Carrier
SANYO

Direct-Fired Double-Effect Absorption Chillers/Heaters

GB/T-19001-2000 to ISO9001/2000

SUPER ABSORPTION

16DJ 11-82

Nominal cooling capacity 352-5274 kW
Nominal heating capacity 268-7026 kW

The Carrier Corporation has more than 100 years experience in providing HVAC systems and equipment around the world. Sanyo is a leading manufacturer in the field of high-efficiency absorption chillers. Carrier-Sanyo absorption chillers, produced by Sanyo for Carrier, provide a unique choice of models for all absorption chiller applications.

Features

- The Carrier-Sanyo gas-fired double-effect absorption chillers/heaters offer building owners a better solution for many new and retrofit applications. Installation of a direct-fired chiller/heater eliminates the need for the boiler required with conventional installations. This reduces the initial cost of the system, making Carrier-Sanyo chillers/heaters competitive with conventional chiller/boiler systems.
- Excellent for peak shaving during high electrical demand periods.
- Units can provide cooling without expensive electrical service upgrades.
- Carrier-Sanyo gas-fired absorption chillers allow diversification of critical cooling requirements. Critical cooling loads are met with minimal electrical power input.
- 16DJ units allow the use of for smaller emergency generators since the electrical load associated with an absorption chiller is minimal compared to an electrical driven chiller.
- The units are ozone-safe and CFC-free. Cooling requirements are met without chlorine-based refrigerants.
- They reduce the contribution to global warming and minimize the global impact by greatly reducing electricity consumption and eliminating production of greenhouse gases.
- The molybdate solution inhibitor has no impact on the environment.
- An absorption chiller does not utilize a large motor-compressor, and this leads to quiet, vibration-free operation.
- The high-efficiency of double-effect chillers has reduced the space required for installation of the absorption chiller, resulting in a smaller footprint.

Carrier-Sanyo is the industry leader in compact absorption units.

Carrier-Sanyo absorption chiller features

With the ever-changing requirements of building owners and continual changes in building designs, Carrier-Sanyo introduces the next generation of high-efficiency gas-fired, double-effect absorption chillers to the world market.
In many parts of the world, the cost of electricity and penalties administered through demand limits, inverted rates, time-of-day rates, ratchet clauses, etc. have forced the need for alternative chiller systems to be developed.

Electrical peak power shaving

- By using a combination of electrically driven and absorption chillers for air conditioning loads, a central plant can take advantage of lower base electricity rates during times of high electricity demand. The absorption unit is used to shave peak power demands during summer operation, while operating the electric chiller below the assigned demand limit, avoiding costly demand charges and saving money all year-round.
- With the limited capacity of the world power plants and environmental and financial concerns blocking construction of new ones, many areas are faced with extremely high demand charges and escalating electricity costs. In these areas, the entire cooling load can be handled by Carrier-Sanyo absorption units, allowing the allotted electricity to be used elsewhere in the building where there are no practical alternatives.

Heating and cooling operation

- With the Carrier-Sanyo 16DJ direct-fired double-effect chillers/heaters, the unit can be used for heating during winter months without additional cost of extra controls. In many applications the chillers/heaters can replace a traditional electric chiller and boiler design combination, with the advantage of reducing machine room floor space and realising up to 40% savings on the system start up cost.

Double-effect absorption cycle

- The direct-fired Carrier-Sanyo chillers utilize a double-effect absorption cycle resulting in unit COPs of 1.1 for the direct-fired chillers/heaters. This high-efficiency design has reduced the input energy of the original single-stage-absorption chillers by up to 30%. The Carrier-Sanyo state-of-the-art double-effect design has also allowed the unit to be reduced in size compared to previous generation units, making Carrier-Sanyo the industry leader in efficiency and space utilization.

Many applications

- Carrier-Sanyo offers one of the widest equipment ranges and operating conditions in the entire industry: 23 discrete unit sizes from 350 kW to 5300 kW. Using natural gas as one of the heat sources for direct-fired units, the customer is assured of a fuel that is clean burning and ozone-friendly.

No CFCs

- In addition to the extensive list of design benefits above, the Carrier-Sanyo units are completely ozone safe and use no CFCs or HCFCs.
- All cooling is achieved utilizing a refrigerant with a proven track record and ample supplies that is environmentally safe: namely, water!
- Additionally, since an absorption cycle is accomplished without a large motor-compressor drive arrangement, the customer can be assured of quiet, trouble-free, ultra-low vibration operation.

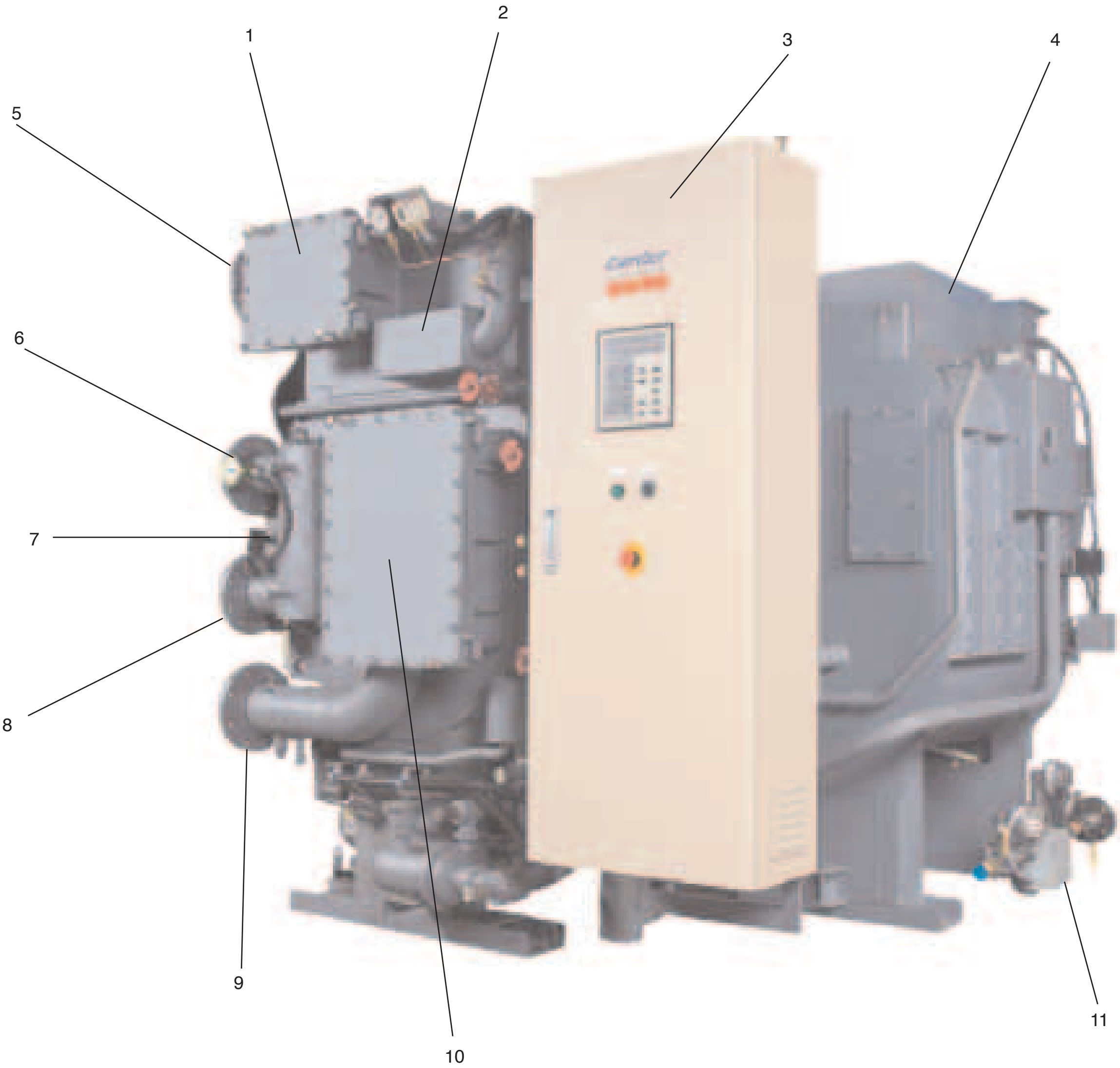
Nomenclature

16DJ - 11

Unit type: Double-effect, direct-fired

Capacity code

Component identification



Legend

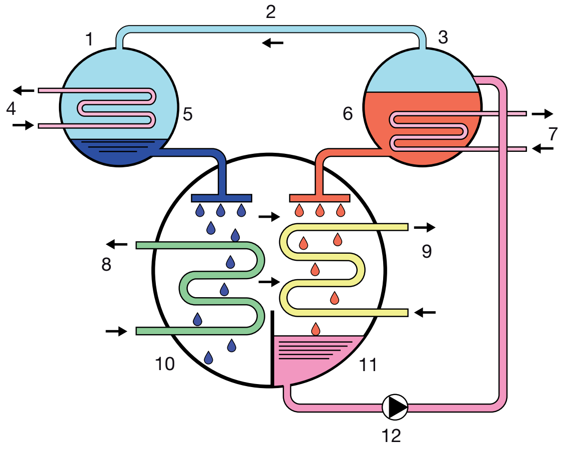
1. Condenser
2. Low-temperature generator
3. Control panel
4. High-temperature generator
5. Cooling water outlet
6. Chilled-water outlet
7. Evaporator
8. Chilled-water inlet
9. Cooling water inlet
10. Absorber
11. Gas train

The absorption cycle

The absorption cooling cycle, like the mechanical vapour compression refrigeration cycle, utilizes the latent heat of evaporation of a refrigerant to remove heat from the entering chilled water. Vapour compression refrigeration systems use a chlorine-based refrigerant and a compressor to transport the refrigerant vapour to be condensed in the condenser. The absorption cycle, however, uses water as the refrigerant and an absorbent lithium bromide solution to absorb the vaporized refrigerant. Heat is then applied to the solution to release the refrigerant vapour from the absorbent. The refrigerant vapour is then condensed in the condenser.

The basic single-effect absorption cycle (see Figure 1) includes generator, condenser, evaporator and absorber with refrigerant (liquid) and lithium bromide as the working solutions. The generator utilizes a heat source (burner, steam or hot water) to vaporize the diluted lithium bromide solution. The water vapour that is released travels to the condenser where it is condensed back into a liquid, transferring the heat to the cooling tower water. Once condensed, the liquid refrigerant is distributed over the evaporator tubes, removing the heat from the chilled water and vaporizing the liquid refrigerant. The concentrated lithium bromide solution from the generator passes into the absorber, absorbs the refrigerant vapour solution from the evaporator and dilutes itself. The diluted lithium bromide solution is then pumped back to the generator where the cycle is started again.

Figure 1 - Simplified absorption cycle

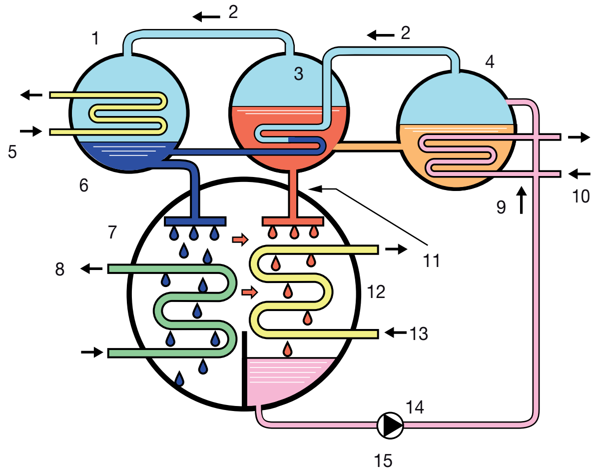


Legend
1. Condenser
2. Refrigerant vapour
3. Generator
4. Cooling water
5. Liquid refrigerant
6. Concentrated solution
7. Heat source
8. Cooling water
9. Chilled water
10. Evaporator
11. Absorber
12. Absorbent pump

Double-effect type

- The generator section is divided into a high-temperature generator and a low-temperature generator. The refrigerant vapour produced by the high-temperature generator is used to heat the LiBr solution in the low-temperature generator in which the pressure (hence the boiling point) is lower. Thus the heat of condensation is effectively utilized.

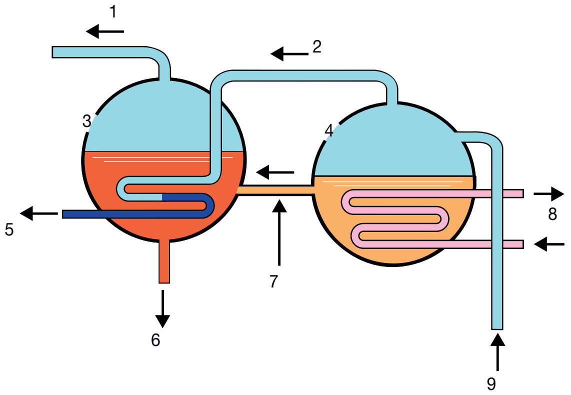
Figure 2 - Double-effect absorption cycle



Legend
1. Condenser
2. Refrigerant vapour
3. Low-temperature generator
4. High-temperature generator
5. Cooling water
6. Liquid refrigerant
7. Evaporator
8. Chilled water
9. Intermediate solution
10. Heat source
11. Concentrated solution
12. Absorber
13. Cooling water
14. Diluted solution
15. Absorbent pump

- As mentioned for the single-effect type, the refrigerant vapour produced by the low-temperature generator is sent to the condenser to become liquid refrigerant. On the other hand, the refrigerant vapour produced by the high-temperature generator turns to water as it releases heat to the intermediate LiBr solution. This happens inside the heat transfer tubes in the low-temperature generator. The refrigerant vapour produced by both low and high-temperature generators turns to refrigerant liquid and mixes in the condenser before returning to the evaporator.

Figure 3 - Detail of generator



Legend
1. Refrigerant vapour to condenser
2. Refrigerant vapour
3. Low-temperature generator
4. High-temperature generator
5. Condensed refrigerant
6. Concentrated solution
7. Intermediate solution
8. Heat source
9. Diluted solution

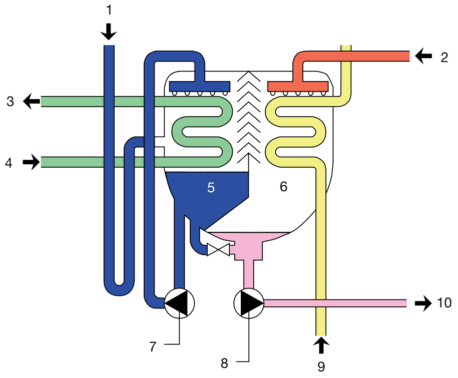
Absorption cooling cycle

■ The Carrier-Sanyo Super Absorption machine applies the same basic absorption principles but enhances the cycle by adding additional heat exchangers and a second generator to recover all the available energy of the system and maximize the unit COP (Figure 2).

The absorption cycle operates in a vacuum. This permits the liquid refrigerant to boil at a lower temperature, transferring the latent heat of evaporation from the entering chilled water to cooling the chilled water.

On the following pages is a component description of the absorption cycle with reference to the Dühring diagram shown in Graph 1 in the chapter “Cooling cycle”.

Figure 4 - Lower shell



Legend
1. Liquid refrigerant
2. Concentrated solution
3. Chilled-water outlet
4. Chilled-water inlet
5. Evaporator
6. Absorber
7. Refrigerant pump
8. Absorbent pump
9. Cooling water inlet
10. Diluted solution

A. Evaporator section

Liquid refrigerant entering the evaporator is dispersed uniformly on the chilled-water evaporator tubes (Figure 4). The low pressure of the evaporator causes the refrigerant to boil, thus vaporizing the refrigerant and causing the latent heat of the vaporized refrigerant to cool the chilled water.

B. Absorber section

Concentrated solution entering the absorber is dispersed uniformly on the cooling water tubes (Figure 4). The concentrated solution in the absorber section absorbs the refrigerant vapour from the evaporator section of the vessel. Cooling water flowing through the absorber section heat transfer tubes extracts the heat generated by this absorption process. The concentrated solution, after absorbing the refrigerant vapour from the evaporator, becomes a diluted solution.

Line A to B in Graph 1 describes the process in the absorber. The concentration of the lithium bromide solution entering the absorber section is 63.5% (all concentration levels and temperatures are approximate). The lithium bromide solution then absorbs the refrigerant vapour from the evaporator section and is cooled from 50°C to 37°C by the cooling water. This causes the bromide solution to become diluted and it then leaves the absorber at a concentration of 57.7% (point B, Graph 1).

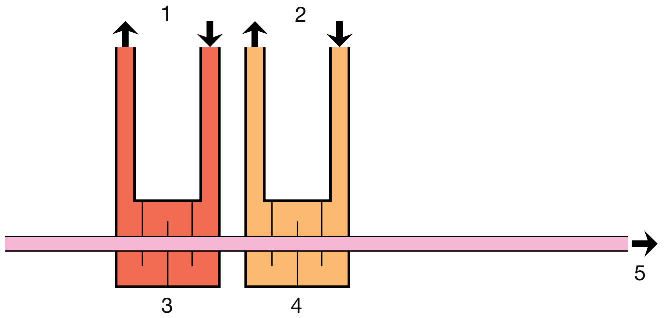
C. Low and high-temperature heat exchangers

The diluted solution, after leaving the absorber section, passes through the low-temperature heat exchanger (see Figure 5) where it is heated by the concentrated solution. The diluted solution then passes through the high-temperature heat exchanger where it is further heated by intermediate solution.

The intermediate and concentrated solutions are cooled by the diluted solution. This cooling process of the concentrated solution allows for greater absorbing power due to its lower temperature.

Line B to C to D’ of Graph 1 shows the temperature rise of the diluted solution in the low and high-temperature heat exchangers.

Figure 5 - Heat exchangers



Legend
1. Concentrated solution
2. Intermediate solution
3. Low-temperature heat exchanger
4. High-temperature heat exchanger
5. Diluted solution

D. High-temperature generator section

The diluted solution from the heat exchangers is heated by the burner or steam upon entering the high-temperature generator and separates into refrigerant vapour and intermediate solution (Figure 6).

Line D’ to E of Graph 1 shows the heating and concentration process in the high-temperature generator. The diluted solution at point D’ is heated at a constant concentration to point D, where the refrigerant vapour is released and the solution becomes concentrated to 60.8% (point E, Graph 1).

Following the intermediate solution, line E to F’ of Graph 1 shows heat transfer from the intermediate solution to the diluted solution in the high-temperature heat exchanger (Figure 5).

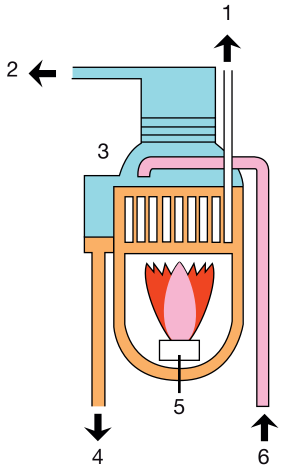
E. Low-temperature generator section

The refrigerant vapour from the high-temperature generator passes through the heat transfer tubes of the low-temperature generator (Figure 7). The intermediate solution from the high-temperature heat exchanger passes to the low-temperature generator where it is heated by the refrigerant vapour. The heated intermediate solution releases additional refrigerant vapour and becomes concentrated to its final level. The condensed refrigerant in the heat transfer tubes and the refrigerant vapour of the low-temperature generator section then flows to the condenser.

Line F’ to F to G of Graph 1 shows the concentration process in the low-temperature generator. The intermediate solution enters the low-temperature generator and is heated by the refrigerant vapour from the high-temperature generator. Additional refrigerant vapour is released and the intermediate solution becomes concentrated into its final concentration level of 63.7% (point G, Graph 1).

Following the concentrated solution, Line G to A’ of Graph 1 shows the process of temperature reduction in the low-temperature heat exchanger by heat transfer to the diluted solution (Figure 5). Line A’ to A shows the temperature reduction of the concentrated solution entering the absorber.

Figure 6 - High-temperature generator



Legend
1. Exhaust gas
2. Refrigerant vapour
3. High-temperature generator
4. Intermediate solution
5. Burner
6. Diluted solution

F. Condenser section

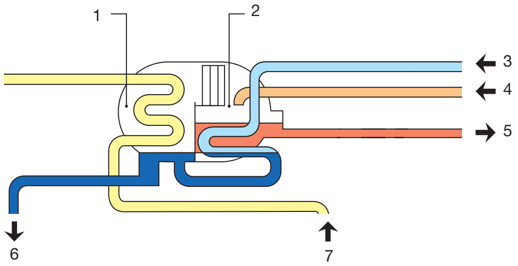
The refrigerant vapour from the low-temperature generator is condensed on the cooling water heat transfer tubes of the condenser (see Figure 7). The cooling water from the absorber flows through the condenser and removes the heat of condensation from the refrigerant vapour from the low-temperature generator section and is rejected to the cooling tower.

The condensed (liquid) refrigerant then flows to the evaporator where the cycle starts again.

G. Refrigerant path and flow

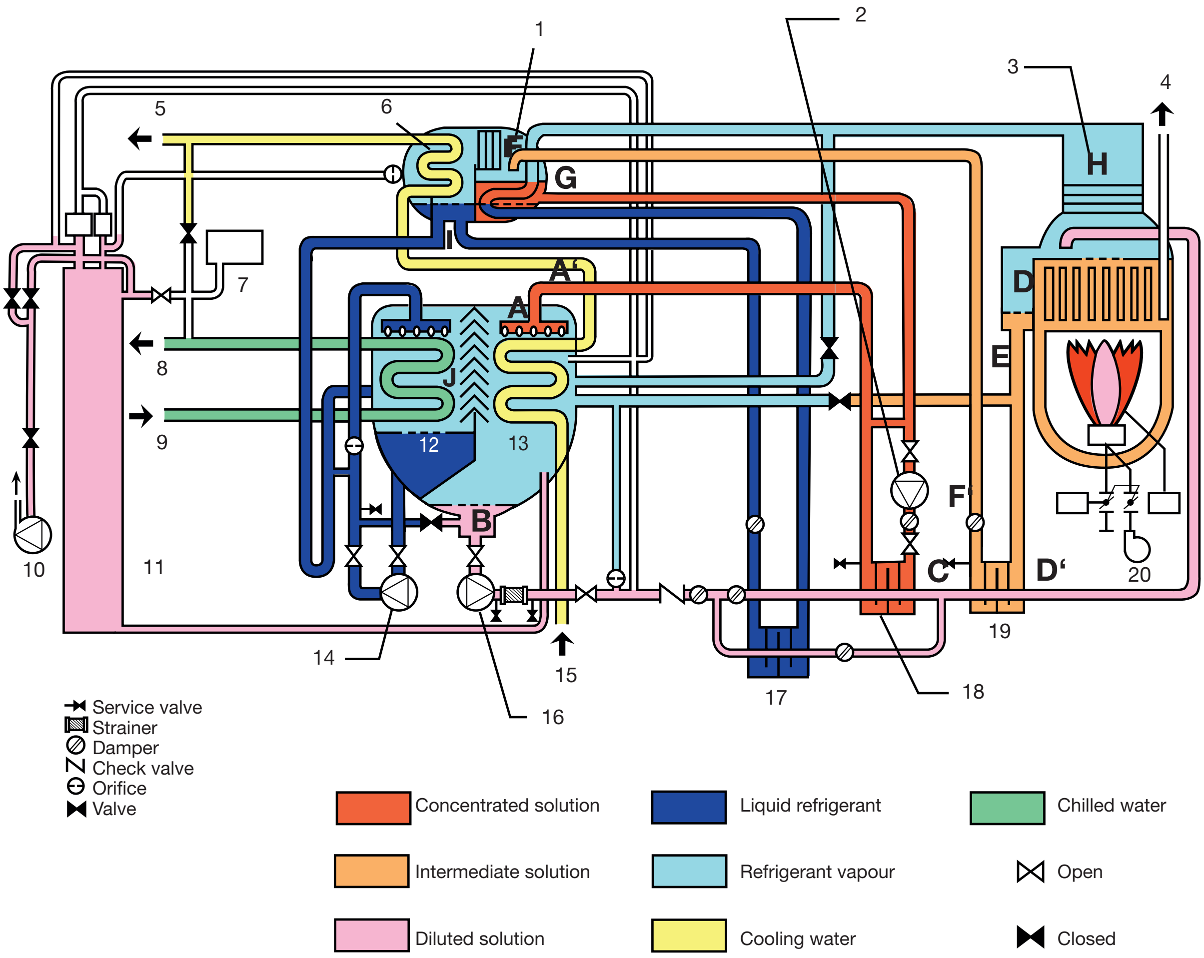
In the high-temperature generator, the heat source separates the refrigerant from the lithium bromide solution.
The lithium bromide solution follows line D to E of Graph 1. Line D to H of Graph 1 follows the refrigerant path and illustrates the change of refrigerant vapour to liquid as it passes through the low-temperature generator. The refrigerant then flows to the condenser (line H to I) where additional heat is removed. In the low-temperature generator additional refrigerant is released from the lithium bromide solution (line F to G); this released refrigerant travels to the condenser (line F to I) where it is condensed into a liquid. Point I represents the combination of liquid refrigerant from both the low-temperature generator and the condenser. The liquid refrigerant flows into the evaporator where it mixes with evaporator refrigerant and is pumped to the evaporator's dispersion trays (line I to J). The refrigerant is dispersed on the evaporator heat transfer tubes and vaporizes; the vapour is absorbed by the concentrated solution in the absorber causing the bromide solution to become diluted (line J to B). The diluted solution flows to the low-temperature heat exchanger (line B to C) where the cycle is repeated.

Figure 7 - Upper shell



Legend
1. Condenser
2. Low-temperature generator
3. Refrigerant vapour
4. Intermediate solution
5. Concentrated solution
6. Liquid refrigerant
7. Cooling water

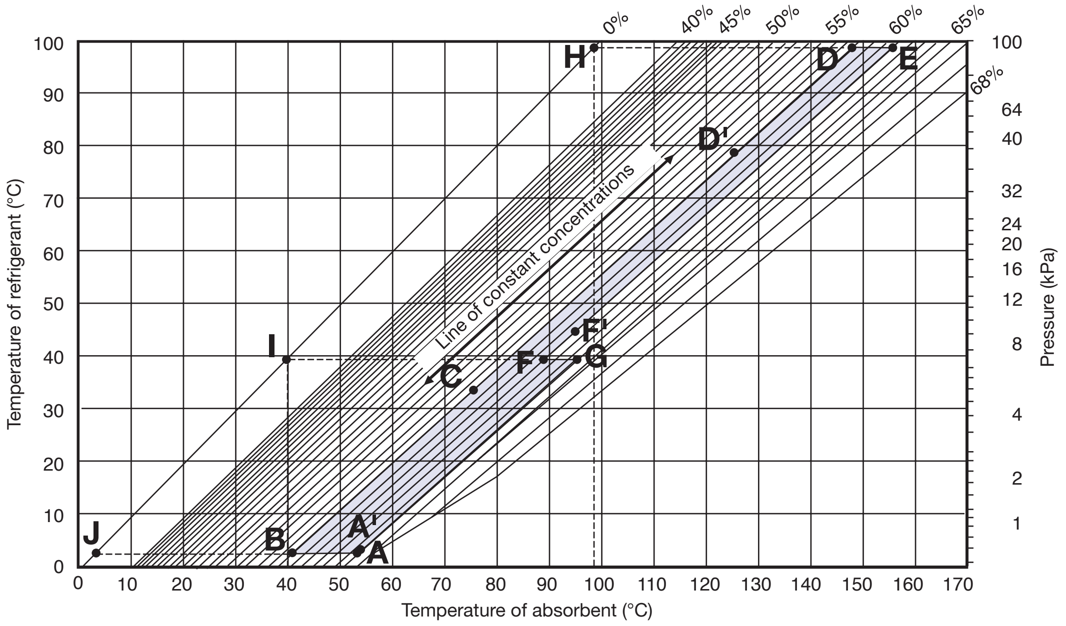
Cooling cycle



Legend

1. Low-temperature generator
2. No. 2 Absorbent pump
3. High-temperature generator
4. Exhaust gas
5. Cooling water outlet
6. Condenser
7. Purge tank
8. Chilled-water outlet
9. Chilled-water inlet
10. Purge pump
11. Purge unit
12. Evaporator
13. Absorber
14. Refrigerant pump
15. Coling water inlet
16. No. 1 Absorbent pump
17. Refrigerant drain heat reclaimer
18. Low-temperature heat exchanger
19. High-temperature heat exchanger
20. Burner

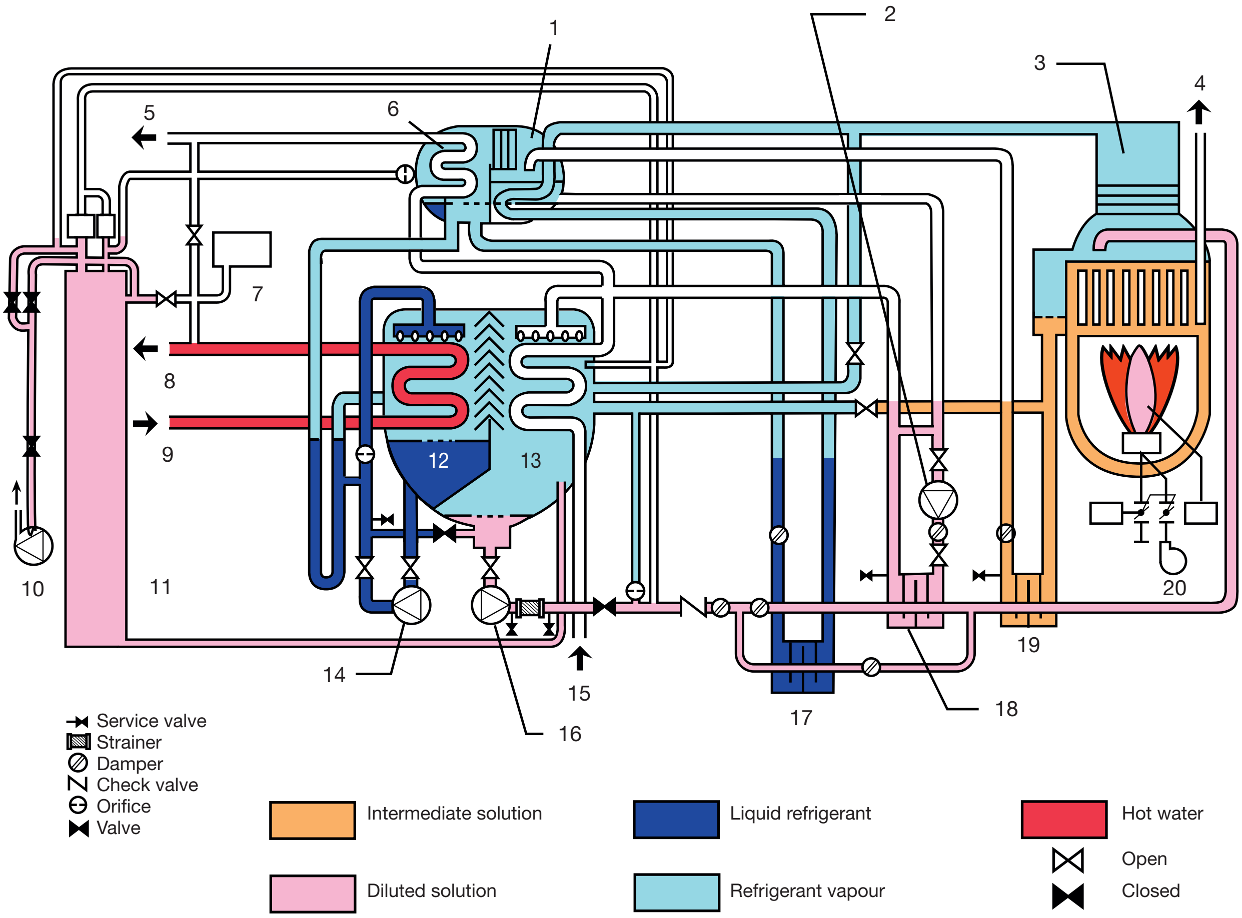
Graph 1 - Dühring diagram



Heating cycle

In the absorption heating cycle the unit is essentially acting as a boiler. Diluted solution is heated in the high-temperature generator releasing refrigerant vapour from the absorbent.

The refrigerant vapour flows to the absorber/evaporator and condenses on the heat transfer tubes of the evaporator. The water through the evaporator heat transfer tubes removes the sensible heat of the condensed refrigerant and transfers the heat to the hot water loop. The condensed refrigerant is mixed with the intermediate solution creating diluted solution. The diluted solution is pumped back to the high-temperature generator where the cycle is started again.



Legend

1. Low-temperature generator
2. No. 2 Absorbent pump
3. High-temperature generator
4. Exhaust gas
5. Coling water outlet
6. Condenser
7. Purge tank
8. Chilled-water outlet
9. Chilled-water inlet
10. Purge pump
11. Purge unit
12. Evaporator
13. Absorber
14. Refrigerant pump
15. Cooling water inlet
16. No.1 Absorbent pump
17. Refrigerant drain heat reclaimer
18. Low-temperature heat exchanger
19. High-temperature heat exchanger
20. Burner

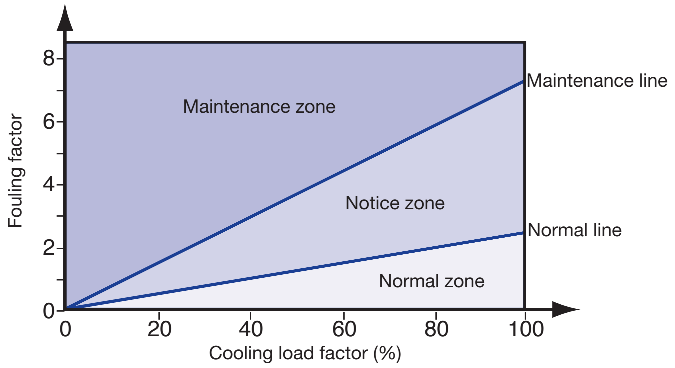
Chiller features

Expert self-diagnosis function

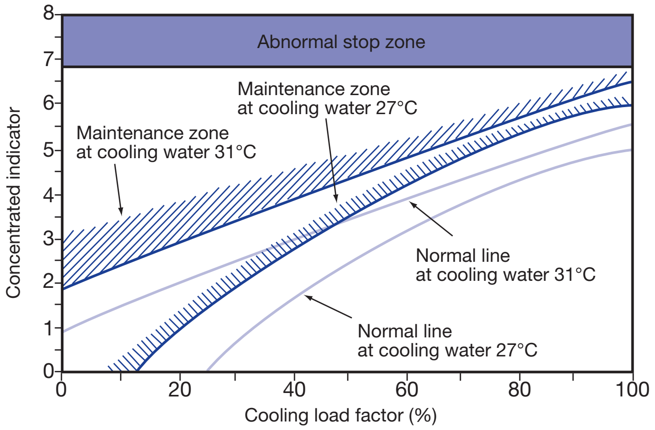
- The expert function is provided to monitor operating conditions, predict chiller information and maintain stable operation.

Predictive maintenance information

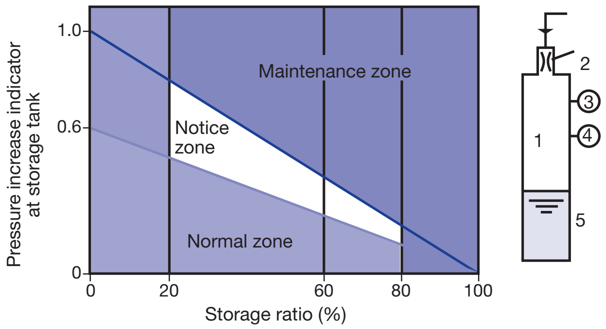
Graph 2 - Fouling of heat transfer tubes in cooling water system



Graph 3 - Trend of absorbent concentration



Graph 4 - Vacuum condition monitoring



Legend

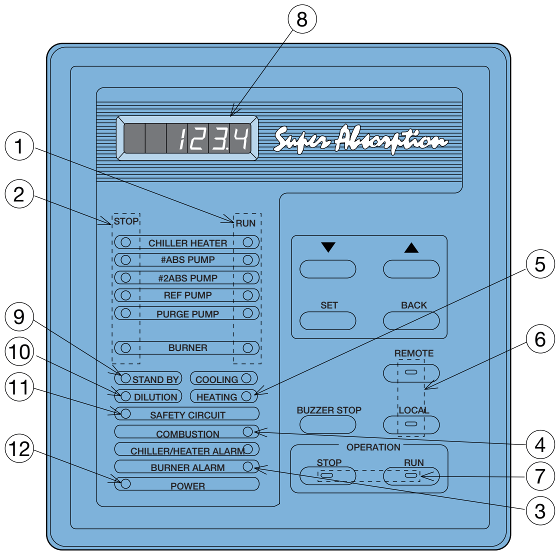
1. Storage tank
2. Diluted solution
3. Purge nozzle
4. Pd cell
5. Pressure sensor

Carrier-Sanyo control system

- The Carrier-Sanyo control system surpasses other proportional only control systems available today. The digital PID (proportional plus integral plus derivative) control maximizes unit performance by maintaining a ±0.5 K variance in leaving chilled-water temperature from the setpoint. Proportional controls can typically only maintain a ±1 K variance from the setpoint. The controller's innovative design also incorporates the ability to start and stop the system chilled/hot and cooling water pumps. During shutdown these pumps are sequenced to ensure a complete dilution cycle.
- The leaving chilled-water temperature is measured every five seconds and fuel input is changed according to the gradient of the leaving chilled-water temperature curve. System temperatures, setpoints, and operational records are displayed along with indicator lights for the chiller, pumps and burner.
- The Carrier-Sanyo control system offers its users self-diagnostics by constantly monitoring the chiller status and will automatically shut the chiller down should a fault occur. The cause of shutdown will be retained in memory and can be displayed for immediate operator review. The controller's memory will also retain and display the cause of the last three system fault conditions. This method of retaining fault conditions is extremely useful for maintaining an accurate record of unit performance and fault history.

Display and control board

Figure 8 - Indication lights



Legend

	Name	Light Color
1.	Operation indication light	Green
2.	Stop indication light	Orange
3.	Alarm indication light	Red
4.	Combustion indication light	Green
5.	Cooling/heating indication light	Green
6.	Remote/local select button with LED	Green
7.	Operation select button with LED	Green
8.	Data display	7-segment LED (Red)
9.	Stand-by indication light	Green
10.	Dilution indication light	Green
11*.	Safety circuit indication light	Green
12*.	Power indication light	Orange
GL*.	Purge indication light	Green
43P.	Purge pump on - off switch	
43ES.	Emergency stop switch	

* On the control panel door, see p. 22

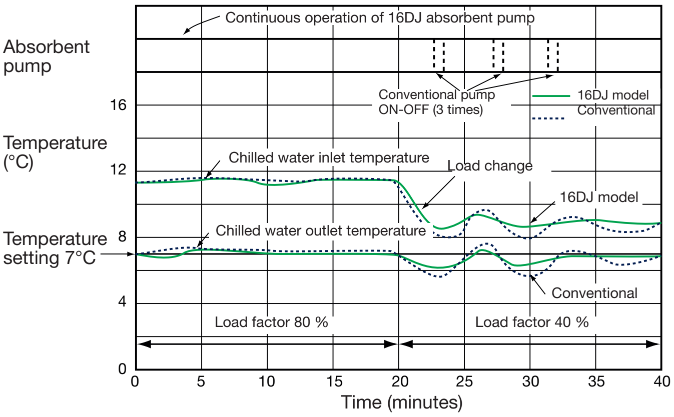
Fast digital PID control

- The introduction of new digital PID control to the J-model stabilizes the chilled/hot-water temperature with higher accuracy than the previous E-model. It quickly responds to the load fluctuation and supplies stable chilled/hot-water temperature. It is suitable for airconditioning of intelligent buildings which require sophisticated control.

Control of high-temperature generator using solution level control

- With the new control system, the solution flow rate is precisely controlled so that the solution level of the high-temperature generator is maintained at a certain level.
- Control accuracy has been substantially increased through the use of absorbent pump inverter control. This enables the supply of a more stable temperature for chilled/hot water compared to conventional models.

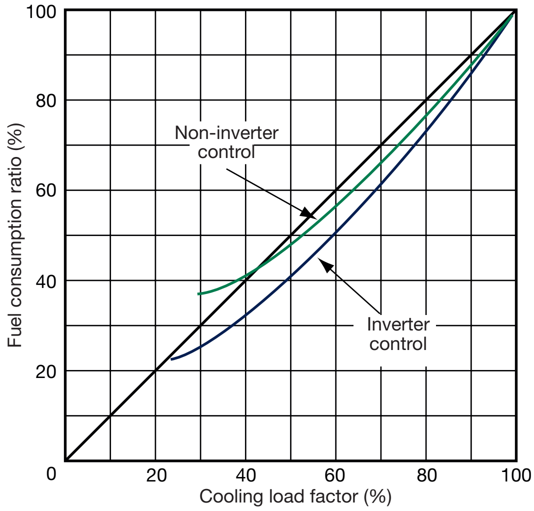
Graph 5 - Fast PID control (gas-fired)



Saving energy with the inverter

- Balancing the load and flow rate with the absorbent pump's inverter control enables efficient and energy-saving operation. As a result, it reduces input energy and electric power consumption. Running cost is decreased by 5% compared to non-inverter control.

Graph 6 - Running cost curve



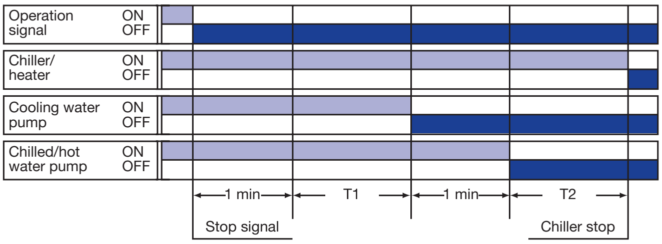
1. Chilled-water outlet temperature 7°C constant
2. Cooling water inlet temperature:

Load factor (%)	Temperature (°C)
100	32
50	27
30	25

Microprocessor monitoring substantially reduces the optimum dilution cycle period

- This results in the appropriate dilution cycle operating hours.

Graph 7 - Dilution cycle chart



T1: Counts the time until generator temperature goes down to 120°C (about 4 to 20 minutes)
T2: Determines the time by generator temperature (about 5 to 10 minutes)

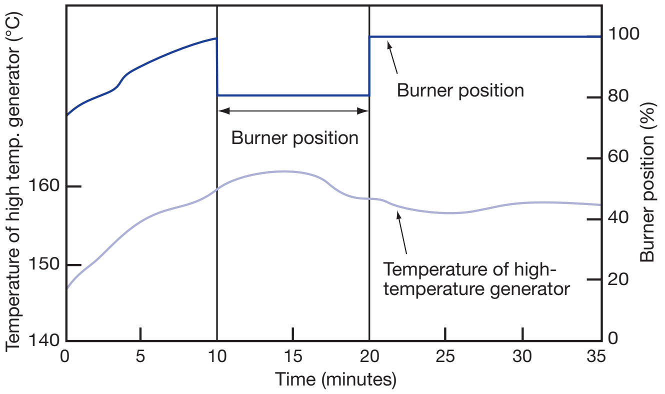
Purge system

- The high-performance purge system maintains the required operating pressure, preserves chiller performance characteristics, minimizes chiller maintenance to one purge operation per season (for year-round operation).

High-temperature generator safety control

- When the temperature of the high-temperature generator is higher than a certain level, gas consumption is controlled to sustain safe operation.
- Using cooling water safety control and absorbent crystallization protection control, the safe operating zone is broadened.

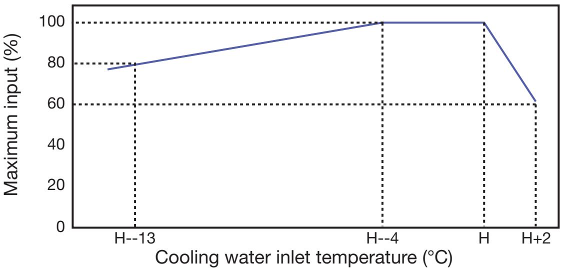
Graph 8 - Safe operation control chart



Expansion of safe operating zone

- This ensures quick response to rapid changes and maintains stable operation.
- The safe operating zone is between 19°C and 34°C cooling water temperature (for a nominal cooling water entering temperature of 32°C)

Graph 9 - Safe operating zone chart



(H = 32°C (variable from 20°C to 33°C)

Crystallization protection

- A microprocessor monitors the absorbent concentration. Heating supply is stopped, and the unit is returned to normal operation, when the concentration is over a certain limit, to prevent the crystallization of absorbent.

Heavy-duty unit

- Designed for 4000 hours per year for 15 years of operation.
- Absorbent and refrigerant pumps with isolation valves and bearing wear monitor sensor function (control by vibration).

Technical data

Double-effect direct-fired absorption chillers/heaters

16DJ		**11**	**12**	**13**	**14**	**21**	**22**	**23**	**24**	**31**	**32**	**41**	**42**	**51**	**52**	**53**
Cooling capacity	kW	352	422	527	633	738	844	985	1125	1266	1407	1582	1758	1969	2215	2461
Heating capacity	kW	268	322	403	483	564	644	751	859	966	1074	1208	1342	1503	1691	1879
Chilled-water system*																
Flow rate	l/s	15.1	18.2	22.7	27.3	31.8	36.3	42.4	48.4	54.5	60.6	68.1	75.7	84.8	95.4	106.0
Pressure drop	kPa	70	71	90	94	85	89	61	65	69	72	62	65	56	75	98
Connection (ANSI)	inch	4	4	4	4	5	5	6	6	6	6	8	8	8	8	8
Retention volume	m^3	0.12	0.13	0.15	0.17	0.22	0.24	0.28	0.30	0.34	0.36	0.46	0.48	0.65	0.71	0.77
Hot-water system**																
Flow rate	l/s	15.1	18.2	22.7	27.3	31.8	36.3	42.4	48.4	54.5	60.6	68.1	75.7	84.8	95.4	106.0
Pressure drop	kPa	70	71	90	94	85	89	61	65	69	72	62	65	56	75	98
Connection (ANSI)	inch	4	4	4	4	5	5	6	6	6	6	8	8	8	8	8
Retention volume	m^3	0.12	0.13	0.15	0.17	0.22	0.24	0.28	0.30	0.34	0.36	0.46	0.48	0.65	0.71	0.77
Cooling water system*																
Flow rate	l/s	25.2	30.3	37.9	45.4	53.0	60.6	70.7	80.7	90.8	100.9	113.6	126.2	141.3	159.0	176.6
Pressure drop	kPa	33	36	50	56	43	46	88	94	76	80	85	89	68	92	121
Connection (ANSI)	inch	5	5	5	5	6	6	8	8	8	8	10	10	12	12	12
Retention volume	m^3	0.31	0.34	0.38	0.42	0.53	0.58	0.63	0.69	0.89	0.95	1.11	1.19	1.87	2.01	2.14
Fuel type		Natural gas														
Supply gas pressure	mbar	135	135	135	135	135	135	135	135	135	135	300	300	300	300	300
Cooling consumption***	kW	320	384	479	575	671	767	895	1023	1151	1279	1438	1598	1790	2014	2237
Heating consumption***	kW	320	384	479	575	671	767	895	1023	1151	1279	1438	1598	1790	2014	2237
Gas connection (ANSI)	inch	1	1	1	1-1/2	1-1/2	1-1/2	2	2	2	2	2	2	2	2-1/2	2-1/2
Flue connection	mm	280	280	280	280	310	310	310	310	360	360	410	410	350	350	350
	mm	210	210	210	210	310	310	310	310	310	310	310	310	500	500	500
Length (L)	mm	3080	3080	3810	3810	3980	3980	4980	4980	5000	5000	5040	5040	5310	5850	6350
Width (W)	mm	1810	1810	1910	1910	2090	2090	2130	2130	2290	2290	2490	2490	2990	2990	2990
Height (H)	mm	1960	1960	1960	1960	2160	2160	2160	2160	2390	2390	2600	2600	2900	2900	2900
Tube removal space	mm	2400	2400	3400	3400	3400	3400	4500	4500	4500	4500	4500	4500	4600	5200	5700
Operating weight	kg	5200	5500	6600	7100	8300	8800	10100	10700	13200	13900	16300	17100	22800	24600	26300
Max. shipping weight	kg	4800	5100	6100	6500	7600	8000	9200	9700	12000	12600	14700	15400	20100	21700	23300
Total shipping weight	kg	4800	5100	6100	6500	7600	8000	9200	9700	12000	12600	14700	15400	20100	21700	23300
Shipping method		One-piece														
Power supply		400 V - 3 phase - 50 Hz														
Apparent power	kVA	7.0	7.0	7.0	10.9	10.9	10.9	12.8	12.8	12.8	12.8	17.5	22.3	23.7	23.7	23.7
Total electric current	A	10.8	10.8	10.8	16.3	16.3	16.3	19.2	19.2	19.2	19.2	26.0	32.9	34.9	34.9	34.9
No.1 absorbent pump	kW	1.3	1.3	1.3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	6.2	6.2	6.2	6.2
	A	3.5	3.5	3.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	14.5	14.5	14.5	14.5
No. 2 absorbent pump	kW	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	1.5	1.5	1.5	1.5	1.5
	A	1.35	1.35	1.35	1.35	1.35	1.35	1.5	1.5	1.5	1.5	4.7	4.7	4.7	4.7	4.7
Rerfrigerant pump	kW	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
	A	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.35	1.35	1.35	1.35	1.35
Purge pump	kW	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	A	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Burner motor	kW	0.76	0.76	0.76	1.4	1.4	1.4	3.0	3.0	3.0	3.0	4.5	4.5	5.5	5.5	5.5
	A	2.1	2.1	2.1	3.5	3.5	3.5	6.0	6.0	6.0	6.0	9.5	9.5	11.5	11.5	11.5
Pd cell heater	W	38	38	76	76	76	76	152	152	152	152	152	152	152	152	152
Control circuit	W	600	600	600	600	600	600	700	700	700	700	700	700	700	700	700

Legend

* Cooling as per ARI 560 2000
12.2 —> 6.7°C (fouling factor = 0.0176 m^2 K/kW)
29.4 —> 35.3°C (fouling factor = 0.044 m^2 K/kW)

** Heating
55.8 —> 60°C (fouling factor = 0.0176 m^2 K/kW)

*** Consumption in Nm^3/h of gas = $\frac{\text{Consumption (kW)}}{\text{High gas calorific value (kW/h/Nm3)}}$

For selection outside of above operating conditions please contact Carrier.

Technical data

(Continued)

16DJ		**61**	**62**	**63**	**71**	**72**	**73**	**81**	**82**
Coling capacity	kW	2813	3165	3516	3868	4220	4571	4923	5274
Heating capacity	kW	2147	2415	2684	2952	3221	3489	3757	4026
Chilled-water system*									
Flow rate	l/s	121.1	136.3	151.4	166.5	181.7	196.8	212.0	227.1
Pressure drop	kPa	69	91	120	74	94	116	94	115
Connection (ANSI)	inch	10	10	10	12	12	12	14	14
Retention volume	m^3	0.99	1.06	1.13	1.41	1.51	1.61	1.83	1.94
Hot-water system**									
Flow rate	l/s	121.1	136.3	151.4	166.5	181.7	196.8	212.0	227.1
Pressure drop	kPa	69	91	120	74	94	116	94	115
Connection (ANSI)	inch	10	10	10	12	12	12	14	14
Retention volume	m^3	0.99	1.06	1.13	1.41	1.51	1.61	1.83	1.94
Cooling water system*									
Flow rate	l/s	201.9	227.1	252.3	277.6	302.8	328.0	353.3	378.5
Pressure drop	kPa	83	112	146	90	115	142	117	142
Connection (ANSI)	inch	14	14	14	16	16	16	16	16
Retention volume	m^3	2.79	2.97	3.15	3.67	3.90	4.11	4.51	4.76
Fuel type		Natural gas							
Supply gas pressure	mbar	300	300	300	300	300	300	300	300
Cooling consumption***	kW	2557	2877	3196	3516	3836	4155	4475	4795
Heating consumption***	kW	2557	2877	3196	3516	3836	4155	4475	4795
Gas connection (ANSI)	inch	2-1/2	2-1/2	3	3	4	4	4	4
Flue connection	mm	400	400	400	400	400	400	400	400
	mm	620	620	620	900	900	900	900	900
Length (L)	mm	6110	6600	7130	6490	7020	7520	7010	7510
Width (W)	mm	3250	3250	3250	4100	4100	4100	4450	4450
Height (H)	mm	3330	3330	3330	3450	3450	3450	3650	3650
Tube removal	mm	5200	5700	6200	5700	6200	6700	6200	6700
Operating weight	kg	32700	35200	37900	46100	49500	52500	57200	60200
Max. shipping weight	kg	17600	18800	19900	23100	24700	25900	27800	29200
Total shipping weight	kg	29300	31400	33900	41500	44400	48100	51400	54000
Shipping method		Two-piece							
Power supply		400 V - 3 phase - 50 Hz							
Apparent power	kVA	28.2	33.2	38.8	40.1	40.1	45.7	47.1	47.1
Total electric current	A	41.4	48.7	56.7	58.7	58.7	66.8	68.8	68.8
No. 1 absorbent pump	kW	6.2	8.5	8.5	8.5	8.5	8.5	8.5	8.5
	A	14.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
No. 2 absorbent pump	kW	1.5	1.5	1.5	1.5	1.5	3.7	3.7	3.7
	A	4.7	5.0	5.0	5.0	5.0	11.0	11.0	11.0
Refrigerant pump	kW	0.3	0.3	0.3	0.75	0.75	1.2	1.2	1.2
	A	1.35	1.35	1.35	2.5	2.5	4.6	4.6	4.6
Purge pump	kW	0.4	0.4	0.4	0.75	0.75	0.75	0.75	0.75
	A	1.1	1.1	1.1	1.9	1.9	1.9	1.9	1.9
Burner motor	kW	9.0	9.0	13.5	13.5	13.5	13.5	14.0	14.0
	A	18.0	18.0	26.0	26.0	26.0	26.0	28.0	28.0
Pd cell heater	W	152	152	152	152	152	152	152	152
Control circuit	W	700	700	700	700	700	700	700	700

Legend

* Cooling as per ARI 560 2000
12.2 —> 6.7°C (fouling factor = 0.0176 m^2 K/kW)
29.4 —> 35.3°C (fouling factor = 0.044 m^2 K/kW)

** Heating
55.8 —> 60°C (fouling factor = 0.0176 m^2 K/kW)

*** Consumption in Nm^3/h of gas = $\frac{\text{Consumption (kW)}}{\text{High gas calorific value (kW/h/Nm3)}}$

For selection outside of above operating conditions please contact Carrier.

Scope of supply

1. **Standards met**
   The units comply with the following standards:
   - ARI 560-2000
   - 89/382/EEC (machine directive)
   - 73/23/EEC (low-voltage directive)
   - 89/336/EEC (electromagnetic compatibility directive)
   - 97/23/EC (pressure equipment directive)
   - 90/396/EEC (gas directive)

2. **Absorption chillers/heaters**
   1. Lower shell
      - Evaporator and refrigerant dispersion tray
      - Absorber and absorbent dispersion tray
      - Eliminators

   2. Heat exchangers
      - High-temperature (HT) heat exchanger
      - Low-temperature (LT) heat exchanger
      - Refrigerant drain heat reclaimer

   3. Upper shell
      - Low-temperature (LT) generator
      - Condenser
      - Eliminators

   4. High-temperature (HT) generator

   5. Burner and gas train
      - Dual fuel burner as option

   6. Pumps
      - Absorbent pump(s) with isolating valves
      - Refrigerant pump with isolating valves
      - Purge pump

   7. Control panel
      - Controller with data display.
      - LEDs and operation keys
      - Inverter for absorbent pump
      - Circuit breaker
      - Transformer
      - Purge pump operation switch

   8. Locally mounted controls and instruments
      - Temperature sensor
      - HT generator solution level electrodes
      - HTgenerator pressure gauge

   9. Purge device
      - Purge tank
      - Ejector and liquid trap
      - Piping and various manual valves
      - Palladium cell with heater

   10. Interconnecting piping and wiring

   11. Initial charge
       - Absorbent (lithium bromide)
       - Refrigerant
       - Inhibitor

   12. Paint finish
       - Main unit: rust preventive paint
       - Control panel: finish paint

   13. Rupture disk and counter flange

   14. Accessories
       - Operation manual: one set
       - Washer (for fixing foundation bolts): one set
       - Gasket and sealant for rupture disk: one set

3. **Factory test**
   Tests below are carried out in the Carrier-Sanyo factory.
   1. Check of external dimensions
   2. Leak test (vacuum side and gas train)
   3. Hydraulic test of water headers
   4. Electric insulation resistance test
   5. Dielectric breakdown test
   6. Function test of electric circuit and safety devices

4. **Scope of supply of the purchaser**
   1. Unloading, transportation, and insurance depend on the individual sales contract between your company and Carrier-Sanyo group.
   2. Foundations with foundation bolts.
   3. External chilled/hot water, cooling water, fuel gas and flue piping work including various safety valves, isolating valves, etc.
   4. Piping and tank etc., if necessary.
   5. External wiring and piping for the chillers including necessary parts.
   6. Insulation for the chillers including necessary parts.
   7. Mating flanges, gaskets, bolts and nuts
      - Gas inlet nozzle flange of gas train.
      - Exhaust gas outlet nozzle flange.
      - Inlet/outlet nozzle flanges of chilled/hot water (evaporator)
      - Inlet/outlet nozzle flanges of cooling water (absorber/condenser)
   8. Paint finish of the chillers.
   9. Cooling water inlet temperature control device.
   10. Various temperature/pressure gauges for gas and water lines.
   11. Cooling tower(s), chilled water pump(s), hot water pump(s) and cooling water pump(s) and auxiliary accessories.
   12. Electric power supply (specified value).
   13. Supply of chilled water, cooling water, hot water and gas at rated conditions.
   14. Necessary tools, labour and materials for installation and site test operation.
   15. After-sales service and periodical maintenance of the chillers.
   16. Any other item not specifically mentioned in the scope of supply.

Scope of order

Item	Standard	Option
Chilled water		
Temperature	Entering: 12.2°C. Leaving: 5°C through 12°C Leaving: 6.7°C. Temperature difference 3 K through 10 K	
Flow rate	0.043 l/s x kW Changes depending on chilled water temperature difference (min. 50%)	
Hot water		
Temperature	Entering: 55.8°C. Max. leaving temperature: 60°C Leaving: 60.0°C	
Flow rate	0.043 l/s x kW. Flow rate should correspond to chilled water flow rate	
Rank up	DJ-11 through 42: max. 2 rank ups DJ-53 through 81: max. 1 rank up	
Max. working pressure	1034 kPa	1586 kPa, 206 8 kPa
Hydraulic test pressure	Max. working pressure x 1.5	Max.working pressure x 1.5
Fouling factor	0.018 m^2 K/kW	Max. 0.18 m^2 K/kW
Tube material	Copper tube	CuNi tube
Water quality	Refer to JRA-GL02E-1994	No option
Structure of water header	Removable type and epoxy treated	No option
Manufacturing standard of water header	Carrier-Sanyo standard	Non standard number of passes
Cooling water		
Temperature	Entering: 29.4°C, Entering: 20°C through 33°C Leaving: 35.3°C, Temperature difference 3 K through 7 K	
Flow rate	0.072 l/s x kW. Within water flow rare range of each model	
Max. working pressure	1034 kPa	1586 kPa, 2068 kPa
Hydraulic test pressure	Max. working pressure +196 kPa x 1.5	Max. working pressure x 1.5
Fouling factor	0.044 m^2 K/kW	Max. 0.18 $m^{2\circ}$C/kW
Tube material	Copper tube	Cu Ni tube
Water quality	Refer to JRA-GL02E-1994	No option
Structure of water header	Hinged type and epoxy treated	
Manufacturing standard of water header	Carrier-Sanyo standard	
Fuel		
Fuel type	Natural gas	LPG, kerosene, Diesel oil, different pressures
Supply gas pressure	Refer to specification table	Contact Carrier-Sanyo representative
Electricity		
Nox	80 mg/m^3 80 ppm (02 = 0%)	Contact Carrier-Sanyo representative
Voltage - phase - frequency	400 V - 3 phase - 50 Hz	
	(Voltage control within ±10%, frequency control within ±5%)	Contact Carrier-Sanyo representative
Shipment	One section: DJ-11 through DJ-53 Two sections: DJ-61 through DJ-82	Multi-shipment
Control		
Safety functions	Refrigerant temperature Chilled water freeze protection Chilled water flow switch Hot water temperature Cooling water temperature HT generator temperature HT generator pressure HT generator solution level Exhaust gas temperature Crystallization protection Motor protection	Cooling water flow switch
Capacity control	Digital PID control by chilled-water temperature Inverter control of No. 1 absorber pump	No option
Parts	Selected by Carrier-Sanyo	No option
Control panel		
Paint finish	Munsell 5Y-7/1	No option
Indication lights	Operation	No option
	Stop	No option
	Alarm	No option
Display	LED	No option
External terminals (volt-free normally open contact)	Operation indication Stop indication Alarm indication Ventilation fan operation Feedback indication Combustion indication Cooling mode indication Heating mode indication	No option
Structure	Indoor type	No option
Parts	Selected by Carrier-Sanyo	No option
Electrical wiring and piping	Wire: 600 V grade polyvinyl chloride-insulated wires	No option
	Pipe: Plicatube (flexible metal conduits)	No option
Insulation condition		
Location	Indoor	No option
Ambient temperature	5°C through 40°C	No option
Ambient humidity	Relative humidity: Max. 90 % at 45°C	No option
Atmosphere	Be sure the following are not present - Corrosive gas - Explosive gas - Poisonous gas	No option

Pass arrangement

16DJ	Evaporator			Absorber			Condenser		
	Min.	Standard	Max.	Min.	Standard	Max.	Min.	Standard	Max.
11	2	4	6	2	3	4	1	2	2
12	2	4	6	2	3	4	1	2	2
13	2	3	4	2	2	3	1	1	2
14	2	3	4	2	2	3	1	1	2
21	2	3	4	2	2	3	1	1	2
22	2	3	4	2	2	3	1	1	2
23	2	2	4	2	2	3	1	1	2
24	2	2	4	2	2	3	1	1	2
31	2	2	4	2	2	3	1	1	2
32	2	2	4	2	2	3	1	1	2
41	2	2	4	2	2	3	1	1	2
42	2	2	4	2	2	3	1	1	2
51	2	2	4	2	2	3	1	1	2
52	2	2	4	2	2	3	1	1	2
53	2	2	4	2	2	3	1	1	2
61	2	2	4	2	2	3	1	1	2
62	2	2	4	2	2	3	1	1	2
63	2	2	4	2	2	3	1	1	2
71	2	2	4	2	2	3	1	1	2
72	2	2	4	2	2	3	1	1	2
73	2	2	4	2	2	3	1	1	2
81	2	2	4	2	2	3	1	1	2
82	2	2	4	2	2	3	1	1	2

NOTE: The drawings shown on following pages are for the standard number of passes. For applications outside the nominal conditions of this catalogue, computer selection software can automatically select the most appropriate number of passes.

Dimensional drawings, (mm)

16DJ 11 through 16DJ 12

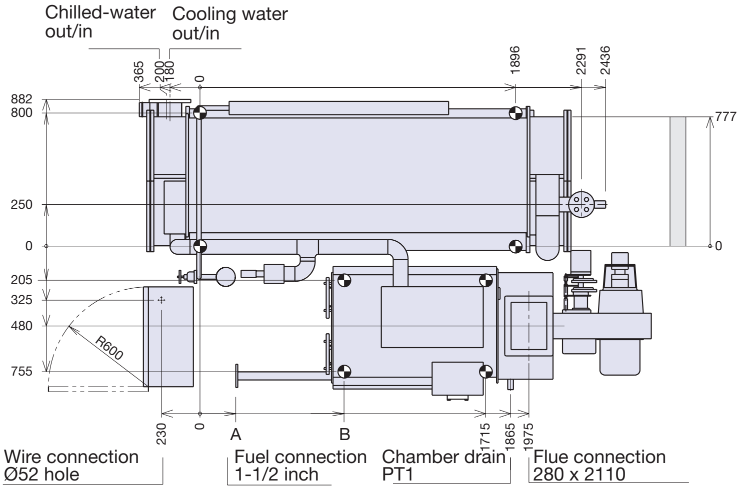
NOTES

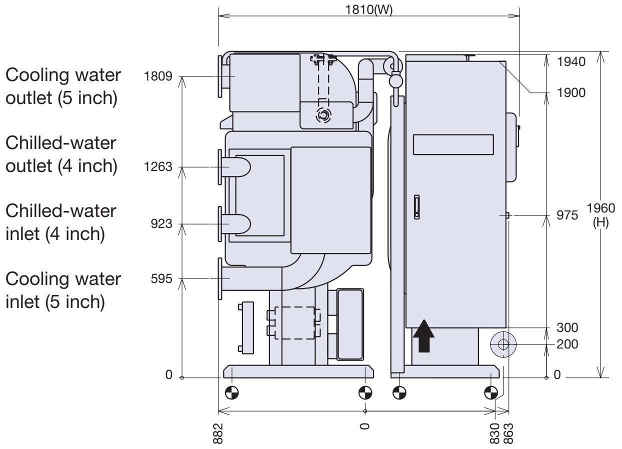
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:

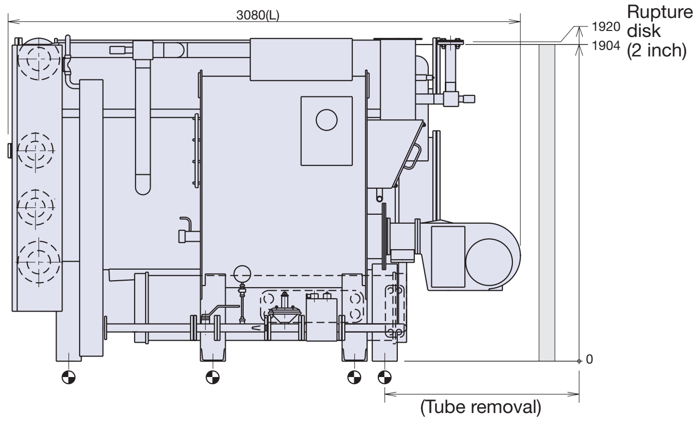
Ends	1000 mm
Top	200 mm
Others	500 mm

6. For the fuel connection diameter and position, refer to the specifications.

16DJ	A	B
11	215	865
12	15	665



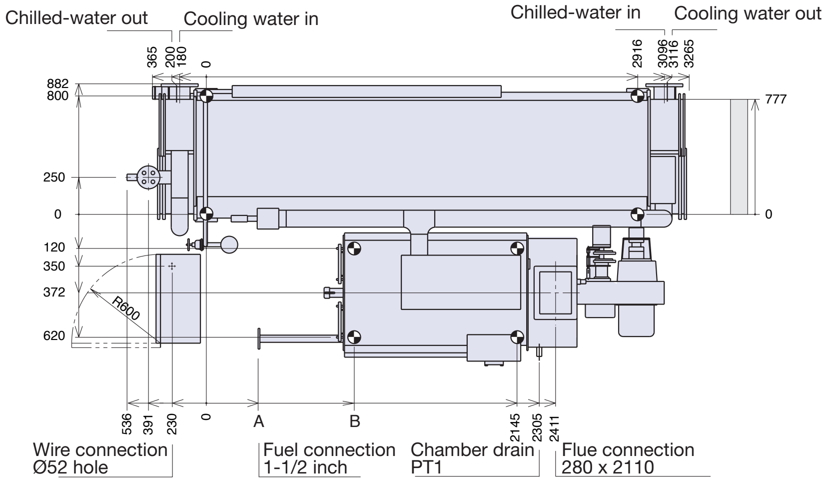


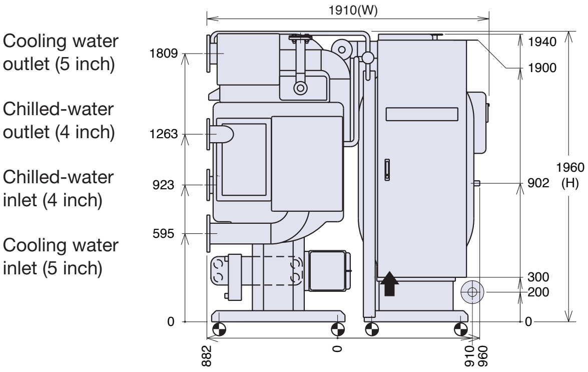


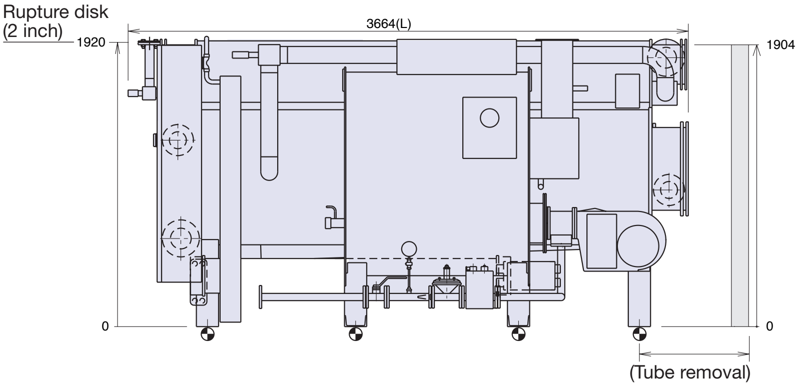
Dimensional drawings, mm (continued)

16DJ 13 through 16DJ 14

16DJ	A	B
13	350	1000
14	150	800







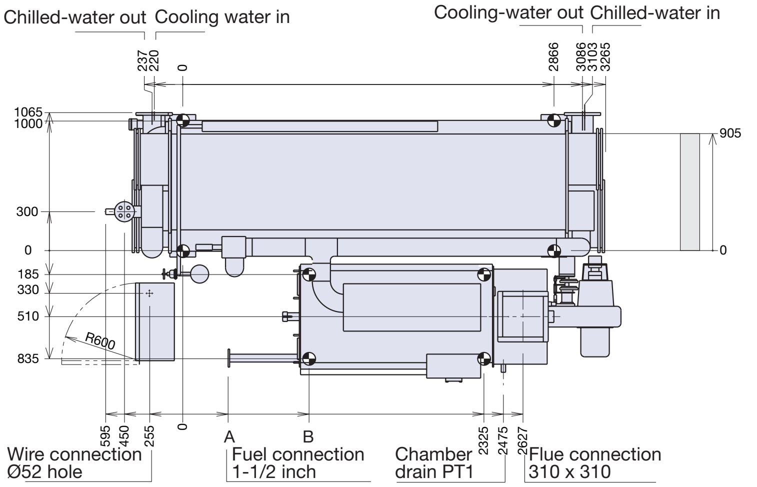
16DJ 21 through 16DJ 22

NOTES

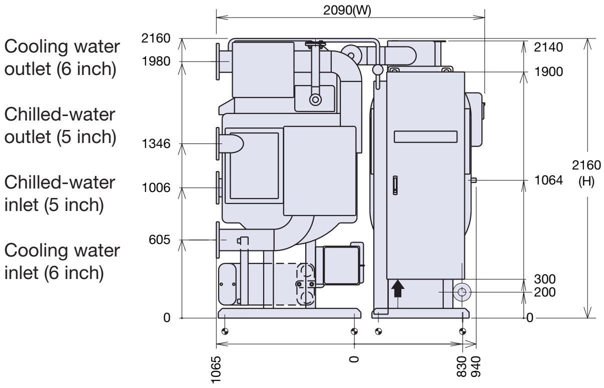
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◐ indicates the position of anchor bolts.
3. All external water piping must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:

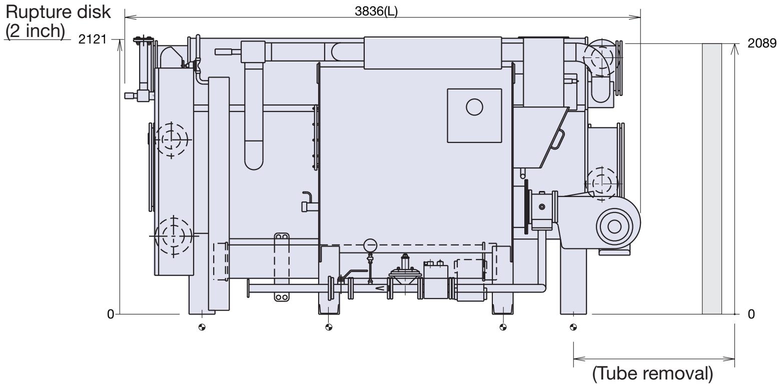
Ends	1000 mm
Top	200 mm
Others	500 mm

6. For the fuel connection diameter and position, refer to the specifications.



16DJ	A	B
21	350	975
22	150	775

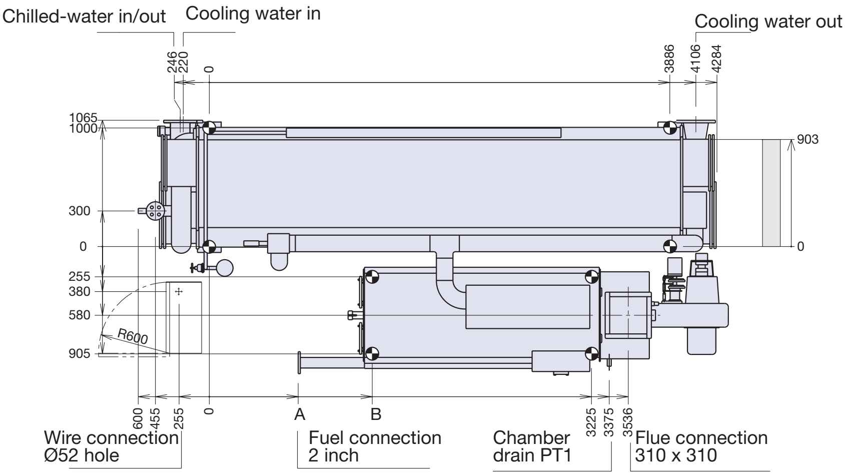




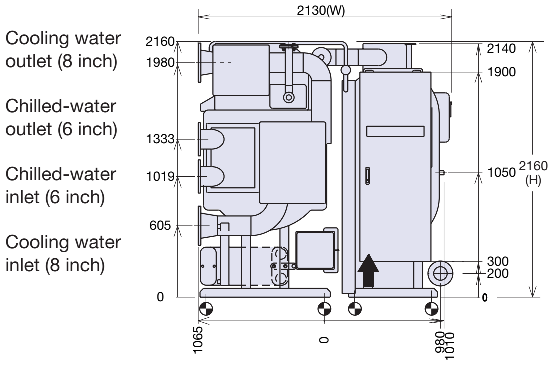
NOTE: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.

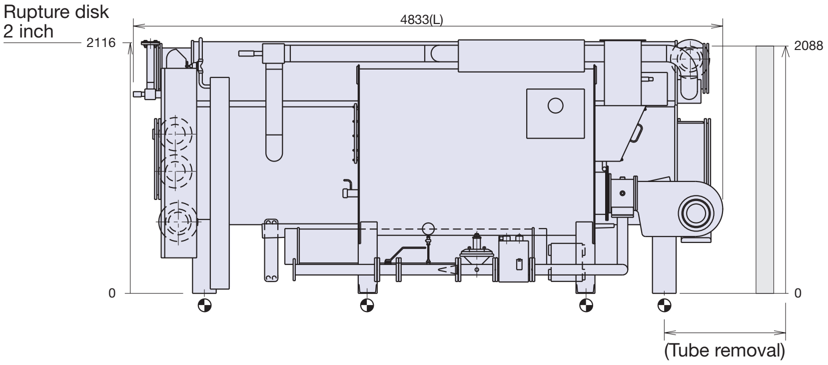
Dimensional drawings, mm (continued)

16DJ 23 through 16DJ 24



16DJ	A	B
23	750	1735
24	550	1775





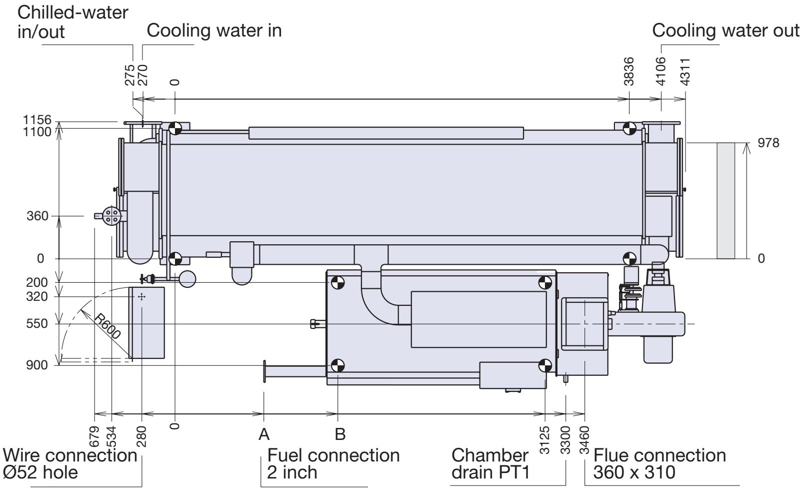
16DJ 31 through 16DJ 32

NOTES

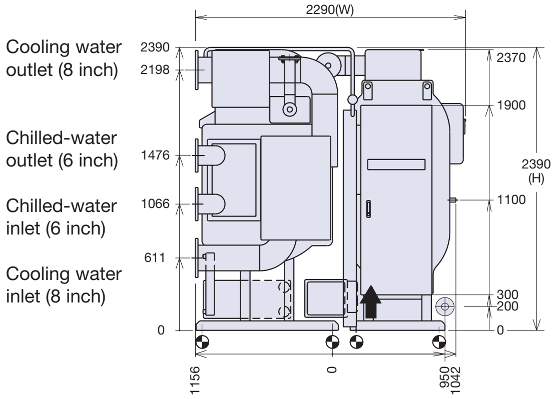
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ◐ indicates the position of anchor bolts.
3. All external water piping must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:

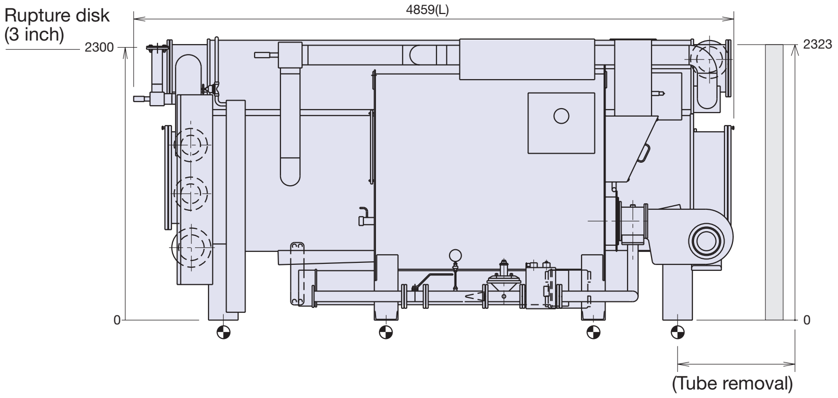
Ends	1000 mm
Top	200 mm
Others	500 mm

6. For the fuel connection diameter and position, refer to the specifications.



16DJ	A	B
31	750	1375
32	550	1775

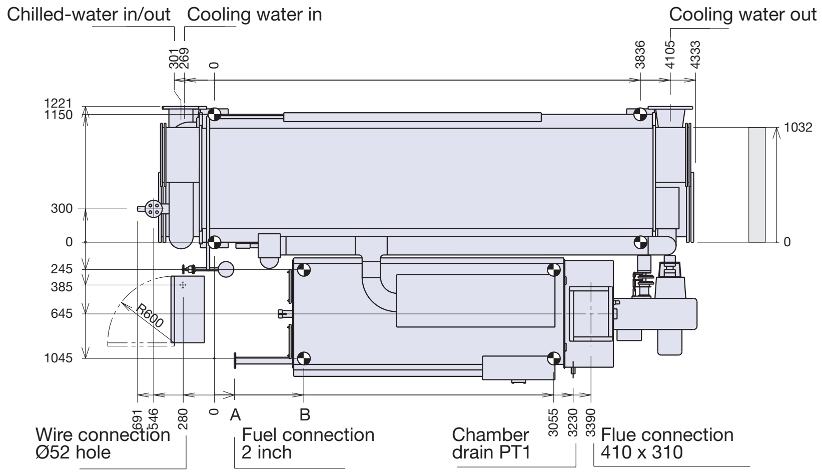




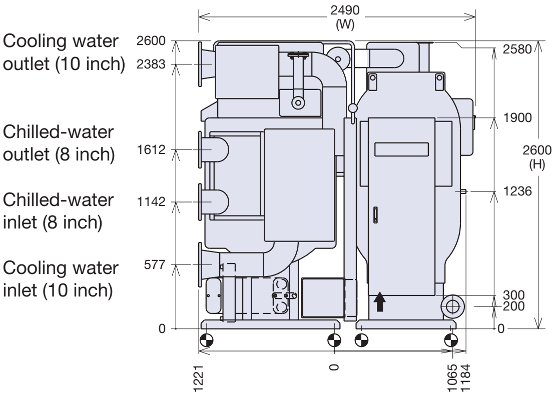
NOTE: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.

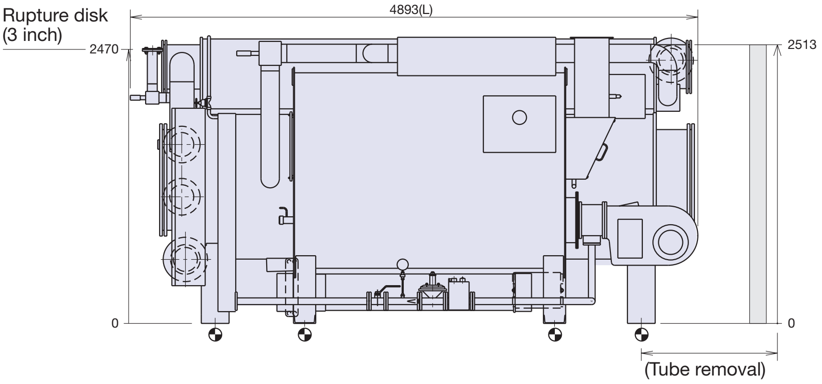
Dimensional drawings, mm (continued)

16DJ 41 through 16DJ 42



16DJ	A	B
41	380	1005
42	180	805



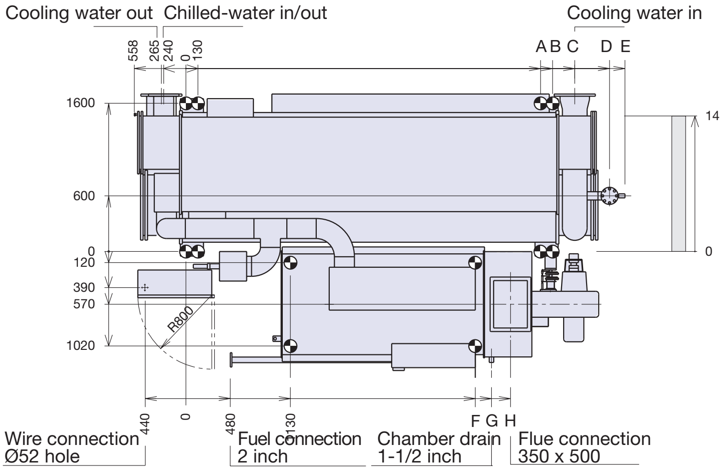


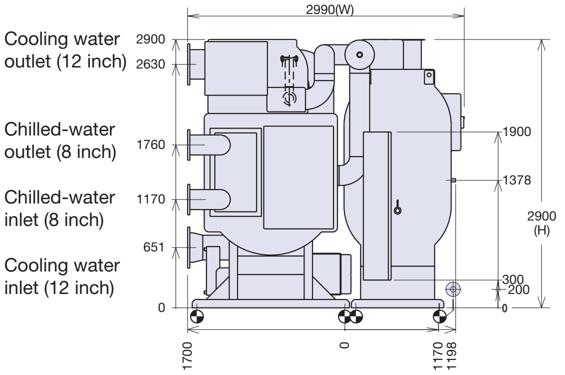
16DJ 51 through 16DJ 53

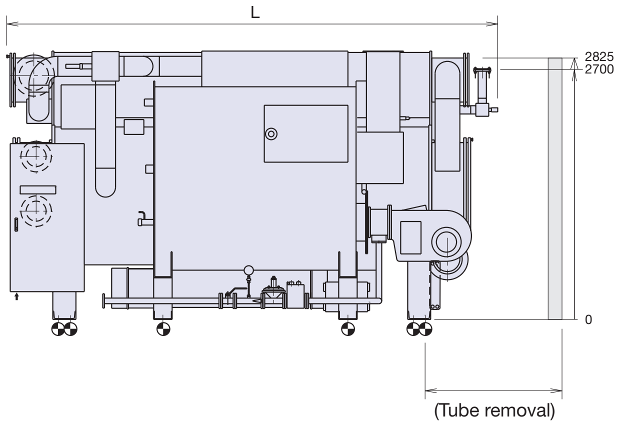
NOTES

1. Dimensions (L), (W), (H) are for a standard machine.
   The dimensions are changed by parts added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:
   Ends 1000 mm
   Top 200 mm
   Others 500 mm
6. For the fuel connection diameter and position, refer to the specifications.

16DJ	A	B	C	D	E	F	G	H	K	L
51	3836	3966	4206	4582	4749	3130	3305	3511	4600	5036
52	4378	4508	4748	5124	5291	3330	3505	3711	5200	5578
53	4876	5006	5246	5622	5789	3530	3705	3911	5700	6076



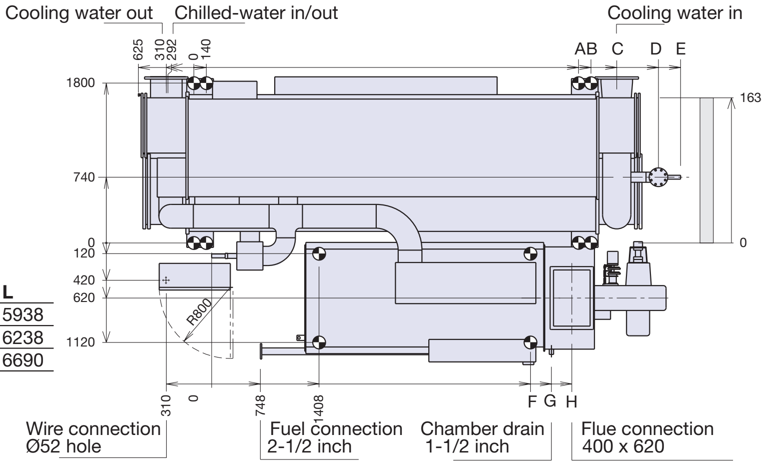




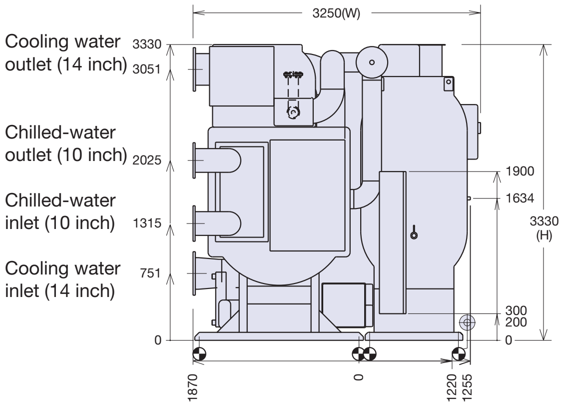
NOTE: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.

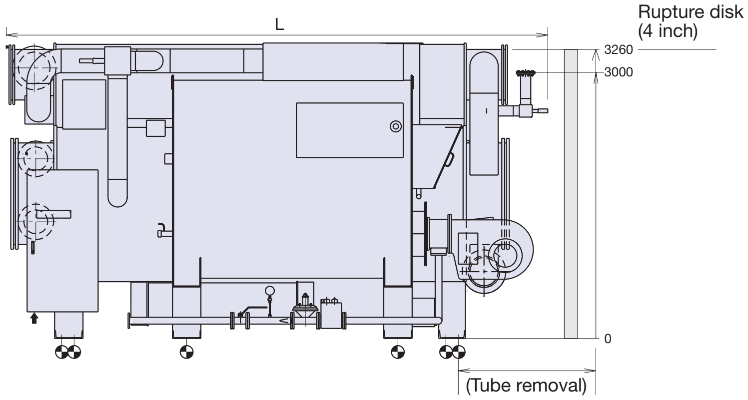
Dimensional drawings, mm (continued)

16DJ 61 through 16DJ 63

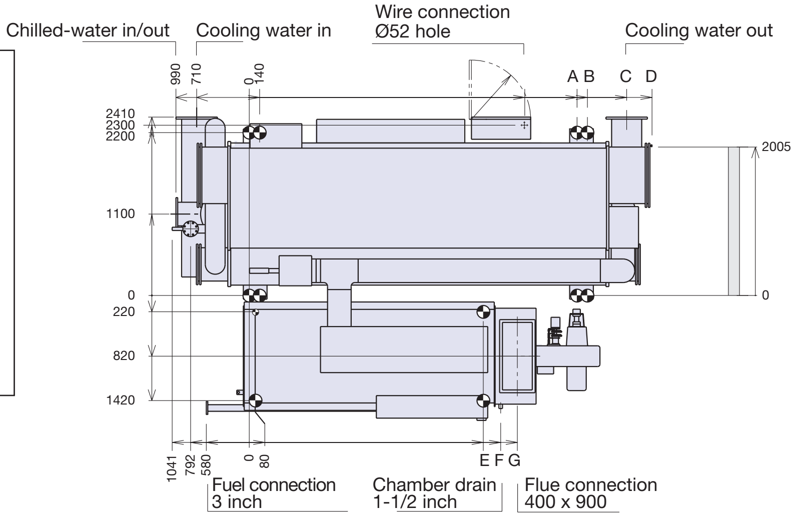


16DJ	A	B	C	D	E	F	G	H	K	L
61	4328	4468	4758	5227	5476	3788	4023	4252	5200	5938
62	4828	4966	5256	5725	5974	4088	4323	4552	5700	6238
63	5351	5491	5781	6250	6499	4388	4623	4852	6200	6690





16DJ 71 through 16DJ 73



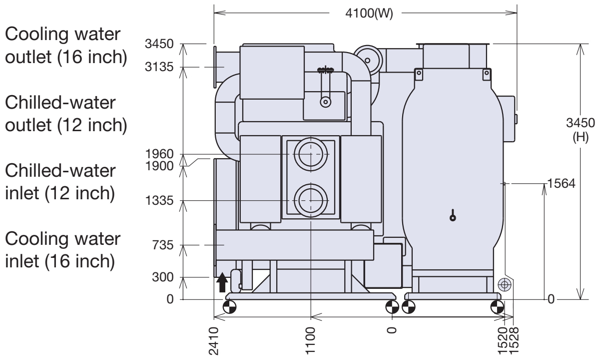
NOTES

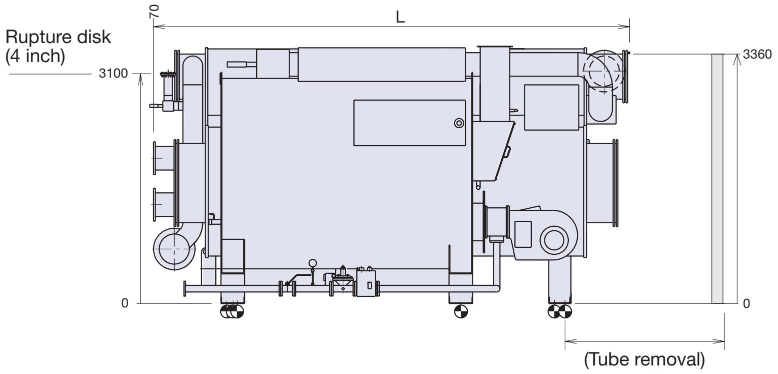
1. Dimensions (L), (W), (H) are for a standard machine. The dimensions are changed by parts added.
2. ⊕ indicates the position of anchor bolts.
3. All external water piping must be provided with welded ANSI 150 LB flanges by the customer.
4. ⬆ indicates the position of the power supply connection on the control panel (diameter 52 mm)
5. Installation clearance:

Ends	1000 mm
Top	200 mm
Others	500 mm

6. For the fuel connection diameter and position, refer to the specifications.

16DJ	A	B	C	D	E	F	G	K	L
71	4426	4566	5096	5440	3160	3395	3620	5700	6428
72	4951	5091	5621	5970	3480	3695	3920	6200	6953
73	5451	5591	6121	6470	3760	3995	4220	6700	7453

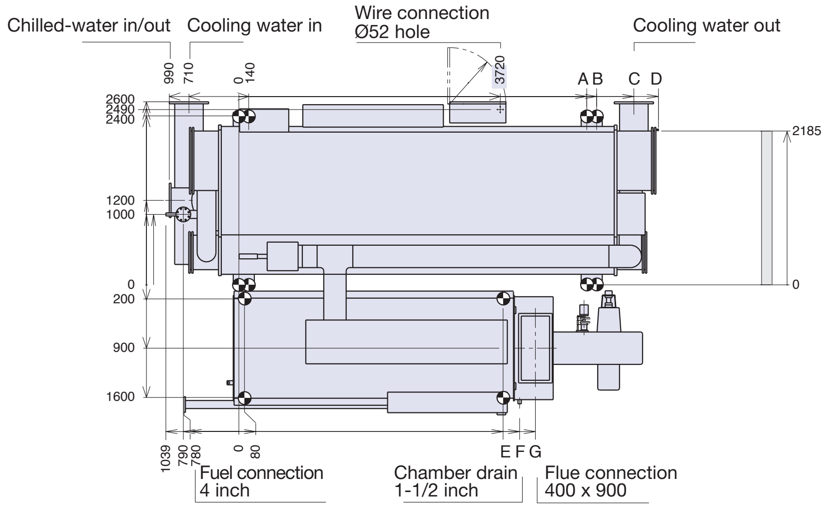




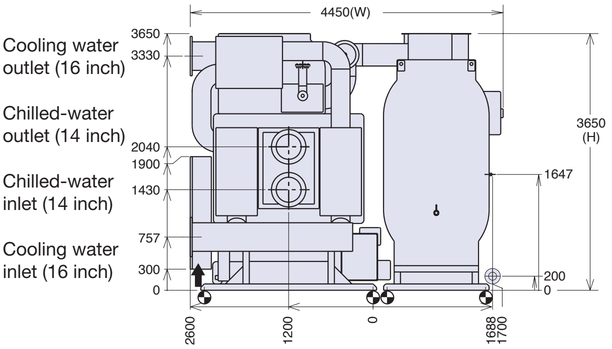
NOTE: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.

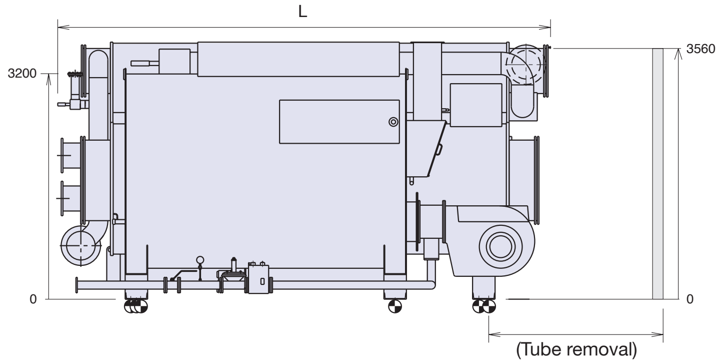
Dimensional drawings, mm (continued)

16DJ 81 through 16DJ 82



16DJ	A	B	C	D	E	F	G	K	L
81	4951	509,1	5621	5970	3780	3995	4220	6200	6960
82	5451	5591	6121	6470	3960	4195	4420	6700	7460





NOTE: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.

Foundation dimensional data, mm

Figure 9 - Details of weld

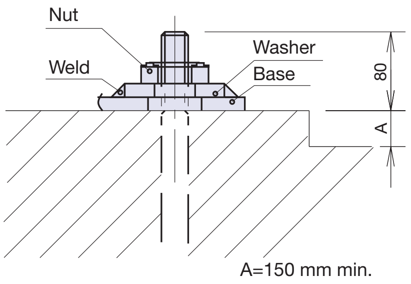


Figure 11 - 16DJ-13 through 16DJ-63

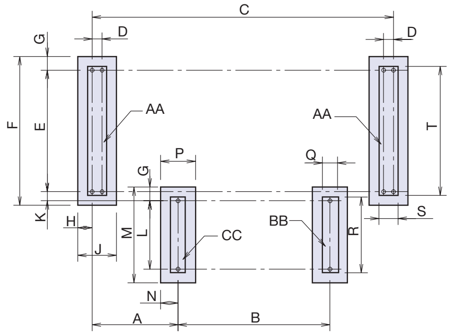


Figure 10 - 16DJ-11 through 16DJ-12

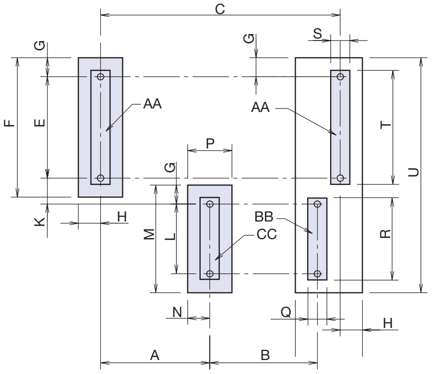
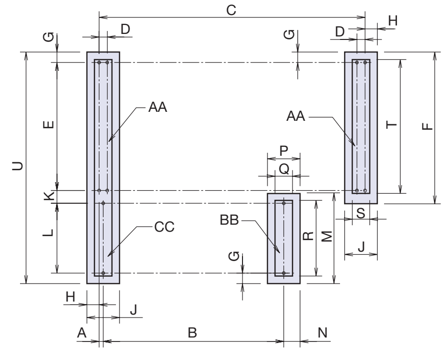


Figure 12 - 16DJ-71 through 16DJ-82



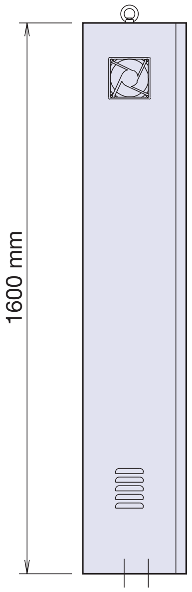
NOTES:

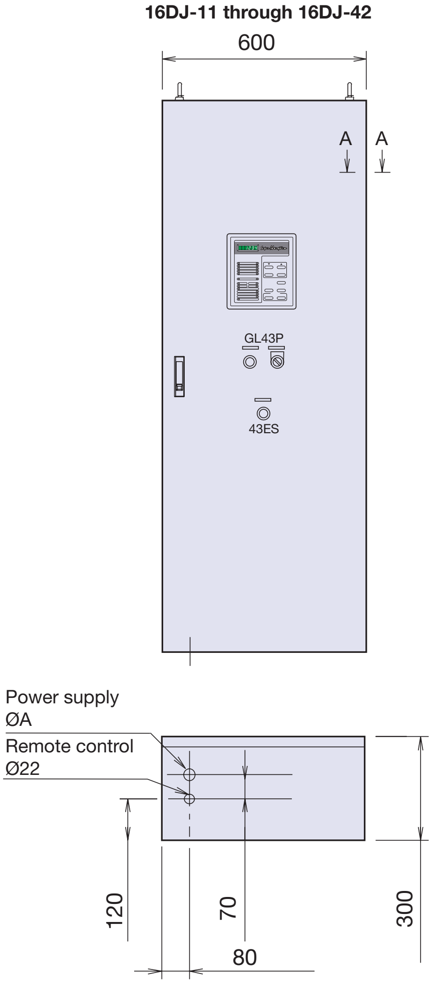
1. Shaded area indicates the base of absorption chillers/heaters.
2. A level concrete foundation must be provided on which to mount the chiller.
3. Provide a floor drainage channel around foundation of the chiller.
4. If foundation anchoring is required, supply anchor bolts and nuts. Fix anchor bolts on the foundation prior to chiller installation and as per detail of weld (Figure 9). Washers are supplied with the chiller.
5. Unit must be level before startup. See leveling information in ”Installation and Application Data ” section of this catalogue.

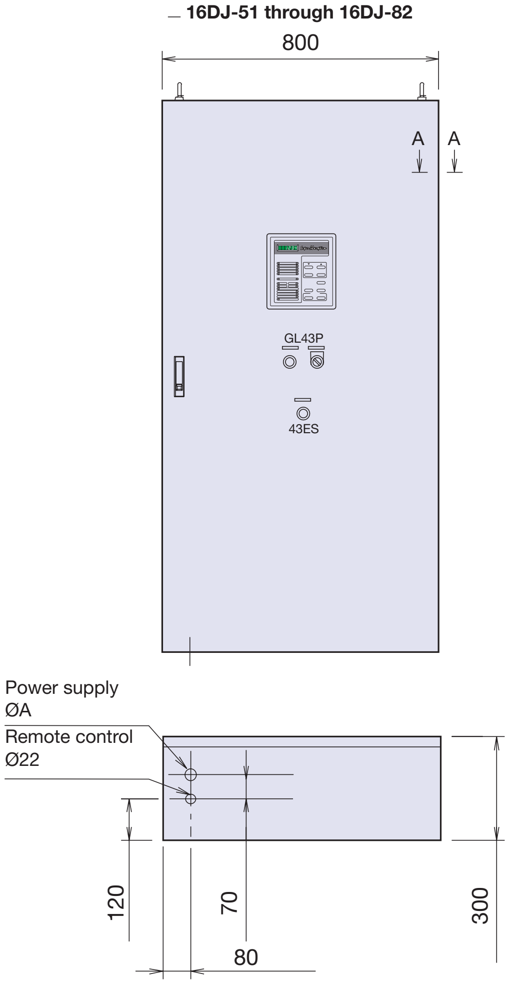
Table 1 - Dimensional data

16DJ	**Foundation weights (kg)**				**Dimensions (mm)**																			
	Ope-rating	**AA**	**BB**	**CC**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**K**	**L**	**M**	**N**	**P**	**Q**	**R**	**S**	**T**	**U**
11	5200	1750	900	800	865	850	1896	--	800	1100	150	175	350	150	550	850	175	350	150	650	150	900	1855
12	5500	1850	1000	800	--	800	1100	150	175	350	--	--	--	150	550	850	175	350	150	650	150	900	1855
13	6600	2250	1200	900	1000	1100	2916	--	800	1100	150	175	350	150	600	900	175	350	150	700	150	900	--
14	7100	2450	1300	900	800	1300	2916	--	800	1100	150	175	350	300	600	900	175	350	150	700	150	900	--
21	8300	2850	1400	1200	1000	1350	2916	--	1000	1300	150	175	350	185	650	950	175	350	150	750	150	1100	--
22	8800	2950	1600	1300	800	1550	2916	--	1000	1300	150	175	350	185	650	950	175	350	150	750	150	1100	--
23	10100	3450	1700	1500	1400	1850	3936	--	1000	1300	150	175	350	255	650	950	175	350	150	750	150	1100	--
24	10700	3650	1900	1500	1200	2050	3936	--	1000	1300	150	175	350	255	650	950	175	350	150	750	150	1100	--
31	13200	4600	2200	1800	1400	1750	3886	--	1100	1400	150	200	400	200	700	1000	200	400	200	800	200	1200	--
32	13900	4700	2400	2100	1200	1950	3886	--	1100	1400	150	200	400	200	700	1000	200	400	200	800	200	1200	--
41	16300	5650	2700	2300	1030	2050	3886	--	1150	1450	150	200	400	245	800	1100	200	400	200	900	200	1250	--
42	17100	5750	3000	2600	830	2250	3886	--	1150	1450	150	200	400	245	800	1100	200	400	200	900	200	1250	--
51	22800	8300	3300	2900	1130	2000	3966	130	1600	1960	180	190	510	120	900	1260	230	460	200	1000	250	1700	--
52	24600	8900	3600	3200	1130	2200	4508	130	1600	1960	180	190	510	120	900	1260	230	460	200	1000	250	1700	--
53	26300	9500	3900	3400	1130	2400	5006	130	1600	1960	180	190	510	120	900	1260	230	460	200	1000	250	1700	--
61	32700	11700	4900	4400	1398	2400	4468	140	1800	2160	180	310	560	120	1000	1360	280	560	300	1100	300	1900	--
62	35200	12500	5400	4800	1398	2700	4966	140	1800	2160	180	210	560	120	1000	1360	280	560	300	1100	300	1900	--
63	37900	13400	5800	5300	1398	3000	5490	140	1800	2160	180	210	560	120	1000	1360	280	560	300	1100	300	1900	--
71	46100	16400	6900	6400	70	3100	4566	140	2200	2560	180	210	560	220	1200	1560	280	560	300	1300	300	2300	--
72	49500	17500	7600	6900	70	3400	5091	140	2200	2560	180	210	560	220	1200	1560	280	560	300	1300	300	2300	--
73	52500	18500	8100	7400	70	3700	5594	140	2200	2560	180	210	560	220	1200	1560	280	560	300	1300	300	2300	--
81	57200	20050	8900	8200	70	3700	5091	140	2400	2760	180	210	560	200	1400	1760	280	560	300	1500	300	2500	--
82	60200	21150	9300	8600	70	3900	5591	140	2400	2760	180	210	560	200	1400	1760	280	560	300	1500	300	2500	--

Control panel dimensions, mm



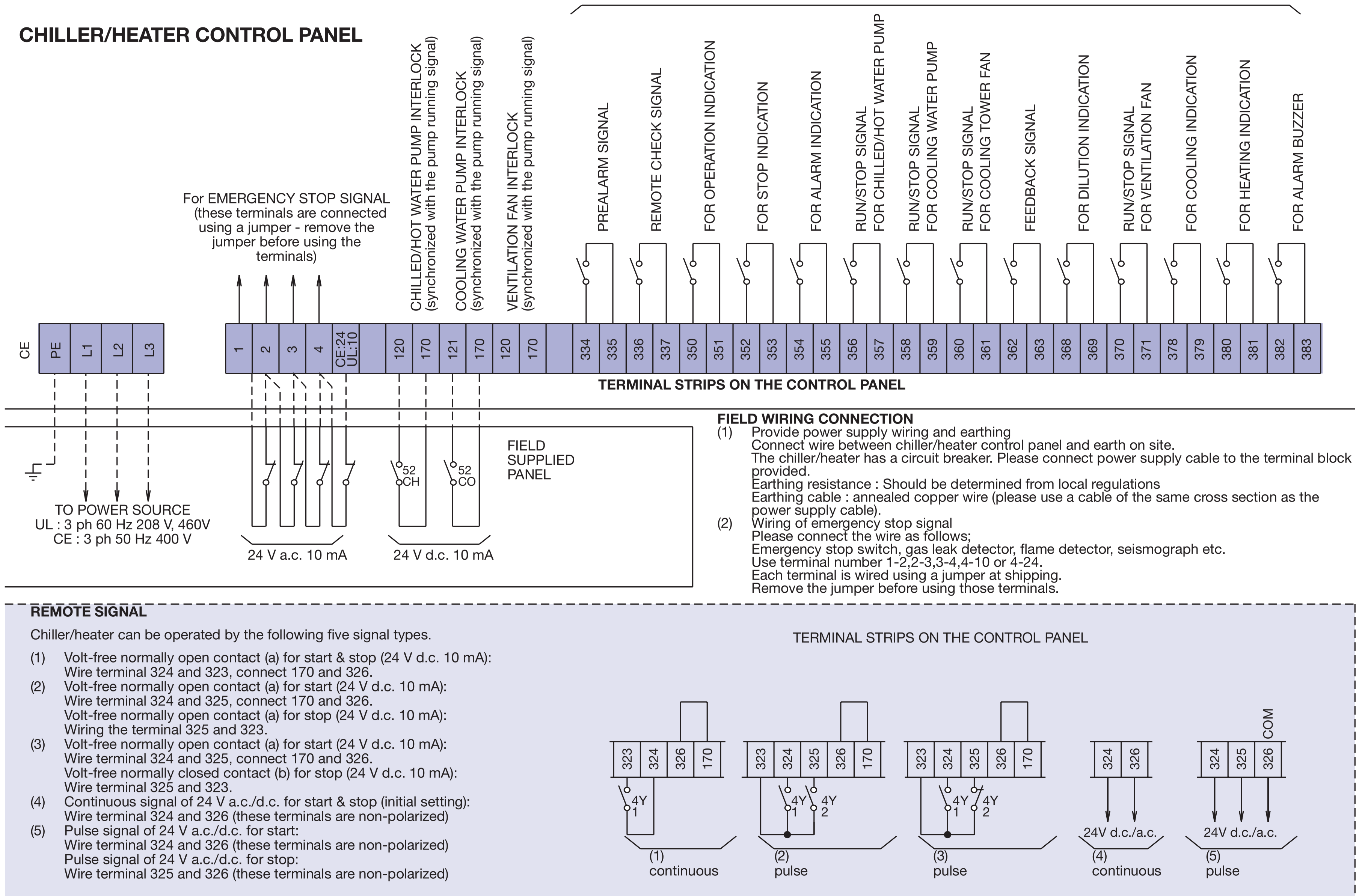




Hole size for wiring

16DJ	**Ø A**
11-61	35
62-72	44
73-82	50

Figure 13 - Typical electrical field connection diagram



FIELD WIRING CONNECTION

(1) Provide power supply wiring and earthing
Connect wire between chiller/heater control panel and earth on site.
The chiller/heater has a circuit breaker. Please connect power supply cable to the terminal block provided.
Earthing resistance : Should be determined from local regulations
Earthing cable : annealed copper wire (please use a cable of the same cross section as the power supply cable).

(2) Wiring of emergency stop signal
Please connect the wire as follows;
Emergency stop switch, gas leak detector, flame detector, seismograph etc.
Use terminal number 1-2,2-3,3-4,4-10 or 4-24.
Each terminal is wired using a jumper at shipping.
Remove the jumper before using those terminals.

REMOTE SIGNAL

Chiller/heater can be operated by the following five signal types.

(1) Volt-free normally open contact (a) for start & stop (24 V d.c. 10 mA):
Wire terminal 324 and 323, connect 170 and 326.

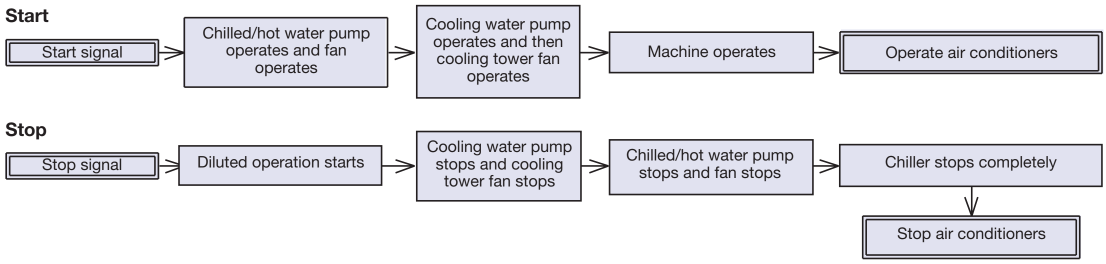
(2) Volt-free normally open contact (a) for start (24 V d.c. 10 mA):
Wire terminal 324 and 325, connect 170 and 326.
Volt-free normally open contact (a) for stop (24 V d.c. 10 mA):
Wiring the terminal 325 and 323.

(3) Volt-free normally open contact (a) for start (24 V d.c. 10 mA):
Wire terminal 324 and 325, connect 170 and 326.
Volt-free normally closed contact (b) for stop (24 V d.c. 10 mA):
Wire terminal 325 and 323.

(4) Continuous signal of 24 V a.c./d.c. for start & stop (initial setting):
Wire terminal 324 and 326 (these terminals are non-polarized)

(5) Pulse signal of 24 V a.c./d.c. for start:
Wire terminal 324 and 326 (these terminals are non-polarized)
Pulse signal of 24 V a.c./d.c. for stop:
Wire terminal 325 and 326 (these terminals are non-polarized)

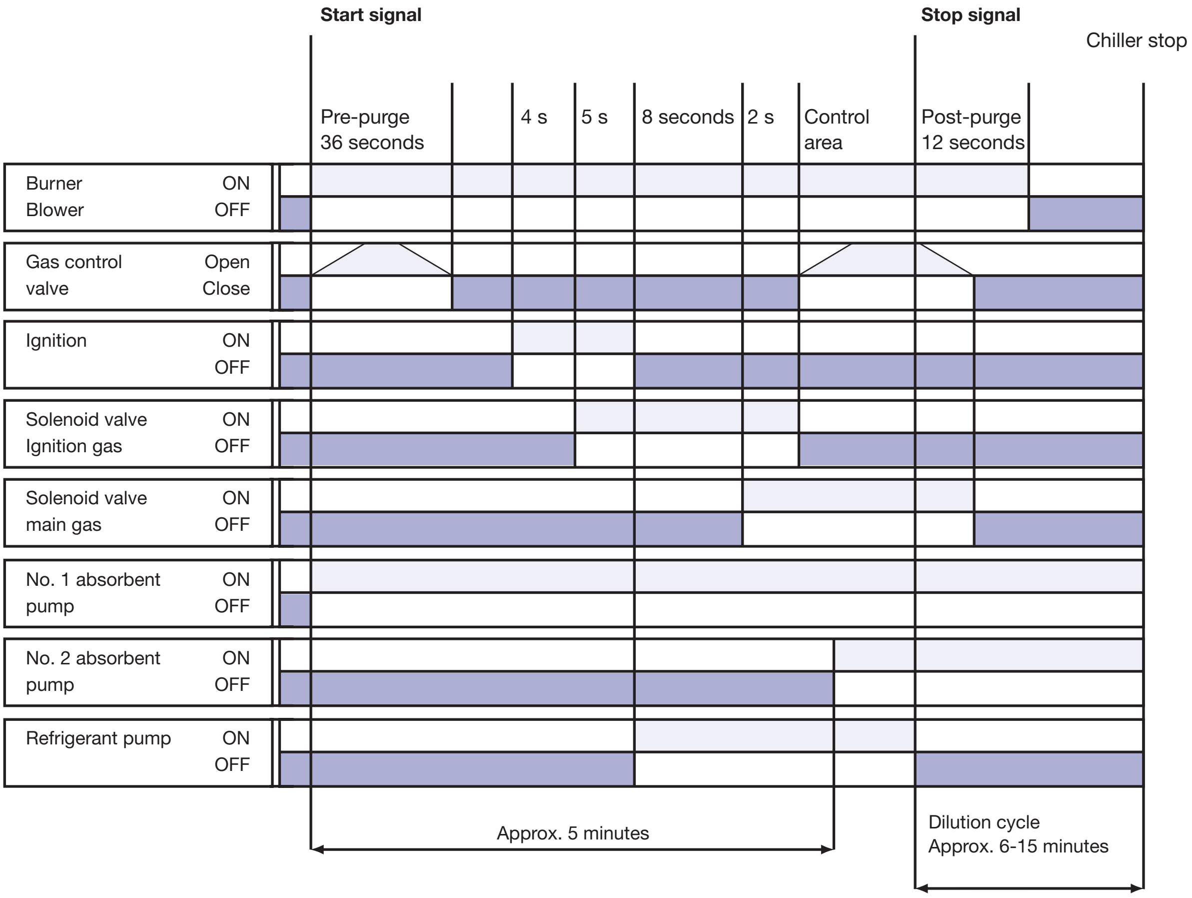
Start/Stop sequence of auxiliary equipment



Sequence of cooling operation

- Figure 14 illustrates the typical operating sequence of a Carrier-Sanyo 16DJ direct-fired absorption chiller/heater.
- With a chilled water setpoint of 6.7°C and with the chillers/heaters enabled, the start signal will be energized as the leaving chilled water temperature rises to 7.7°C, 1.0 K above setpoint.
- The burner initially completes a 36-second pre-purge operation that includes gas valve and supply air damper modulation to fully open to ensure complete purging of the combustion chamber.
- The No. 1 absorbent pump flow rate is changed during all stages of operation to ensure quicker start-up and optimum performance at part load.
- As the cooling load is satisfied with the chillers/heaters at minimum load, the unit will cycle off as the leaving chilled-water temperature drops to 5.5°C, 1.5 K below setpoint.
- When the microprocessor issues a stop signal, the generator heat source will shut off and the dilution cycle will start. The dilution cycle will last between 6 and 15 minutes depending on generator temperature. The dilution cycle will consist of stopping of the refrigerant pump, absorbent pump(s), and the cooling water pump in turn. The unit is capable of restarting during the dilution cycle.

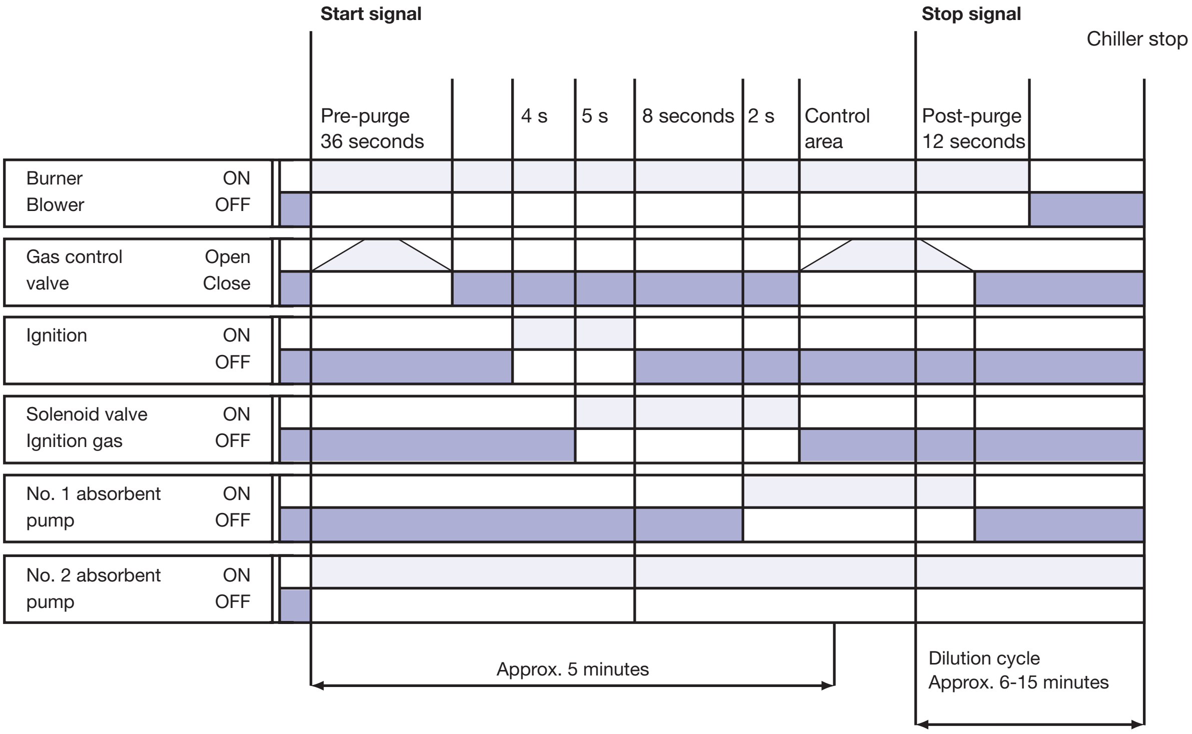
Figure 14 - Typical combustion time chart (cooling operation)



Sequence of heating operation

- Figure 15 illustrates the typical operating sequence of a Carrier-Sanyo 16DJ direct-fired absorption chiller/heater in heating mode.
- With a hot water setpoint of 55°C, the start signal will be energized as the leaving heating water temperature drops to 54°C, 1.0 K below setpoint.
- The burner initially completes a 36-second pre-purge operation that includes gas valve and supply air damper modulation to fully open to ensure complete purging of the combustion chamber. The No. 1 absorbent pump flow rate is varied during all stages of operation to ensure quicker start-up and optimum performance at part load. On chillers/heaters with two absorbent pumps, the No. 2 pump remains off at all times during the heating mode.
- As the heating load is satisfied with the chillers/heaters at minimum load, the unit will cycle off as the leaving heating water temperature rises to 57°C, 2 K above setpoint.
- When the microprocessor receives a stop signal, the generator heat source will shut off and the dilution cycle will begin. The dilution cycle will last approximately 5 minutes depending on generator temperature. The dilution cycle consists of timed stopping of the No. 1 absorbent pump. The chiller/heater is capable of restarting during the dilution cycle.

Figure 15 - Typical combustion time chart (heating operation)



Flue and stack connection

- The flue and stack must be heat-insulated and provided with a damper and a condensate drain.
- The flue should never be connected to an incinerator stack.
- Locate the top end of the smoke stack at a sufficiently large distance away from the cooling tower.
- If the same stack is used for discharging exhaust from two systems, the back flow of exhaust gas should be prevented from going into the inoperative unit.
- Provide a draught regulator if fluctuations in static pressure are expected inside the flue.

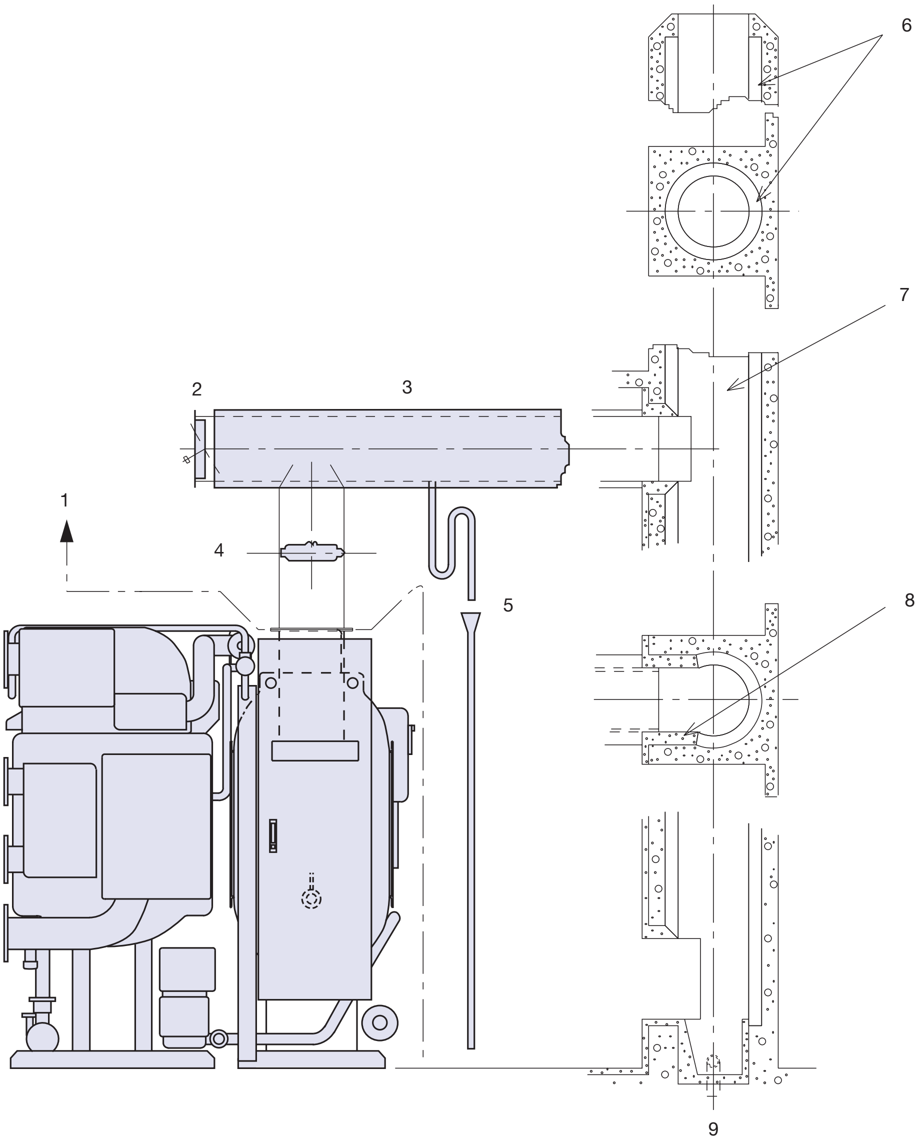
Typical steel stack

- As illustrated, the steel stack should be lined on the interior surface as a protection against corrosion due to exhaust gas.

Compliance with local regulations

- In many areas local codes may regulate large capacity chillers consuming oil or gas as fuel.
- Such regulations should be strictly followed.

Figure 16 - Typical flue and stack installation

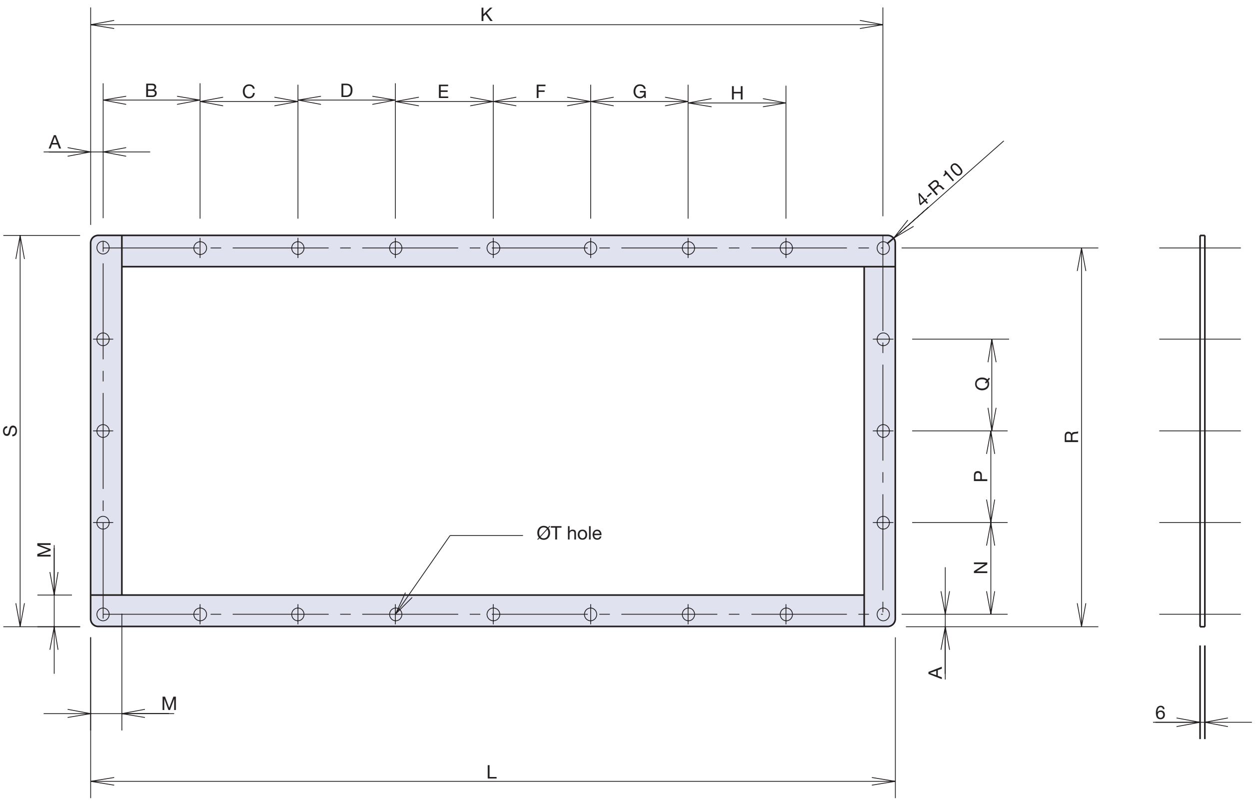


Legend
1. Field supply
2. Draught regulator
3. Flue (insulated)
4. Damper
5. Condensate drain
6. Internal lining
7. Stack
8. Fire-proof mortar
9. Condensate drain

NOTE: Please design the draught pressure at the flue flange of the chillers/heaters with a negative pressure of 0 through -29.4 Pa (0 through -3 mm H_2O).

Flue flange dimensional data (mm)

Figure 17 - Flue flange



NOTE:
Flange is field-supplied and should be made of steel.

Table 2 - Dimensions, mm

16DJ	Dimensions (mm)																
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**K**	**L**	**M**	**N**	**P**	**Q**	**R**	**S**	**T**
11	15	110	110	110	---	---	---	---	345	360	38	130	130	---	275	290	15
12	15	110	110	110	---	---	---	---	345	360	38	130	130	---	275	290	15
13	15	110	110	110	---	---	---	---	345	360	38	130	130	---	275	290	15
14	15	110	110	110	---	---	---	---	345	360	38	130	130	---	275	290	15
21	15	120	120	---	---	---	---	---	375	390	38	120	120	---	375	390	15
22	15	120	120	---	---	---	---	---	375	390	38	120	120	---	375	390	15
23	15	120	120	---	---	---	---	---	375	390	38	120	120	---	375	390	15
24	15	120	120	---	---	---	---	---	375	390	38	120	120	---	375	390	15
31	20	100.5	100.5	100.5	---	---	---	---	422	442	38	117	118	---	372	392	15
32	20	100.5	100.5	100.5	---	---	---	---	422	442	38	117	118	---	372	392	15
41	15	115	115	115	---	---	---	---	475	490	38	120	120	---	375	390	15
42	15	115	115	115	---	---	---	---	475	490	38	120	120	---	375	390	15
51	15	139.5	139.5	139.5	---	---	---	---	573	588	38	137	137	--	426	441	15
52	15	139.5	139.5	139.5	---	---	---	---	573	588	38	137	137	--	426	441	15
53	15	139.5	139.5	139.5	---	---	---	---	573	588	38	137	137	--	426	441	15
61	15	113	113	113	113	113	---	---	693	708	38	114.5	114.5	114.5	473	488	15
62	15	113	113	113	113	113	---	---	693	708	38	114.5	114.5	114.5	473	488	15
63	15	113	113	113	113	113	---	---	693	708	38	114.5	114.5	114.5	473	488	15
71	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
72	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
73	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
81	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19
82	15	119	120	120	120	120	120	120	973	988	38	113	113	112	464	479	19

Burner description

- The 16DJ direct-fired chillers/heaters are equipped with a nozzle mix burner. The burners are capable of firing with natural gas.
- The burner is factory-wired and tested prior to shipment. Manual modulation from low fire to high fire during start-up and routine maintenance procedures are provided by an operation switch on the chiller control panel.
- The burner maximizes flame retention at all capacity ranges of modulation, ensuring long life and efficient operation.

Table 3 - Typcal burner model

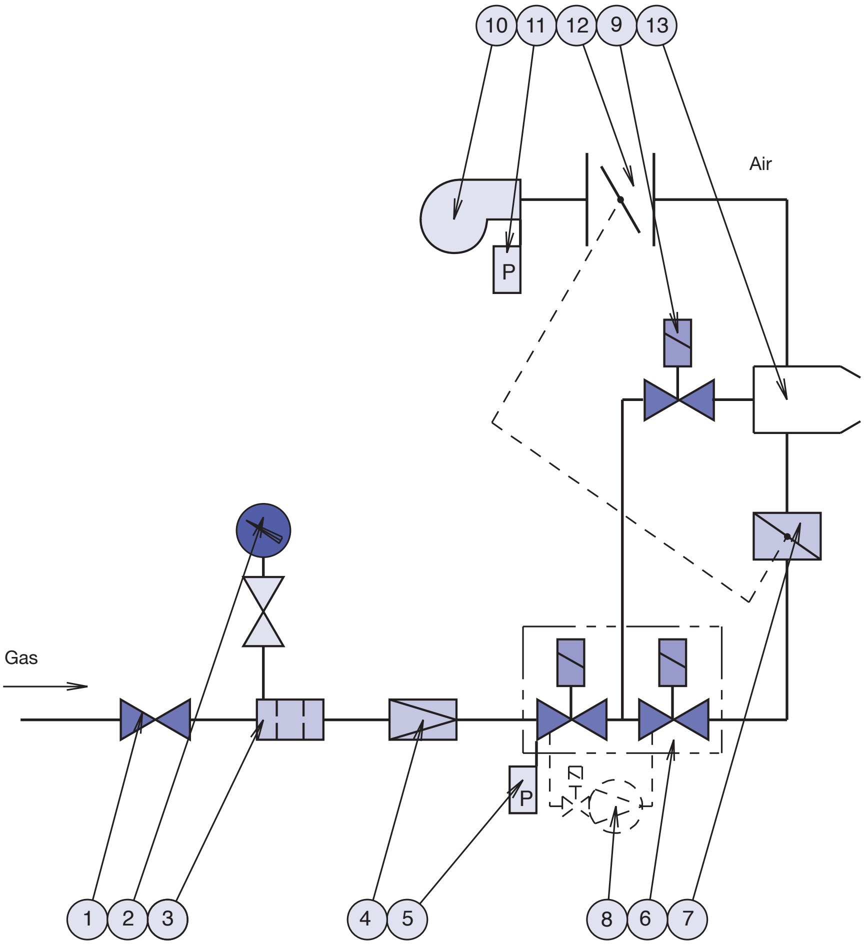
16DJ	**Burner model gas**	**Burner model oil (kerosene)**	**Burner model dual fuel**
11	G3/1-E-ZMD	RL3-A-ZMD	RGL3/1-E-ZMD
12		RL3-A-ZMD	RGL3/1-E-ZMD
13		RL3-A-ZMD	RGL3/1-E-ZMD
14	G5/1-D-ZMD	RL5-ZMD	RGL5/1-D-ZMD
21		RL5-ZMD	RGL5/1-D-ZMD
22		RL5-ZMD	RGL5/1-D-ZMD
23	G7/1-D-ZMD	RL7-ZMD	RGL7/1-D-ZMD
24		RL7-ZMD	RGL7/1-D-ZMD
31		RL7-ZMD	RGL7/1-D-ZMD
32		RL7-ZMD	RGL7/1-D-ZMD
41	G30/2-A-ZM	RL30/2-A-ZM	RGL30/2-A-ZM
42		RL30/2-A-ZM	RGGL30/2-A-ZM
51	G40/1-B-ZM	RL40/1-B-ZM	RGL40/1-B-ZM
52	G40/2-A-ZM	RL40/2-A-ZM	RGL40/2-A-ZM
53		RL40/2-A-ZM	RGL40/2-A-ZM
61	G50/1-B-ZM	RL50/1-B-ZM	RGL50/1-B-ZM
62		RL50/1-B-ZM	RGL50/1-B-ZM
63	G50/2-A-ZM	RL50/2-A-ZM	RGL50/2-A-ZM
71		RL50/2-A-ZM	RGL50/2-A-ZM
72	G60/2-A-ZM	RL60/2-A-ZM	RGL60/2-A-ZM
73		RL60/2-A-ZM	RGL60/2-A-ZM
81	G70/1-A-ZM	RL70/1-A-ZM	RGL70/1-A-ZM
82		RL70/1-A-ZM	RGGL70/1-A-ZM

The burner and gas train elements can be changed, depending on the gas supply pressure and local requirements.

Gas train

- The following drawing illustrates some of the common components found in a typical gas train and unit installation. Individual jobs may vary depending on chiller size and specific application.

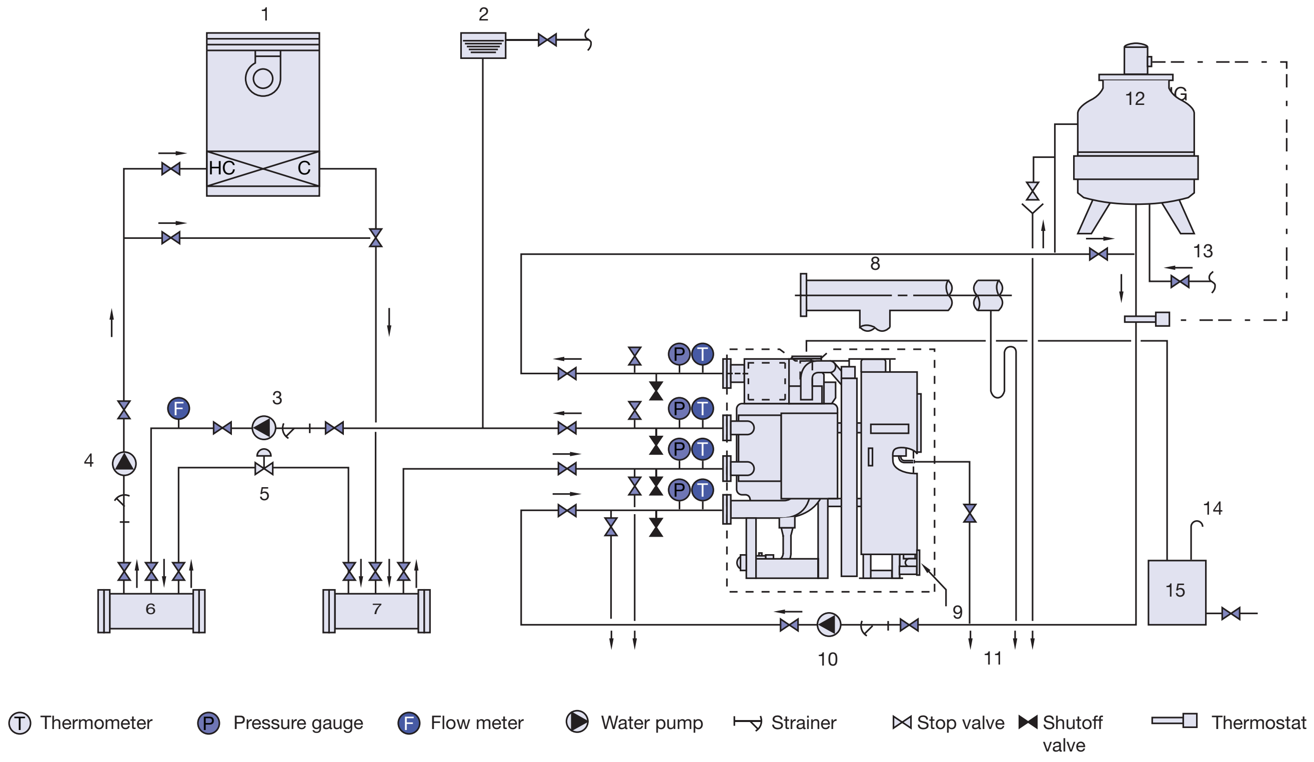
Figure 18 - Typical burner and gas train



Legend

1. Ball valve
2. Pressure gauge with push button valve
3. Gas filter
4. Low-pressure governor
5. Gas pressure switch
6. Double solenoid valve (DMV)
7. Gas butterfly valve
8. Valve proving system (VPS)
9. Solenoid valve for ignition gas
10. Blower
11. Air pressure switch
12. Air damper
13. Burner

Typical piping diagram



Legend

1. Air conditioner
2. Expansion tank
3. Chilled/hot-water pump (primary)
4. Chilled/hot-water pump (secondary)
5. Bypass valve
6. Supply header
7. Return header
8. Flue
9. Fuel
10. Cooling water pump
11. To drain channel
12. Cooling tower
13. Water supply
14. Air vent
15. Min. tank capacity 1 m³

NOTE: In order to prevent freezing of the chilled water continue the operation of the primary and secondary chilled/hot-water pumps during the dilution cycle of the chillers/heaters for about 15 minutes.

General remarks on piping

1. Equipment and parts outside the area surrounded by the broken line 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 a pressure larger than 1034 kPa at any water headers.
4. Cooling water minimum entering temperature control has to be supplied (see Installation Instructions).
5. It is recommended to have separate chilled/hot and cooling water pumps for each chiller/heater.
6. During heating operation, cooling water must be discharged.
7. Provide a thermometer and pressure gauge at the chilled/ hot and cooling water outlet and inlet pipe connections.
8. Provide an air vent valve in each of the chilled/hot and cooling water lines at a point higher than each header.
9. Drain pipes from the evaporator, absorber and smoke chamber should be piped to the drain channel.
10. Provide an expansion tank in the chilled/hot-water line.
11. Provide a blow-down valve in the cooling water line for water quality control.
12. There should be sufficiently large clearances for easy access to the evaporator, absorber and condenser, to facilitate inspection and cleaning.
13. Provide heat insulation to the flue, which should be equipped with a damper and condensate drain.
14. Do not connect the flue to the smoke stack of an incinerator.
15. If 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.
16. The exhaust discharge end of the flue should be kept a sufficient distance away from the cooling tower.
17. If the static pressure inside the flue is subject to fluctuations provide a draught regulator.
18. If necessary, fit the rupture disk on the chillers/heaters according to the rupture disk manual.
19. All external water piping with ANSI 150 LB welding flanges is to be provided by the customer.

⚠ Safety considerations

Before operating the unit

- Before operating the unit be sure to read the operation manual carefully.
- Installation should conform to all applicable local codes and regulations.

During the installation

- Read the installation manual carefully before offloading and installing the unit.
- All work must be carried out by qualified personnel to prevent injuries and damage to the equipment.
- Consult your service office, if work on the flue, exhaust and intake air duct and chimneys is required. If this type of work is not correctly completed, scalding, fire and oxygen deficiency may occur.
- Waterproof the unit foundation and provide a drain channel to prevent water damage to the surrounding equipment.
- Provide adequate space around the unit for maintenance work to ensure safe working conditions.

Maintenance

- In addition to daily inspection periodical maintenance is required. Insufficient or incorrect maintenance may cause fire, electric shock and injuries.
- Please consult your local service office for further guidance.

Avoiding hazardous places

- Keep the units away from dangerous inflammable substances such as gasoline, thinner and combustible gases, as these may result in a fire.

GB/T-24001 to ISO14001:1996

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