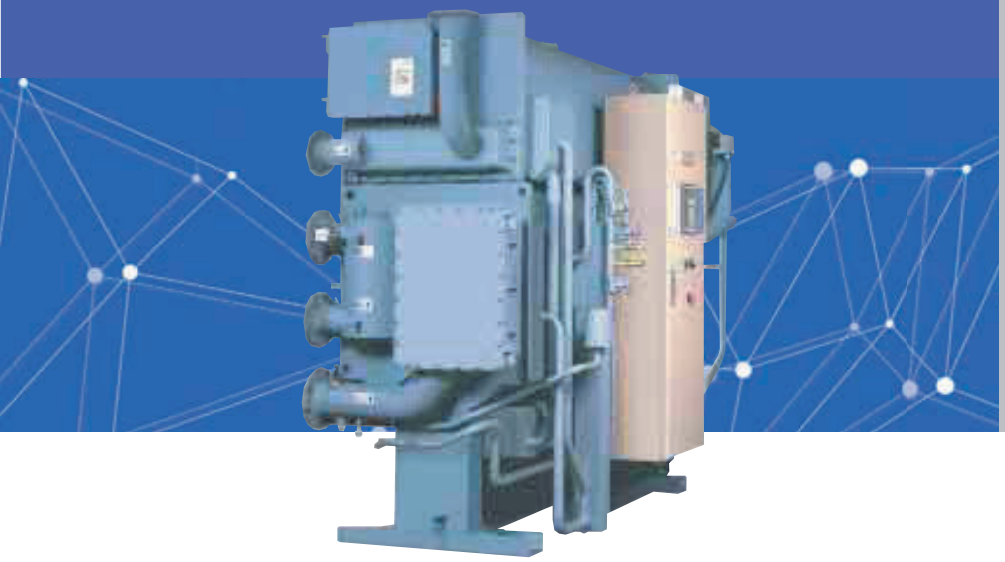
SINGLE-EFFECT HOT WATER-FIRED ABSORPTION CHILLERS



Complete range 80 to 4000 kW

HFC-refrigerant free

Hot water source from

COPr up to 0.78

16LJ01-03
16LJ-A11-82

Nominal cooling capacity 83-3956 kW

The Carrier 16LJ & 16LJ-A single-effect absorption chillers are designed to provide chilled water from waste heat sources generated from industrial processes and cogeneration systems.

Carrier absorption chillers allow diversification of critical cooling requirements. Critical cooling loads are met with minimal electrical power input.

They allow smaller emergency generators 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 minimise the global impact by greatly reducing electricity consumption and production of greenhouse gases.

The solution inhibitor has no impact on the environment.

An absorption chiller does not utilise mechanical moving parts, and this leads to quiet, vibration-free operation.

The use of high-efficiency heat transfer surface has reduced the space required for installation of the absorption chiller, resulting in a smaller footprint.

PHYSICAL DATA

16LJ/16LJ-A		LJ			LJ-A									
Size		01	02	03	11	12	13	14	21	22	23	24	31	32
Capacity	kW	83	131	166	264	316	387	475	545	633	738	844	949	1055
Chilled water system*														
Flow rate	l/sec	3.58	5.64	7.14	12.6	15.1	18.5	22.7	26	30.3	35.3	40.3	45.3	50.3
Pressure drop	kPa	73	60	60	72.2	78.4	48.5	52.9	46.8	50.2	102	105	104	106
Connection(ANSI)	inch	2	2 1/2	2 1/2	3	3	4	4	5	5	5	5	6	6
Retention volume	m^3	0.06	0.08	0.08	0.11	0.13	0.15	0.17	0.22	0.25	0.28	0.30	0.35	0.38
Cooling water system*														
Flow rate	l/sec	5.4	8.5	10.8	20.8	25	30.6	37.5	43.1	50	58.3	66.7	75	83.3
Pressure drop	kPa	23	16	15	78.8	81.8	86.6	95.4	89.1	93.4	58.4	62.5	49.8	51.6
Connection(ANSI)	inch	3	4	4	5	5	5	5	6	6	8	8	8	8
Retention volume	m^3	0.13	0.18	0.23	0.33	0.37	0.40	0.45	0.58	0.63	0.69	0.76	0.98	1.05
Hot water system*														
Flow rate	l/sec	3.28	5.17	6.56	8.4	10.1	12.3	15.1	17.3	20.1	23.4	26.8	30.1	33.5
Pressure drop	kPa	58	41	41	24.7	26.4	65.6	72.8	31.5	32.5	22.0	22.1	22.4	22.3
Connection(ANSI)	inch	2	2 1/2	2 1/2	4	4	4	4	5	5	6	6	6	6
Retention volume	m^3	0.04	0.04	0.07	0.07	0.08	0.09	0.10	0.13	0.14	0.15	0.17	0.21	0.22
Rupture disk connection	inch	2	2	2	2	2	2	2	2	2	2	2	2	2
Dimensions														
Length (L)	mm	1745	2450	2450	2 740	2 740	3 750	3 750	3 850	3 850	4 870	4 870	4 920	4 920
Height (H)	mm	2115	2115	2115	2 330	2 330	2 330	2 330	2 480	2 480	2 480	2 480	2 775	2 775
Width (W)	mm	1255	1255	1435	1 400	1 400	1 400	1 400	1 560	1 560	1 560	1 560	1 630	1 630
Tube removal	mm	900	1350	1350	2 400	2 400	3 400	3 400	3 400	3 400	4 500	4 500	4 500	4 500
Weight														
Operation weight	kg	2070	2680	3150	4 000	4 200	5 200	5 500	6 600	6 900	8 100	8 600	10 500	11 000
Max shipping weight	kg	1820	2380	2720	3 500	3 600	4 500	4 700	5 600	5 900	7 000	7 300	9 000	9 300
Shipping method	u	1	1	1	1	1	1	1	1	1	1	1	1	1
Power supply	V-ph-Hz	400-3-50			400-3-50									
Apparent power	kVA	3.1	3.1	3.1	5.0	5.0	5.0	6.8	6.9	6.9	6.9	6.9	10.5	10.5
Total electric current	A	4.8	4.8	4.8	7.5	7.5	7.5	10.2	10.3	10.3	10.3	10.3	15.5	15.5
Absorbent pump N°1, power input	kW	0.75	0.75	0.75	1.1	1.1	1.1	2.2	2.2	2.2	2.2	2.2	3.0	3.0
Absorbent pump N°1, electric current	A	2.2	2.2	2.2	2.8	2.8	2.8	5.5	5.5	5.5	5.5	5.5	7.5	7.5
Absorbent pump N°2, power input	kW	/	/	/	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	1.5	1.5
Absorbent pump N°2, electric current	A	/	/	/	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	4.7	4.7
Refrigerent pump, power input	kW	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Refrigerent pump, electric current	A	0.7	0.7	0.7	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Purge pump, power input	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
Purge pump, electric current	A	1.1	1.1	1.1	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
PD cell heater	kW	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
Control circuit	kW	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3

* Condition for LJ 12,2/6,7 °C (Fouling Factor = 0.0176 m2°C/kW)
29.4/38.4°C (Fouling Factor = 0.044 m2°C/kW)
95/86°C (Fouling Factor = 0.0176 m2°C/kW)

* Condition for LJ-A 12/7 °C (Fouling Factor = 0.018 m2°C/kW)
29.4/36.3°C (Fouling Factor = 0.044 m2°C/kW)
90/80°C (Fouling Factor = 0.018 m2°C/kW)

Notes : These performance data are provided to support early design activity. For selection outside ARI operating conditions, contact Carrier

PHYSICAL DATA

16LJ-A		LJ-A												
Size		41	42	51	52	53	61	62	63	71	72	73	81	82
Capacity	kW	1 178	1 319	1 477	1 653	1 846	2 110	2 373	2 637	2 901	3 165	3 428	3 692	3 956
Chilled water system*														
Flow rate	l/sec	56.4	63.1	70.6	78.9	88.3	100.8	113.3	126.1	138.6	151.1	163.9	176.4	188.9
Pressure drop	kPa	102	88.5	74.3	37.4	49.3	95.6	45.9	59.9	114	50.7	62.7	50.8	61.7
Connection(ANSI)	inch	8	8	8	8	8	10	10	10	12	12	12	14	14
Retention volume	m^3	0.49	0.56	0.70	0.77	0.83	1.06	1.13	1.21	1.43	1.53	1.63	1.82	1.94
Cooling water system*														
Flow rate	l/sec	93.1	104.2	116.7	130.6	145.8	166.7	187.5	208.3	229.2	250	270.8	291.7	312.5
Pressure drop	kPa	52.8	55.4	94.4	128	43.1	78.1	105	70.6	45.6	57.4	70.8	59.2	71.4
Connection(ANSI)	inch	10	10	12	12	12	14	14	14	16	16	16	16	16
Retention volume	m^3	1.31	1.41	1.97	2.13	2.27	2.87	3.05	3.23	3.79	4.02	4.23	4.75	5.10
Hot water system*														
Flow rate	l/sec	37.4	41.8	46.8	52.4	58.5	66.9	75.2	83.6	91.9	101	109	117	126
Pressure drop	kPa	21.7	22.1	63.8	28.6	37.8	27.2	36.4	47.5	37.9	47.9	59.2	49.3	59.8
Connection(ANSI)	inch	8	8	8	8	8	10	10	10	10	10	10	10	10
Retention volume	m^3	0.29	0.32	0.35	0.37	0.40	0.69	0.72	0.76	0.82	0.86	0.90	0.99	1.03
Rupture disk connection	inch	2	2	2	2	2	2	2	2	2	2	2	2	2
Dimensions														
Length (L)	mm	5 070	5 070	5 210	5 750	6 250	5 750	6 250	6 750	6 490	6 990	7 490	7 090	7 590
Height (H)	mm	3 015	3 015	3 390	3 390	3 390	3 790	3 790	3 790	3 950	3 950	3 950	4 210	4 210
Width (W)	mm	1 750	1 750	1 990	1 990	1 990	2 420	2 420	2 420	2 650	2 650	2 650	2 820	2 820
Tube removal	mm	4 500	4 500	4 600	5 200	5 700	5 200	5 700	6 200	5 700	6 200	6 700	6 200	6 700
Weight														
Operation weight	kg	13 000	13 600	18 400	20 000	21 400	28 300	30 300	32 400	38 700	41 200	43 700	46 900	49 600
Max shipping weight	kg	10 900	11 300	15 400	16 600	17 900	11 500	12 200	13 100	16 000	17 000	18 000	19 000	19 900
Shipping method	u	1	1	1	1	1	2	2	2	2	2	2	2	2
Power supply	V-ph-Hz	400-3-50												
Apparent power	kVA	10.6	10.6	10.6	10.6	10.8	18.7	18.7	18.7	24.2	24.2	25.6	25.6	25.6
Total electric current	A	15.6	15.6	15.6	15.6	15.9	27.4	27.4	27.4	35.3	35.3	37.4	37.4	37.4
Absorbent pump N°1, power input	kW	3.0	3.0	3.0	3.0	3.0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Absorbent pump N°1, electric current	A	7.5	7.5	7.5	7.5	7.5	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Absorbent pump N°2, power input	kW	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	3.7	3.7	3.7	3.7	3.7
Absorbent pump N°2, electric current	A	4.7	4.7	4.7	4.7	5.0	5.0	5.0	5.0	11.0	11.0	11.0	11.0	11.0
Refrigerent pump, power input	kW	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.75	0.75	1.2	1.2	1.2
Refrigerent pump, electric current	A	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	2.5	2.5	4.6	4.6	4.6
Purge pump, power input	kW	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.75	0.75	0.75	0.75	0.75
Purge pump, electric current	A	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.9	1.9	1.9	1.9	1.9
PD cell heater	kW	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
Control circuit	kW	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3

* Condition for LJ-A 12/7 °C (Fouling Factor = 0.018 m2°C/kW)
29.4/36.3°C (Fouling Factor = 0.044 m2°C/kW)
90/80°C (Fouling Factor = 0.018 m2°C/kW)

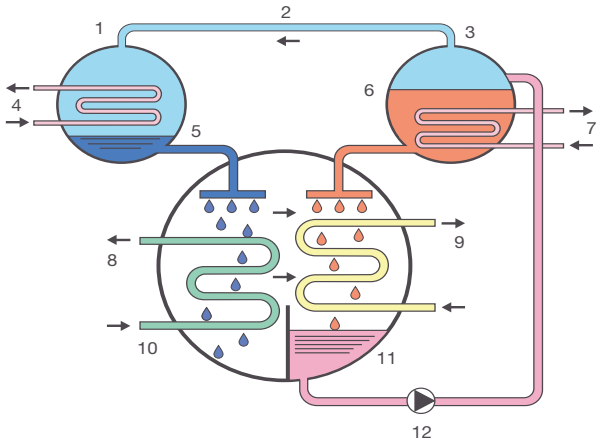
Notes : These performance data are provided to support early design activity. For selection outside ARI operating conditions, contact Carrier

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 vaporised 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 (steam or hot water) to vaporise 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 vaporising 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

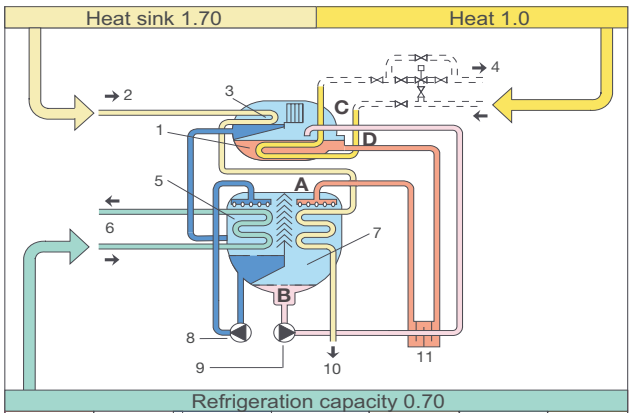


Legend

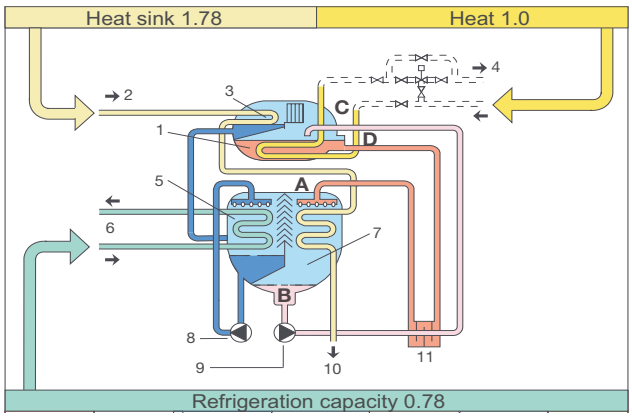
1. Condenser
2. Refrigerant vapour
3. Generator
4. Cooling water
5. Liquid refrigerant
6. Concentrated solution
7. Heat source
8. Chilled water
9. Cooling water
10. Evaporator
11. Absorber
12. Absorbent pump

Cooling cycle schematic

LJ 01/02/03

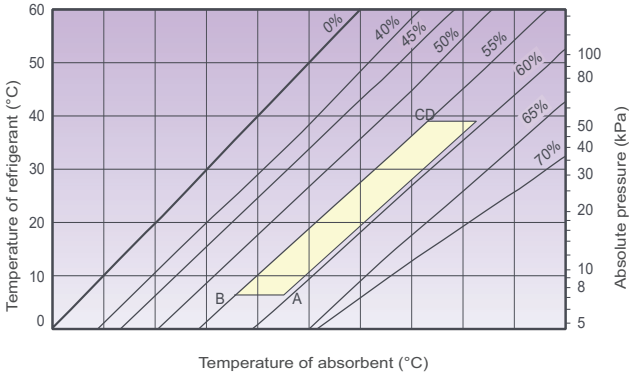


LJA 11-82



Legend

1. Generator
2. Cooling water
3. Condenser
4. Hot water
5. Evaporator
6. Chilled water
7. Absorber
8. Refrigerant pump
9. Absorbent pump
10. Heat exchanger
11. Cooling water
12. Concentrated solution
13. Diluted solution
14. Liquid solution
15. Refrigerant vapour
16. Cooling water
17. Chilled water
18. Hot water



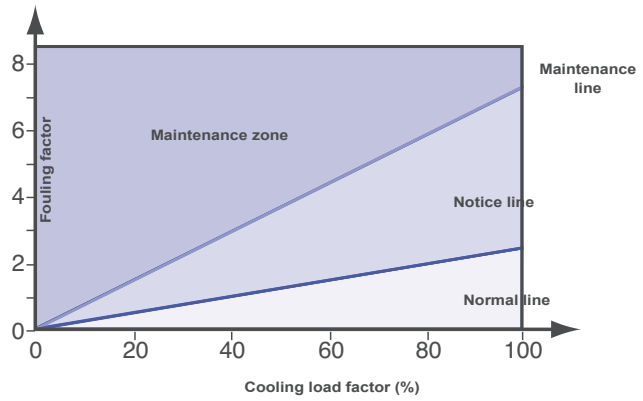
FEATURES AND ADVANTAGES

Expert self-diagnosis function

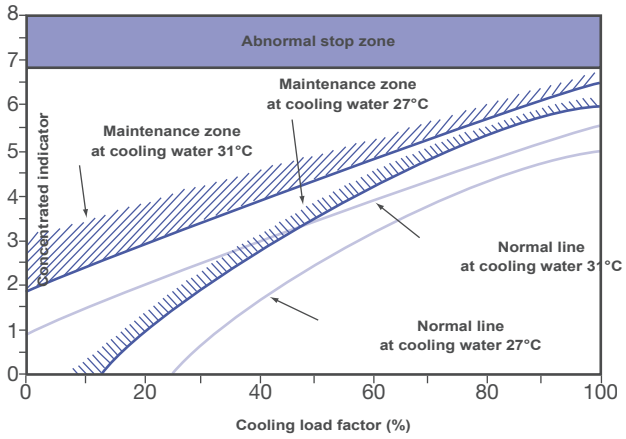
The expert function is provided to monitor operating conditions, predict chiller information and maintain stable operation.

Predictive maintenance information

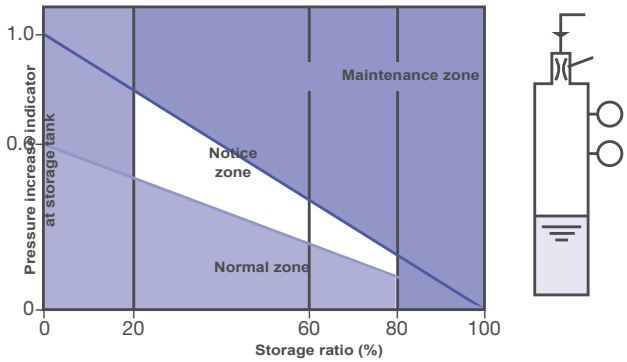
Graph 1 - Fouling of heat transfer tubes in cooling water system



Graph 2 - Tend of absorbent concentration



Graph 3 - Vacuum condition monitoring



Legend

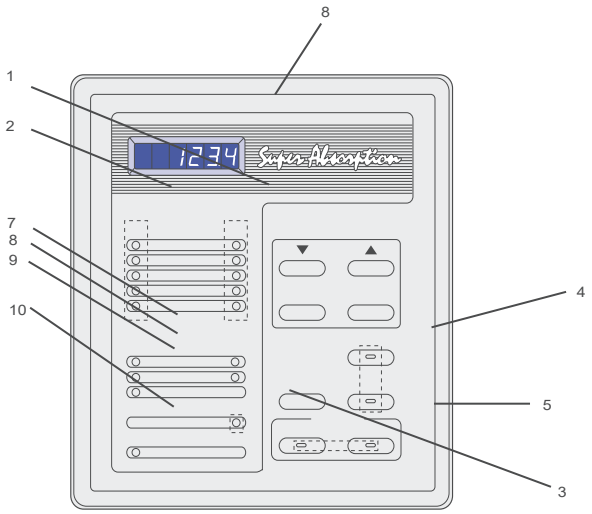
1. Storage tank
2. Diluted solution
3. Purge nozzle
4. Pd cell
5. Pressure sensor

Control system

- The Carrier control system surpasses other proportional only control systems available today. The digital PID (proportional plus integral plus derivative) control maximises unit performance by maintaining a ±0.5 K variance in leaving chilled-water temperature from the set-point. Proportional controls can typically only maintain a ±1 K variance from the set-point. 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 steam input is changed according to the gradient of the leaving chilled-water temperature curve. System temperatures, set-points, and operational records are displayed along with indicator lights for the chiller and pumps.
- The Carrier control system offers its users selfdiagnostics by constantly monitoring the chiller status and will automatically shut the chiller down if a fault occurs. The cause of shutdown will be retained in the 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

Display and control board

Figure 2 - Indication lights



Legend

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

*On the control panel door

FEATURES AND ADVANTAGES

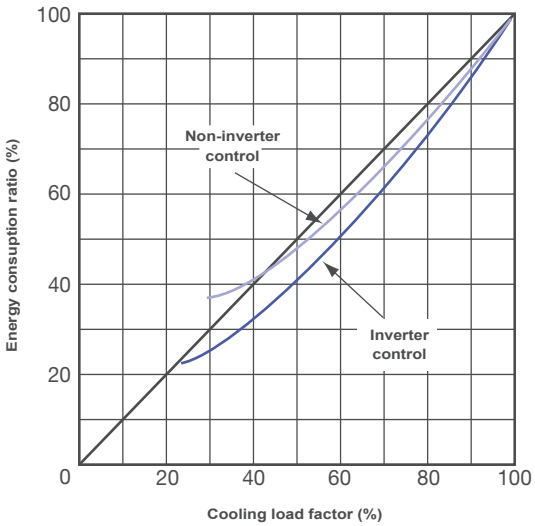
Fast digital PID control

The introduction of new digital PID control stabilises the chilled/hot water temperature with high accuracy. It quickly responds to the load fluctuation and supplies stable chilled/hot water temperature. It is suitable for air-conditioning intelligent buildings which require sophisticated control.

Saving energy with the inverter (option)

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 4 - Running cost curve



Notes
1. Chilled water leaving temperature 7°C constant
2. Cooling water entering temperature:

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

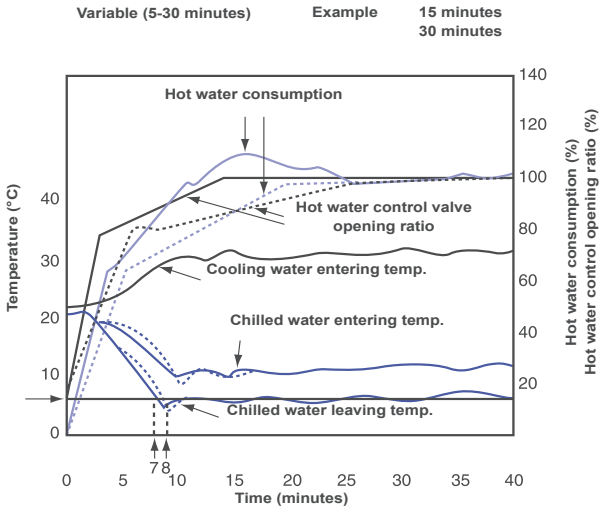
Purge system

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

Hot-water valve opening control

- At the start-up, the opening angle of the hot-water control valve is controlled in three stages, reducing the amount of hot water and the time needed to reach the desired level, compared with the previous model.
- Adjusting the opening speed of the hot-water control valve at the second and third stage, it is possible to set up the most suitable conditions for the site auxiliary equipment.

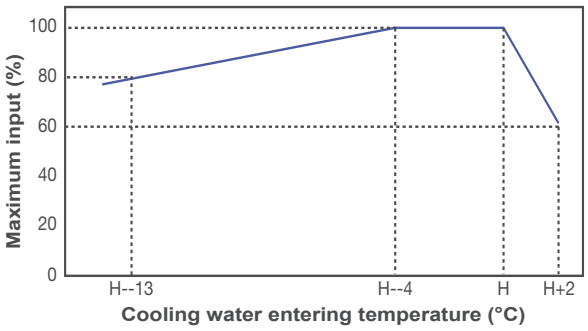
Graph 5 - Hot water valve opening control



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 6 - Safe operating zone chart



Crystallisation protection

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

FOUNDATION DIMENSIONS, MM

Figure 3 - LJ-A 11 to LJ-A 42

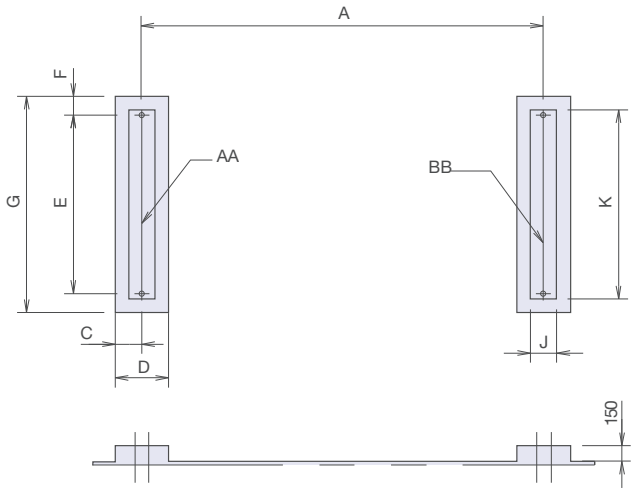


Figure 5 - LJ-A 51 to LJ-A82

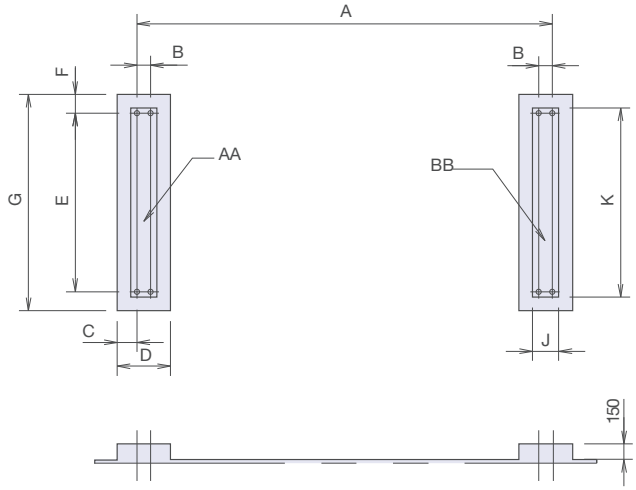
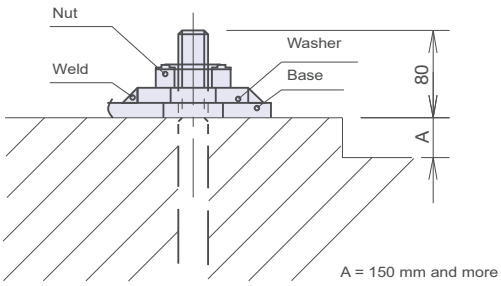


Figure 4 - Details of weld



NOTES:

1. The machine base has ø50-mm hole for the anchor bolt.
2. The anchor bolt should be fixed as shown in the detail drawing.Washer should be welded to the base (see Fig. 4)
3. There should be a drain channel around the foundation.
4. The floor surface should be made waterproof to facilitate maintenance work.
5. The surface of the foundation should be made flat.(Leveling tolerance is 1 mm for 1000 mm)
6. Anchor bolts and nuts are to be supplied by customer.

Table 1 - Foundation dimensions

		Weight			Dimensions								
Model	Size	AA+BB	AA	BB	A	B	C	D	E	F	G	J	K
16LJ-A	11	4000	2000	2000	1896	-	175	360	800	150	1100	160	900
16LJ-A	12	4200	2100	2100	1896	-	175	360	800	150	1100	160	900
16LJ-A	13	5200	2600	2600	2916	-	175	360	800	150	1100	160	900
16LJ-A	14	5500	2750	2750	2916	-	175	360	800	150	1100	160	900
16LJ-A	21	6600	3300	3300	2866	-	200	400	1000	150	1300	200	1100
16LJ-A	22	6900	3450	3450	2866	-	200	400	1000	150	1300	200	1100
16LJ-A	23	8100	4050	4050	3886	-	200	400	1000	150	1300	200	1100
16LJ-A	24	8600	4300	4300	3886	-	200	400	1000	150	1300	200	1100
16LJ-A	31	10500	5250	5250	3836	-	225	450	1100	150	1400	250	1200
16LJ-A	32	11000	5500	5500	3836	-	225	450	1100	150	1400	250	1200
16LJ-A	41	13000	6500	6500	3836	-	225	450	1150	150	1450	250	1250
16LJ-A	42	13600	6800	6800	3836	-	225	450	1150	150	1450	250	1250
16LJ-A	51	18400	9200	9200	3966	130	190	510	1600	180	1960	250	1700
16LJ-A	52	20000	10000	10000	4508	130	190	510	1600	180	1960	250	1700
16LJ-A	53	21400	10700	10700	5006	130	190	510	1600	180	1960	250	1700
16LJ-A	61	28300	14150	14150	4468	140	220	580	1800	180	2160	320	1900
16LJ-A	62	30300	15150	15150	4966	140	220	580	1800	180	2160	320	1900
16LJ-A	63	32400	16200	16200	5491	140	220	580	1800	180	2160	320	1900
16LJ-A	71	38700	19350	19350	4566	140	220	580	2200	180	2560	320	2300
16LJ-A	72	41200	20600	20600	5091	140	220	580	2200	180	2560	320	2300
16LJ-A	73	43700	21850	21850	5591	140	220	580	2200	180	2560	320	2300
16LJ-A	81	46900	23450	23450	5091	140	220	580	2400	180	2760	320	2500
16LJ-A	82	49600	24800	24800	5591	140	220	580	2400	180	2760	320	2500