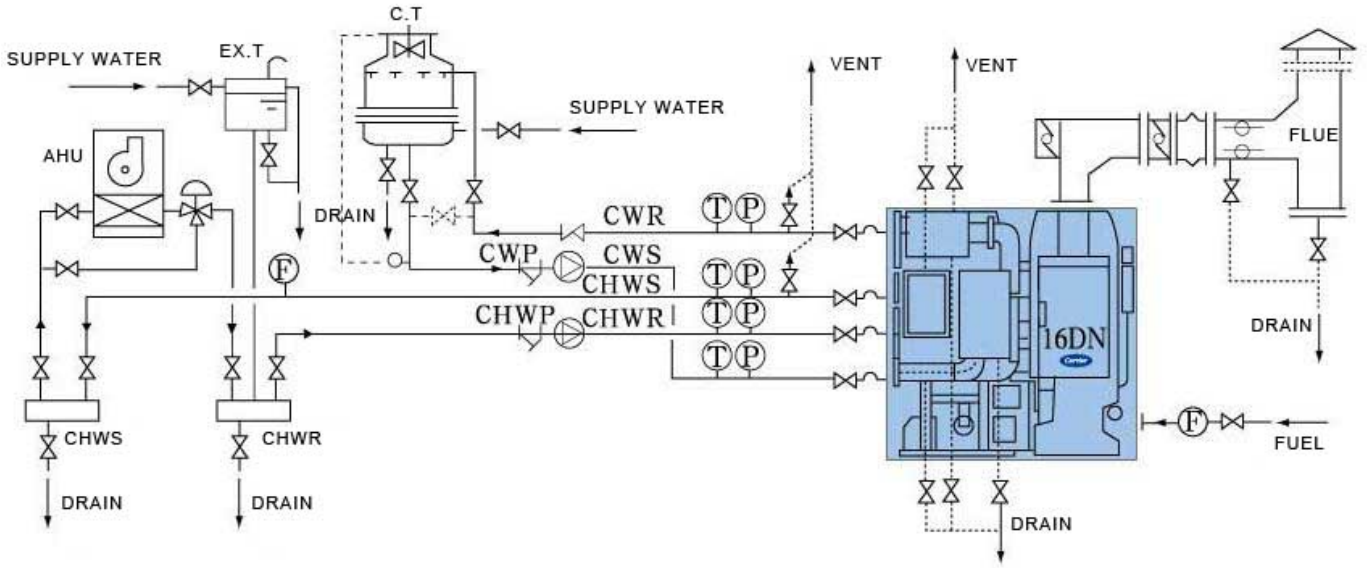
In situations where multiple machines will utilize a common exhaust gas flue stack, individual dampers and/or draft control systems for each unit are recommended.

Connection of the stack to the 16DN exhaust gas outlet flange should be made using a rectangular-to-round transition piece. Dimensions of the exhaust gas flange can be found on the appropriate 16DN certified drawings.

Service access

To perform routine maintenance, allow 3ft (1m) clearance on all sides of machine and 6in. (150mm) above the chiller/heater. For proper tube removal, a clearance equal to the overall length of the machine should be provided on each end of the 16DN. To service the high-stage generator, provide a clearance equal to the length of the high stage generator assembly on both ends of the machine. To allow for opening of hinged waterbox cover, clearance area must be provided at the waterbox end of the chiller. The space opposite the water nozzle must be equal to half the width of dimension “D” on page 12.

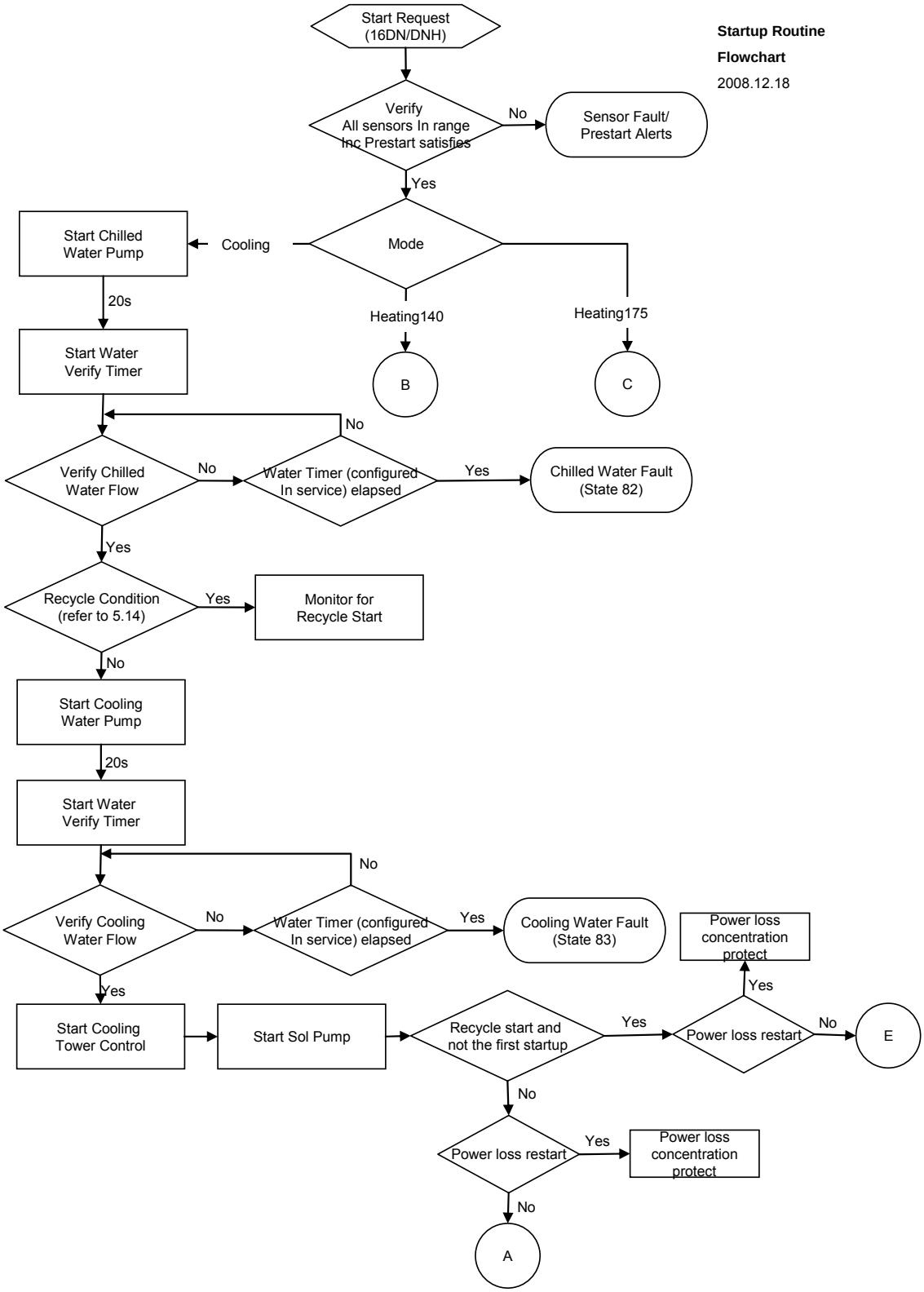
Typical Piping



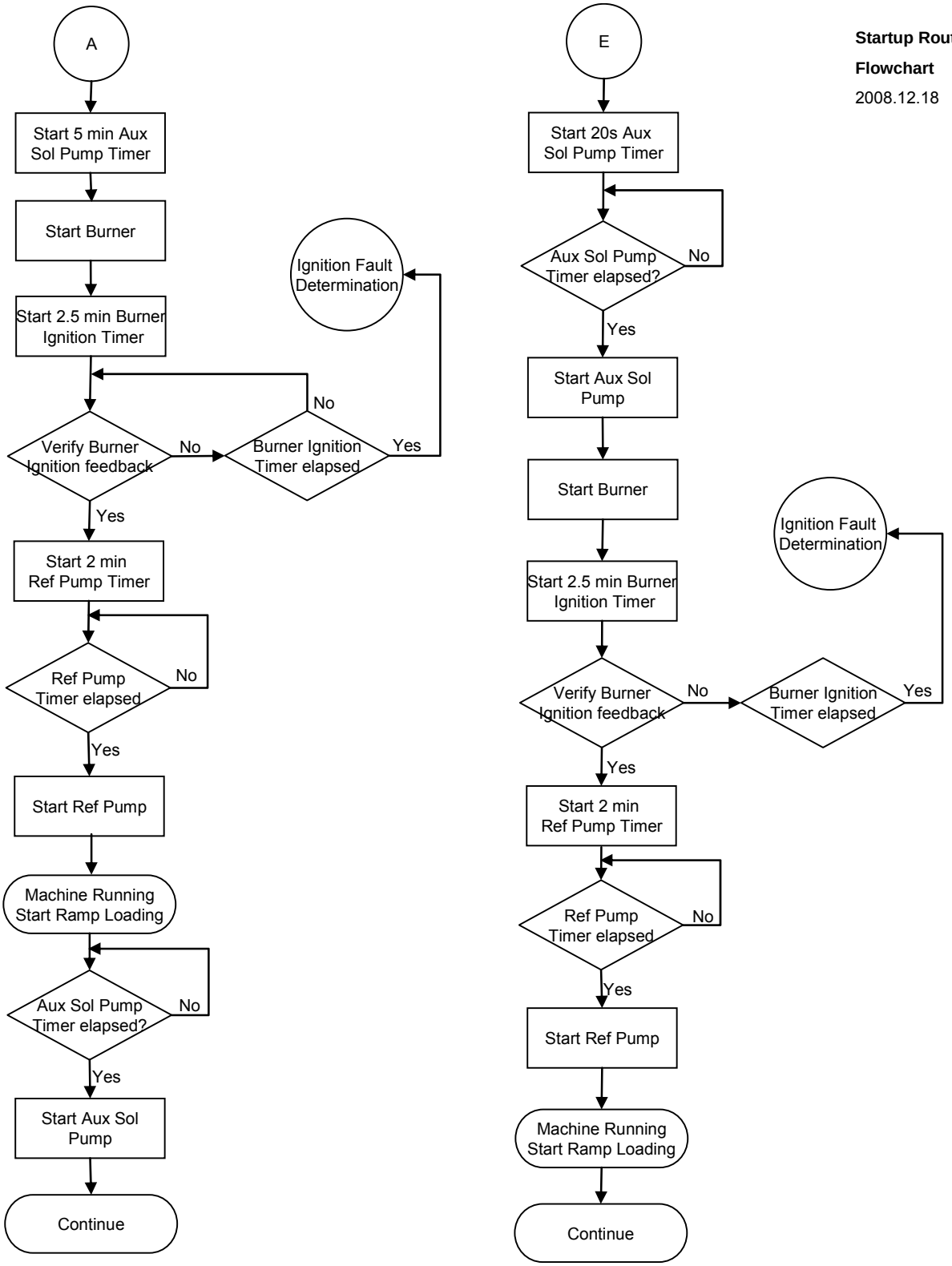
1. Equipment and parts outside the area of blue color are not supplied by Carrier.
2. For pipe connections and diameters refer to the dimensional drawings.
3. Determine the location of the chilled/hot water pumps, cooling water pump and expansion tank with due consideration of the pump's hydrostatic head. The machine should not be subject to pressure larger than 1034kPa at any water headers.
4. It is recommended to have separate chilled/hot and cooling water pumps for each chiller/heater.
5. Strainers should be provided at the chilled/hot and cooling water inlet pipe connections.
6. Provide a thermometer (0~100C) and pressure gauge (0~1.5MPa) at the chilled/hot and cooling water outlet and inlet pipe connections.
7. Provide an air vent valve in each of the chilled/hot and cooling water lines at a point higher than each header and a drain valve at the bottom of outlet pipe connections.
8. Provide vent and drain valves in each waterbox, and drain pipes from the evaporator, absorber and smoke chamber should be piped to the drain channel.
9. Provide a tower bypass valve if the temperature of the cooling water returning from the tower can fall down 59F.
10. A water flow control valve should be provided at the cooling water inlet pipe connections.
11. During heating operation, cooling water must be discharged to prevent freezing of the chiller.
12. Provide an expansion tank in the chilled/hot water line.
13. A flow meter can be installed on the chilled/hot water piping for convenient operation.
14. For water quality control refer to the water quality management and provide a blow-down valve in the water line for water quality control if necessary.
15. There should be sufficiently large clearances for easy access to the evaporator, absorber and condenser, to facilitate inspection and cleaning.
16. During heating operation, the thermal insulation material on the cooling water pipe near the absorber should be heat resistant because the temperature can reach 176F.
17. Provide heat insulation to the flue, which should be equipped with a damper and condensate drain.
18. Do not connect the flue to the smoke stack of an incinerator.
19. When one flue is used for two or more chillers/heaters, a device should be provided to prevent the flow of exhaust gas into the inoperative unit.
20. The exhaust discharge end of the flue should be kept a sufficient distance away from the cooling tower.
21. If the static pressure inside the flue is subject to fluctuations provide a draught regulator.
22. All external water piping with welding flanges is to be provided by the customer.

Typical control sequence

NORMAL START FLOW CHART (PART 1)



NORMAL START FLOW CHART (PART 2)



Startup Routine

Flowchart

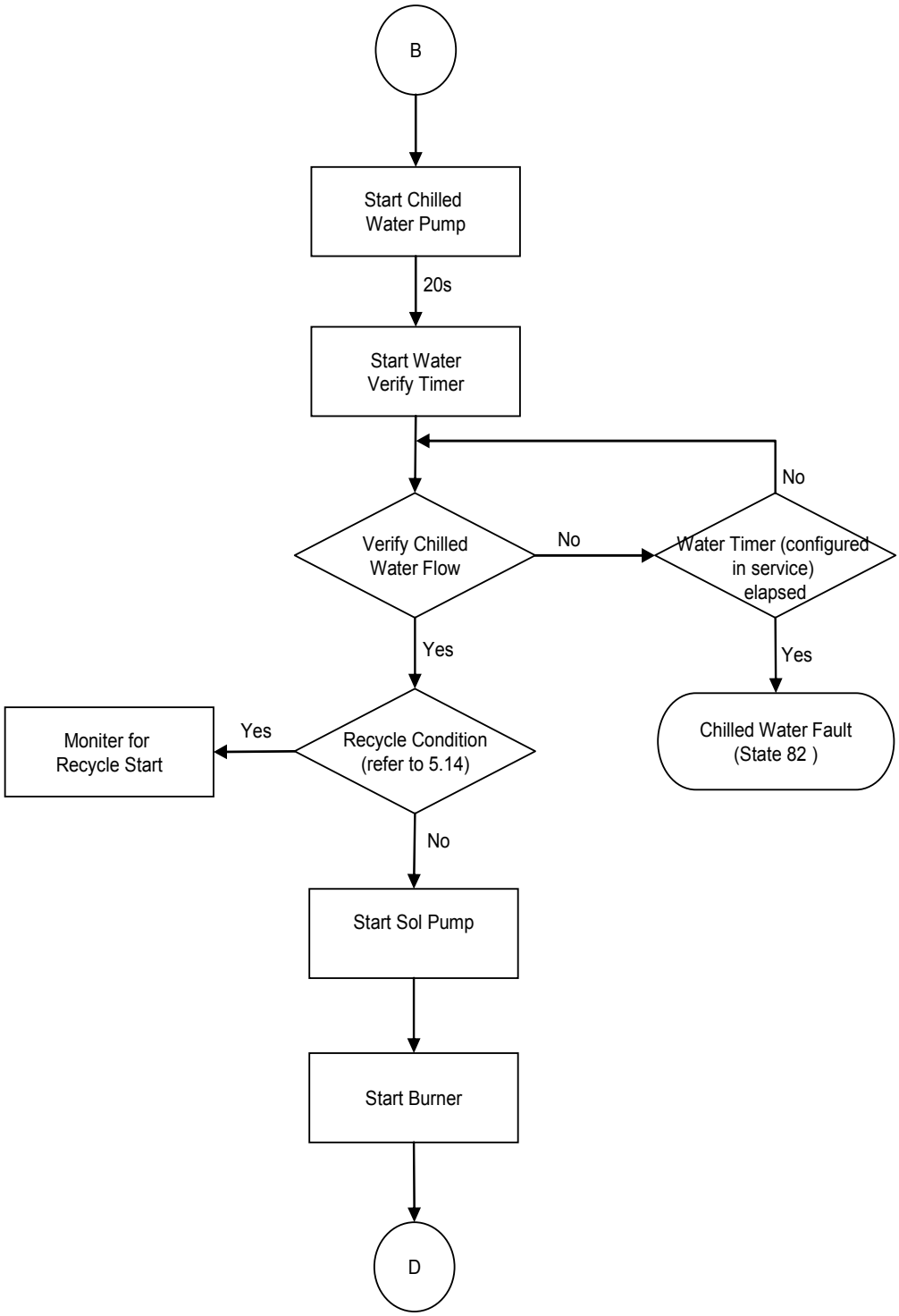
2008.12.18

NORMAL START FLOW CHART (PART 3)

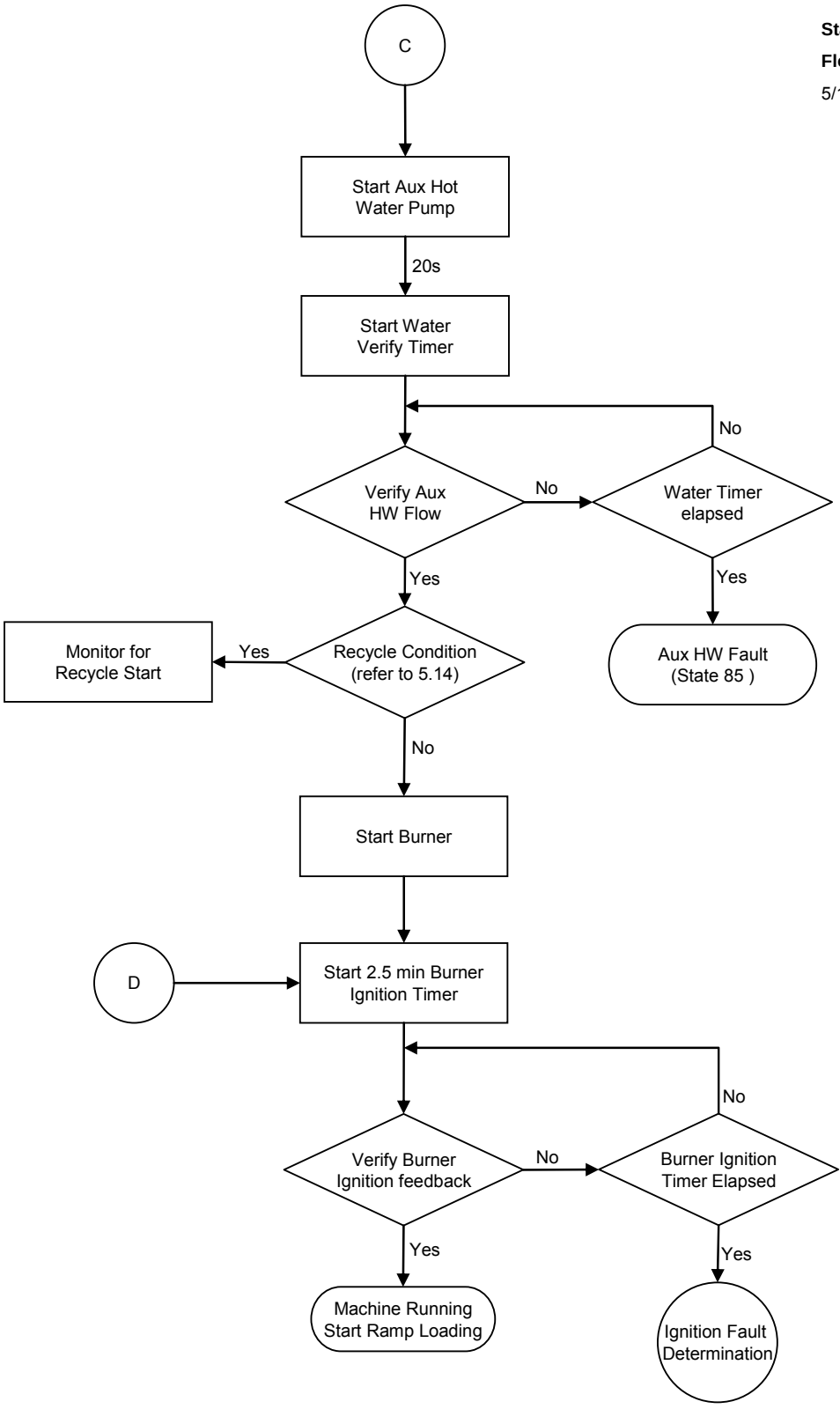
Startup Routine

Flowchart

5/14/2008



NORMAL START FLOW CHART (PART 3)

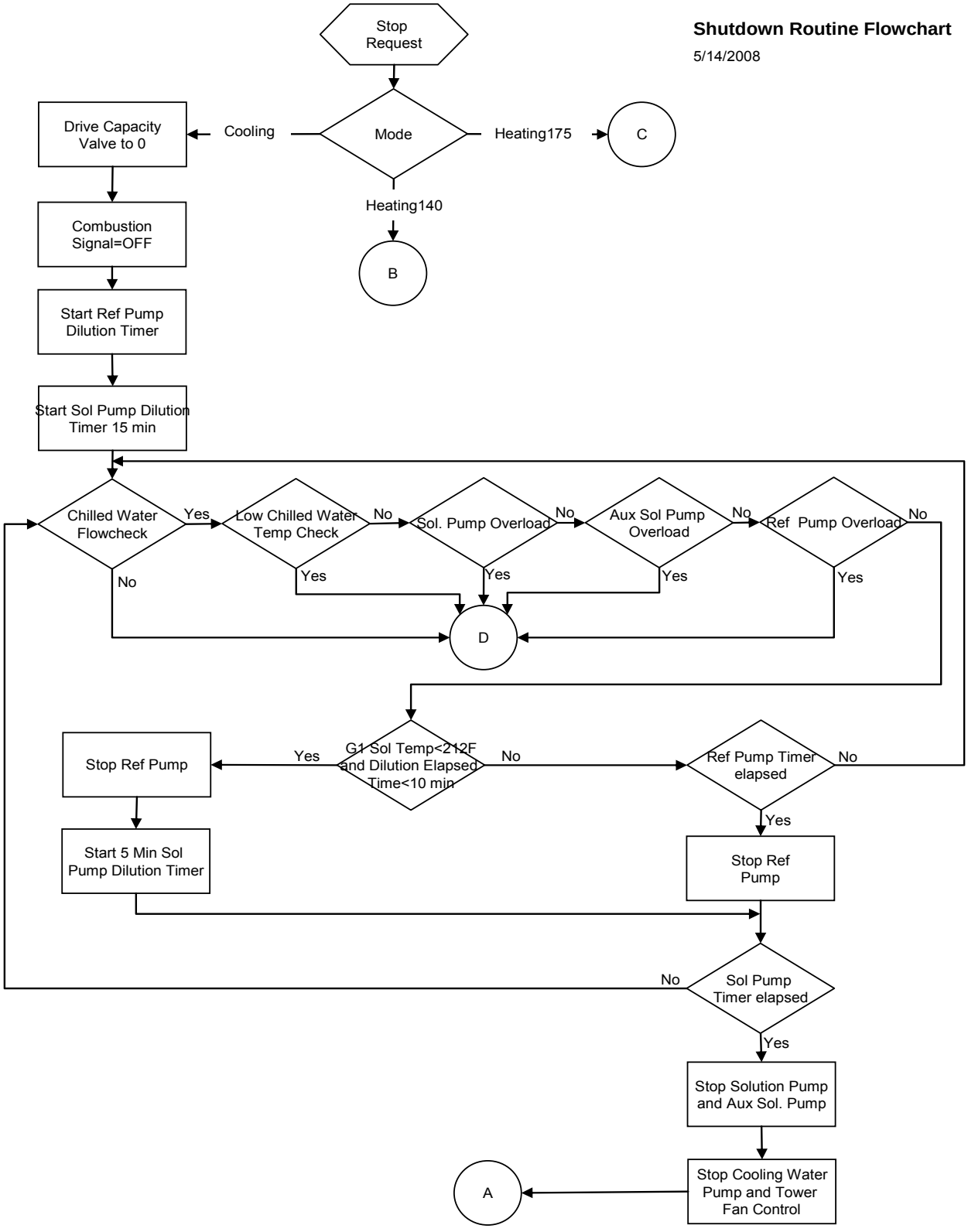


Startup Routine

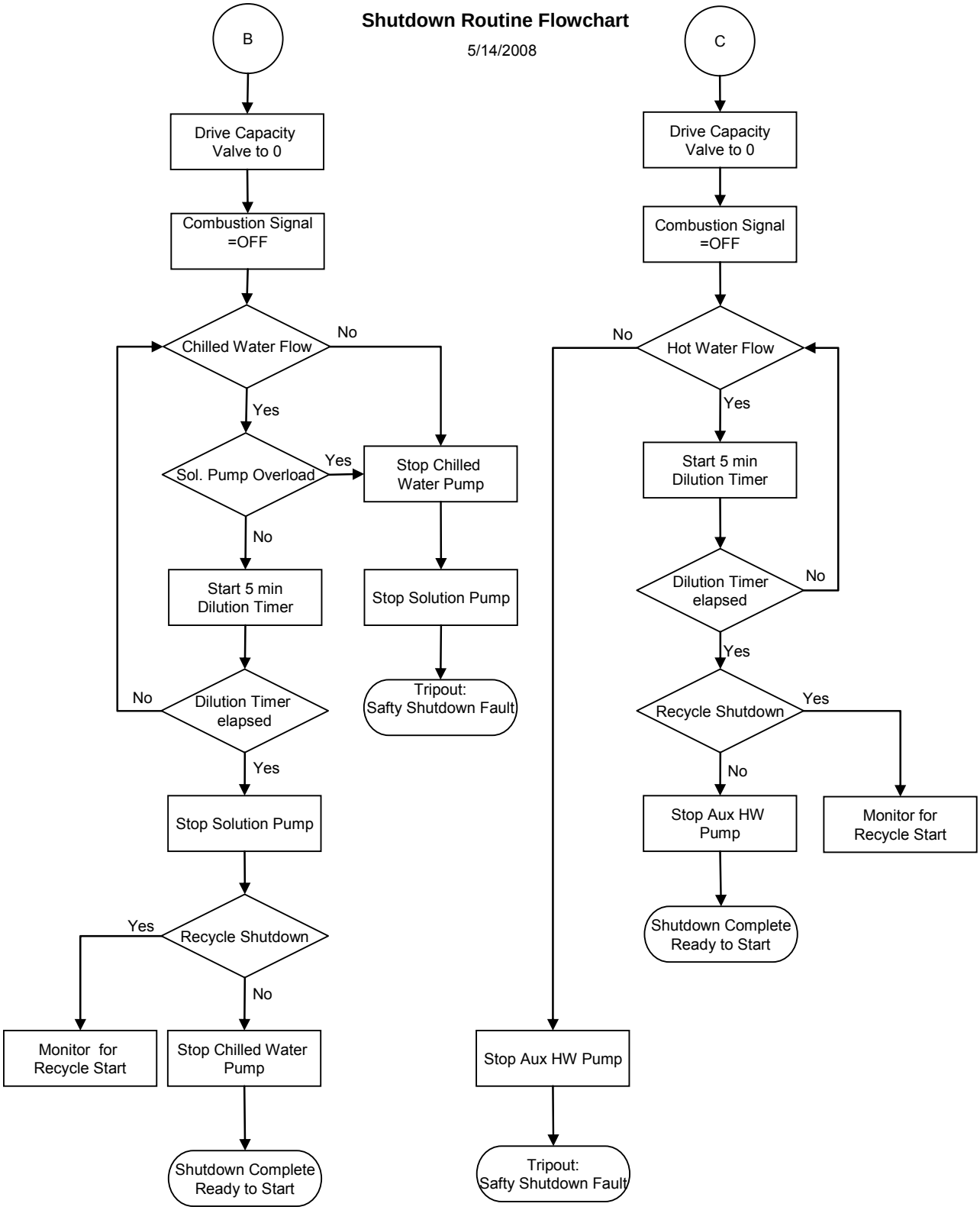
Flowchart

5/14/2008

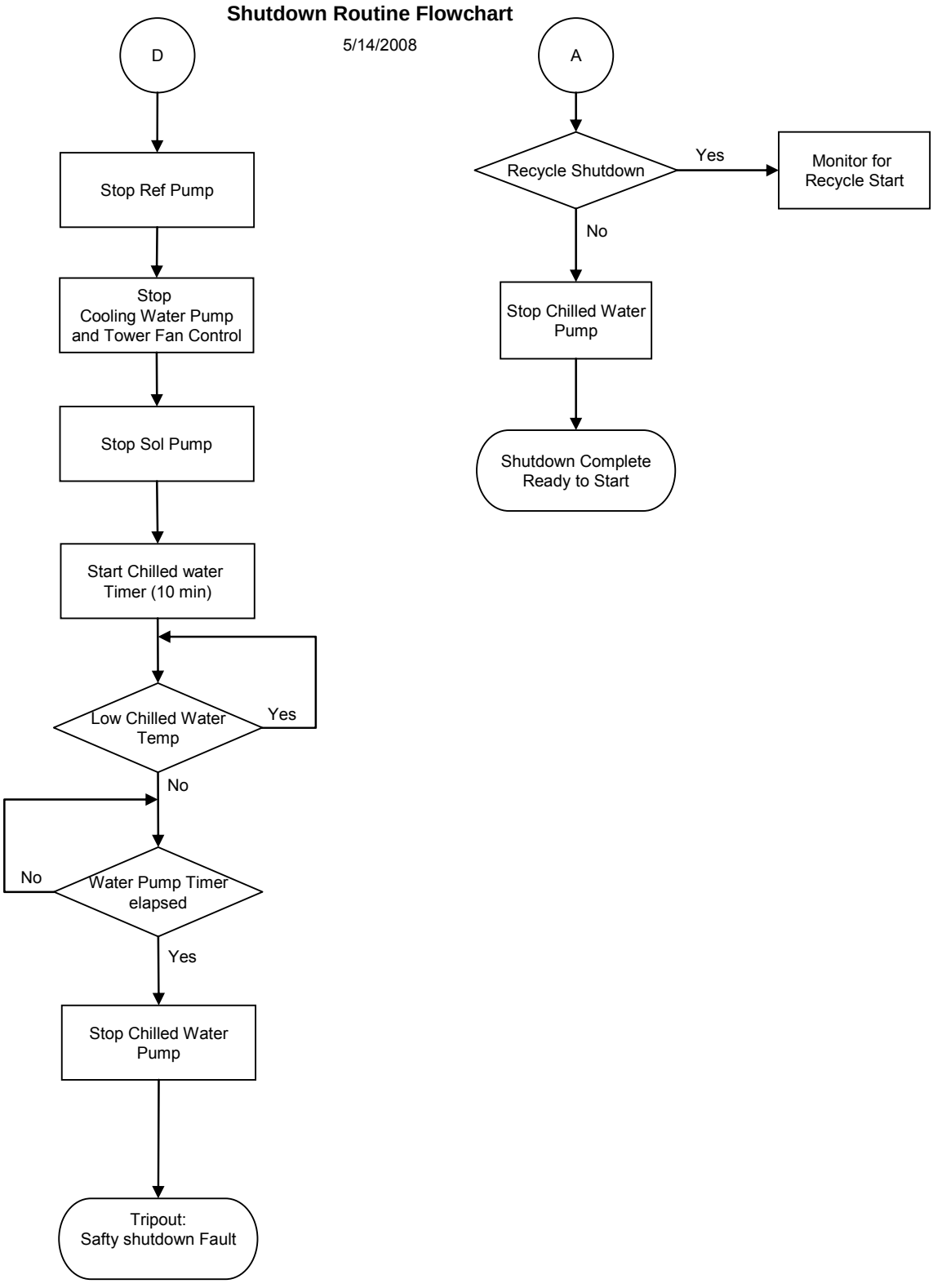
NORMAL STOP FLOW CHART (PART 1)



NORMAL STOP FLOW CHART (PART 2)



NORMAL STOP FLOW CHART (PART 3)



Guide specifications

Hermetic Absorption Liquid Chiller/Heater
Size Range: **150 to 660 tons (528 to 2321 kW)**
Carrier Model Numbers: **16DN**

Part 1 – General

1.01 SYSTEM DESCRIPTION

Electronically controlled, double-effect (two-stage) absorption liquid chiller/heater utilizes hermetic refrigerant and solution pumps, lithium bromide solution as the absorbent, and water as the refrigerant. The combustion of natural gas or No. 2 oil within the generator shall serve 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 and designed 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 shellside of each chiller shall be leak tested by pressurizing to 11.6psig (80kPa) 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 shellside of the machine. The acceptable leak rate as measured by the mass spectrometer test shall not exceed $1*10^{-6}$ atm.cc/sec standard air.
   2. The tubeside 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/heater 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, name-plate 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. Normally, unit shall be charge with lithium bromide solution at the jobsite in accordance with the manufacturer's written instructions. But if customer requires, unit can be factory-charged with lithium bromide solution and performance tested before shipping as special requirement.
C. Machines shall be pressurized to 4.4psig (0.03MPa) with dry nitrogen gas on the shell side.
D. Burner, burner control center and gas train (or oil control system) shall be factory-installed for sizes 16DN015-066.
E. 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. Carrier 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/heater shall include evaporator, absorber, condenser, high- and low-stage generators, solution heat exchanger, burner/gas train (or burner/oil control system) assembly, refrigerant/solution pumps, purge system, piping, wiring, controls, and auxiliaries. Shipment of the machine shall be in 1 piece with an option for 2-piece shipment. Initial charge of lithium bromide can be included with the chiller/heater for charging at the jobsite. The high-stage generator shall be configured such that the fire tubes are horizontally positioned above the combustion chamber with flue gas inside the tube and lithium bromide solution on the outside of the tubes. This design shall simplify the process of tube cleaning and shall prevent the flame from coming into direct contact with the tubes. This shall ensure maximum life and reliability.

Guide specifications (cont)

B. Operating Characteristics

1. Chiller operation shall be characteristic of a double-effect absorption cycle with series solution flow. The weak solution from the absorber shall be entering the high-temperature generator via the low- and the high-temperature solution heat exchangers. A variable frequency drive pump shall automatically regulate the flow of solution to the generators to maintain optimum flow at all operating conditions. This shall result in improved part-load efficiency and eliminate the need for manual set-up adjustments of the solution flow.
2. Unit shall be capable of continuous operation from 100 to 20% capacity for gas fired series and 100% to 30% for oil fired series, with entering cooling 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).
3. Standard chiller design shall be based on a 2–pipe system capable of operation in either the cooling or heating mode. When in the heating mode, the evaporator tube bundle shall be utilized as the heating bundle supplying hot water through the standard evaporator nozzle connections to simplify piping. The hot water temperature leaving the unit shall be 140F (60C).

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 grooveless tubesheets and expanded into tube support sheets, except for the high- and low- stage generator tubes. High-stage generator tubes shall be welded into tube sheets. All tubes shall be individually replaceable. Low-stage tubes shall be rolled into grooved tubesheets and expanded into tube support sheets.
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. GB RF flanges shall be furnished on the all waterbox nozzle connections. ANSI (American National Standards Institute) raised face flanges are available.
3. The high-stage generator shall incorporate a cylindrical combustion chamber. The carbon steel (boiler type) fire tubes shall be located above the combustion chamber in a horizontal position and shall be seal welded to the tubesheets. Turbolators shall be provided in each fire tube to increase heat transfer. Access to the high-stage generator shall be provided via a flange type refractory door on the end opposite the burner. A sightglass shall be provided in the chamber to observe flame size and shape. A flanged rectangular flue gas outlet connection shall be located on the burner end above the burner assembly.
4. A high-temperature and a low-temperature solution heat exchanger shall be an integral part of the machine to increase efficiency by pre-heating weak solution on the tubeside with strong solution on the shellside. Tube material for the high-temperature heat exchanger shall be cupronickel, and tube material for the low-temperature heat exchanger shall be copper.
5. Spray heads for the evaporator and absorber shall be of a non-clogging design, specifically designed for the intended duty, and 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. For molybdate systems, the following tube specifications shall apply to ensure long machine life and continuous operation:

Evaporator ---------- copper, externally-finned
Absorber----------copper, externally-finned
Condenser----------copper, corrugated
Low-Temperature Generator--copper,externally-finned
High-Temperature Generator----------carbon steel

If chiller manufacturer requires the use of tube materials other than as listed above, due to the use of a less effective inhibitor, the chiller manufacturer shall guarantee performance of the machine for its design life and shall replace tubes and/or tube bundles as necessary during this period at no additional cost to the owner.

D. Pump/Motors

Refrigerant and solution pump/motors shall be self-contained, leakproof, hermetic type, with isolation valves, and internal seal water system to minimize air leakage into the machine. 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 of 5 years (or 20,000 hours) 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 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

Guide specifications (cont)

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. The vacuum pump shall be factory mounted on the chiller and wired to the control center by the chiller manufacturer.

F. Burner Assembly

1. Burner shall be manufactured by Weishaupt Co. or supplier with equivalent quality and shall be of the turbo-ring forced draft type with stainless steel flame retention-type combustion head to assure stable, pulsation-free operation. Primary-secondary air ratio and total air volume shall be manually adjustable to provide control at the firing head for optimum burner efficiency. The burner shall incorporate its own sequence, combustion, supervision, and safety controls but shall operate under the direction of the chiller microprocessor. Interfacing with the chiller control center shall be done via a field-installed wiring harness.
2. The burner assembly and gas train (or oil control system) shall consist of strainers, shutoff valves, regulators, control valves, safety valves, ignition transformers, flame detectors, and pressure switches as necessary to meet national, state, and/or local code requirements. The burner control center shall house the blower motor contactor, overloads, combustion safety controls, and all other components for safe, proper operation.
3. Burner shall be capable of operation on either natural gas, No. 2 oil, or both (dual-fuel). A fuel transfer switch shall be provided on the burner control center to enable switching between gas and oil when configured for dual-fuel operation.

G. Controls

1. General

   The 16DN series chiller contains a PD5 control center that monitors and controls all operations of the machine. The PD5 controls system matches the cooling capacity of the machine to the cooling load while providing state-of-the-art machine protection. The system controls cooling capacity within the set point plus the dead band by sensing the leaving chilled water and regulating the burner capacity valve via a mechanically linked actuator motor.
2. 16DN Series PD5 (Pro-Dialog 5)

   The PD5 is the control system on the machine. The PD5 controls the operation of the machine by monitoring all operating conditions. The PD5 can diagnose a problem and let the operator know what the problem is and what to check. It promptly positions the burner capacity valve to maintain leaving chilled water temperature. It can interface with auxiliary equipment such as pumps and cooling tower fans. It continually checks all safeties to prevent any unsafe operating condition. The PD5 can be interface with the Carrier Comfort Network (CCN). It can communicate with other PIC-equipped chiller and CCN device.

   - PD5 Board:
     The control system consists of a PD5-BASE board, two PD-AUX boards and an NRCP - BASE board. All boards communicate via an internal LEN bus. The PD5-BASE boards continuously manage the information received from the various pressure and temperature probes, and incorporates the program that controls the unit.
   - PD5 Touch Screen:
     The user interface is a touch screen. It is connected to the main basic board and gives access to a full array of control parameters.
3. 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

4. PD5 System Functions
   - Capacity Control:
     The PD5 controls the chiller capacity by modulating the capacity valve in response to chilled water temperature changes away from the CONTROL POINT. The CONTROL POINT may be changed by a CCN network device, or is determined by the PD5 adding any active chilled water reset to the ECW (Entering Chilled Water) SET POINT or LCW (Leaving Chilled Water) SET POINT
   - Entering Chilled Water Control (Optional):
     The PD5 uses ENTERING CHILLED WATER temperature to modulate the vanes instead of LEAVING CHILLED WATER temperature.
   - Chiller Timer:
     The PD5 maintains 2 runtime clocks, known as SOLUTION PUMP ONTIME AND SERVICE ONTIME. SOLUTION PUMP ONTIME indicates the total lifetime. The SERVICE ONTIME is a resettable timer that can be used to indicate the hours since the last service visit or any other reason.
   - Occupancy Schedule:
     This schedule determines when the chiller is either occupied or unoccupied. The chiller will shut down when the schedule goes to UNOCCUPIED. These schedules can be set up to the follow the building schedule or to be 100% OCCUPIED if the operator wishes. The schedules also can be bypassed by forcing the Start/Stop commend on the PD5 Status screen to start. The schedules also can be overridden to keep the unit in an OCCUPIED mode for up to 4 hours, on a one-time basis.
5. Safety Control
   The PD5 monitors all safety control inputs and if required shuts down the chiller or VFD speed stops solution pump to protect the chiller from possible damage from any of the critical conditions. The PD5 screen displays primary and secondary massage if the controller starts safety controls to stop, the alarm relay operates and alarm indicator is brink. The alarm is saved in the PD5 alarm table to correct the problems.
6. Remote Start/Stop Control
   A remote device, such as a time clock which uses a set of contacts, may be used to start and stop the chiller.
7. Spare Safety Inputs
   Normally closed (NC) digital inputs for additional field-supplied safeties may be wired to the spare protective limits input channel in place of the factory-installed jumper. (Wire multiple inputs in series.) The opening of any contact will result in a safety shutdown and PD5 display.
8. Tower-Fan Relay
   The tower-fan relay control is in cooling mode. It operates when the cooling water pump is running, cooling water flows and temperature of the weak solution leaving from absorber is 30 C. it may stop when the cooling water pump is stopped, cooling water is not flow and the weak solution temperature leaving from absorber is below 25C.
9. Auto Restart After Power Failure
   If the control power is interrupted during operation, the chiller stops immediately without the normal shutdown sequence and dilution. Solution crystallization can occur if the concentration is high (chiller was operating with a relatively large load). The machine will start automatically when the power is back on.
10. Water Temperature Reset
    This process shall only run when the Heat/Cool Mode is set to Cooling. Three types of chilled water reset are available and can be viewed or modified.
    - mA Reset
    - Remote Temp Sensor Reset
    - Machine Delta T Reset

H. Machine Safety Devices
1. Machine safety and limit devices shall be included as follows:
   a. High solution level – generator (limit)
   b. Low solution level – generator
   c. Low chilled water temperature
   d. Low chilled water flow
   e. Low cooling water flow (optional)
   f. High solution temperature – generator
   g. High hot water temperature (limit)
   h. High flue gas temperature
   i. High motor winding temperature – ref/sol pump
   j. High motor amperage – refrigerant/solution

Guide specifications (cont)

pump
k. High pressure – generator
l. Low fuel pressure
m. Low combustion airflow
n. Flame failure
o. Low fire at ignition verification

2. Chiller shall include a rupture disk (optional) or a fusible plug to protect against accidental overpressure.

I. Electrical Requirements
1. Power supply to the unit shall be 3ph/50Hz/400V and 3ph/60Hz/460V. If need, carrier also can meet customer's requirement.
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 control system, if applicable.

J. Piping Requirements
1. Piping and instrumentation for the chilled water, cooling water, flue supply (except for the gas train), and breaching shall be supplied and installed by the contractor/owner.
2. Chilled water flow switch shall be factory supplied and factory installed in the evaporator water nozzle. Condenser water flow switch shall be field installed or factory installed if customer requires and supplied by either the chiller manufacturer or the contractor/owner.
3. 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.

K. Thermal Insulation
Insulation of cold or hot surfaces shall be field supplied and field installed on the machine. Chiller manufacturer shall specify the recommended material and surface area to be insulated.

L. Sound Level
The overall sound pressure level of the chiller shall not exceed 85dbA when measured per Standard ARI Standard 575 (latest edition).

M. Start-up
1. Unit manufacturer shall provide a factory-trained service representative, employed by the chiller manufacturer, 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-up, operation, and maintenance procedures.
3. Manufacturer shall provide the following literature:
a. Installation, Operating and Maintenance Instructions
b. Field Wiring Diagrams

N. Options and Accessories
1. High-Pressure Waterboxes:
Waterboxes rated for 250psig (1724kPa) or 300psig (2068kPa) working pressure shall be furnished when specified on the equipment schedule
2. Special Tubing:
Tubing of non-standard materials and/or wall thickness shall be provided when specified on the equipment schedule.
3. Dual-Fuel Burner:
A burner capable of operation on either natural gas or No. 2 oil shall be furnished when specified on the equipment schedule.
4. Shipping Configuration:
Chiller shall ship in 1 or 2 pieces, as specified on the equipment schedule.
5. Isolation Package:
A vibration isolation package consisting of machine soleplates and neoprene isolation pads shall be furnished for field installation when specified on the equipment schedule.
6. Condenser Water Flow Switch:
A condenser water flow switch, rated for either 150psig (1034kPa), or 300psig (2068kPa) shall be field installed or factory installed if customer requires and supplied by either the chiller manufacturer or the contractor/owner.

Carrier improves the world around us; Carrier improves people's lives; our products and services improve building performance; our culture of improvement will not allow us to rest when it comes to the environment.

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