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: 

[Image of a machine]
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**

---

**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**

- 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**
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 pump
7. Refrigerant pump
8. Absorber
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

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

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.
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. 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

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. 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. 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
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

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-diagnostic 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

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

Legend

1. Operation indication light
2. Stop indication light
3. Alarm indication light
4. Combustion indication light
5. Cooling/heating indication light
6. Remote/local select button with LED
7. Operation select button with LED
8. Data display
9. Stand-by indication light
10. Dilution indication light
11*. Safety circuit indication light
12*. Power indication light
13. Purge indication light
14. Purge pump on - off switch
15. 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

Microprocessor monitoring substantially reduces the optimum dilution cycle period
■ This results in the appropriate dilution cycle operating hours.

Graph 7 - Dilution cycle chart

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
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

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**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 88.8 92.8 96.8
- Pressure drop kPa 70 71 90 94 85 89 61 65 69 72 62 65 56 75 98 98
- Connection (ANSI) inch 4 4 4 4 5 5 6 6 6 6 8 8 8 8 8 8
- Retention volume m³ 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 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 95.4 106.0 106.0
- Pressure drop kPa 72 73 92 96 85 89 61 65 69 72 62 65 56 75 98 98
- Connection (ANSI) inch 4 4 4 4 5 5 6 6 6 6 8 8 8 8 8 8
- Retention volume m³ 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 0.77

**Fuel type**
- Natural gas

**Supply gas pressure mbar**
- Natural gas 135 135 135 135 135 135 135 135 135 135 300 300 300 300 300

**Consumption*** kW
- Cooling 320 384 479 575 671 767 895 1023 1151 1279 1438 1598 1790 2014 2237 2237
- Heating 320 384 479 575 671 767 895 1023 1151 1279 1438 1598 1790 2014 2237 2237

**Power supply**
- 400V - 3 phase - 50Hz

**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 23.7 23.7 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 34.9 34.9 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 6.2 8.2 8.2 8.2 8.2 8.2

**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 1.5

**Refrigerant 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 0.3

**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 0.4

**Burner motor kW**
- 0.76 0.76 0.76 1.4 1.4 1.4 1.4 1.4 1.4 1.4 4.5 4.5 4.5 4.5 4.5 4.5

**Pd cell heater W**
- 38 38 38 38 38 38 38 38 38 38 38 38 38 38 38 38

**Control circuit W**
- 600 600 600 600 600 600 700 700 700 700 700 700 700 700 700 700

**Legend**

* Cooling as per ARI 560 2000
12.2 → 6.7°C (fouling factor = 0.0176 m² K/kW)
29.4 → 35.3°C (fouling factor = 0.044 m² K/kW)

**Heating**
55.8 → 60°C (fouling factor = 0.0176 m² K/kW)

**Pd cell heater W**
- 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 0.4

**Control circuit 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 1.1

**Pd cell heater A**
- 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 0.4

**Burner motor A**
- 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1

For selection outside of above operating conditions please contact Carrier.
### Chilled-water system

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### Hot-water system

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### Cooling water system

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### Fuel type

- Natural gas

### Gas consumption

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<th>61</th>
<th>62</th>
<th>63</th>
<th>71</th>
<th>72</th>
<th>73</th>
<th>81</th>
<th>82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling consumption**</td>
<td>kW</td>
<td>2557</td>
<td>2877</td>
<td>3196</td>
<td>3516</td>
<td>3836</td>
<td>4155</td>
<td>4475</td>
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<tr>
<td>Heating consumption**</td>
<td>kW</td>
<td>2557</td>
<td>2877</td>
<td>3196</td>
<td>3516</td>
<td>3836</td>
<td>4155</td>
<td>4475</td>
</tr>
</tbody>
</table>

### Dimensions

- Length (L): mm 6110, 6600, 7130, 6490, 7520, 7520, 7520, 7520
- 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, 6200, 6200, 6200, 6200, 6200
- Operating weight: kg 37500, 37500, 37500, 46100, 46100, 49500, 52500, 52000
- Max. shipping weight: kg 29200, 34000, 33900, 47500, 44400, 48100, 51400, 53000
- Total shipping weight: kg 29200, 34000, 33900, 47500, 44400, 48100, 51400, 53000
- Shipping method: Two-piece

### Power supply

- 400V - 3 phase - 50Hz

### Apparent power

<table>
<thead>
<tr>
<th>16DJ</th>
<th>61</th>
<th>62</th>
<th>63</th>
<th>71</th>
<th>72</th>
<th>73</th>
<th>81</th>
<th>82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparent power</td>
<td>kVA</td>
<td>28.2</td>
<td>33.2</td>
<td>38.8</td>
<td>40.1</td>
<td>40.1</td>
<td>45.7</td>
<td>47.1</td>
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<tr>
<td>Total electric current</td>
<td>A</td>
<td>41.4</td>
<td>48.7</td>
<td>56.7</td>
<td>58.7</td>
<td>58.7</td>
<td>66.8</td>
<td>68.8</td>
</tr>
</tbody>
</table>

### Technical Data

- Cooling as per ARI 560 2000
- Heating as per ARI 560 2000

**Legend**

- Cooling as per ARI 560 2000
- Heating as per ARI 560 2000
- High gas calorific value (kW/hr/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
      - HT generator 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

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chilled water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Entering: 12.2°C, Leaving: 5°C through 12°C</td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>0.043 l/s x kW, Changes depending on chilled water temperature difference (min. 50%)</td>
<td></td>
</tr>
<tr>
<td><strong>Hot water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Entering: 55.8°C, Max. leaving temperature: 60°C</td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>0.043 l/s x kW, Flow rate should correspond to chilled water flow rate</td>
<td></td>
</tr>
<tr>
<td>Rank up</td>
<td>DJ-11 through 42: max. 2 rank ups, DJ-53 through 81: max. 1 rank up</td>
<td></td>
</tr>
<tr>
<td>Max. working pressure</td>
<td>1034 kPa, Max. working pressure x 1.5, 1586 kPa, 2068 kPa</td>
<td></td>
</tr>
<tr>
<td>Hydraulic test pressure</td>
<td>Max. working pressure x 1.5, Max. working pressure x 1.5.</td>
<td></td>
</tr>
<tr>
<td>Fouling factor</td>
<td>0.018 m² K/kW, Max. 0.18 m² K/kW</td>
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</tr>
<tr>
<td>Tube material</td>
<td>Copper tube, CuNi tube, No option</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td>Refer to JRA-GL02E-1994, No option</td>
<td></td>
</tr>
<tr>
<td>Structure of water header</td>
<td>Removable type and epoxy treated, Carrier-Sanyo standard, No option</td>
<td></td>
</tr>
<tr>
<td>Manufacturing standard of water header</td>
<td>Carrier-Sanyo standard, Non standard number of passes</td>
<td></td>
</tr>
<tr>
<td><strong>Cooling water</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Entering: 29.4°C, Entering: 20°C through 33°C, Temperature difference 3 K through 7 K</td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>0.072 l/s x kW, Within water flow range of each model</td>
<td></td>
</tr>
<tr>
<td>Max. working pressure</td>
<td>1034 kPa, 1586 kPa, 2068 kPa</td>
<td></td>
</tr>
<tr>
<td>Hydraulic test pressure</td>
<td>Max. working pressure x 1.5, Max. working pressure x 1.5.</td>
<td></td>
</tr>
<tr>
<td>Fouling factor</td>
<td>0.044 m² K/kW, Max. 0.18 m² K/kW</td>
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<tr>
<td>Tube material</td>
<td>Copper tube, CuNi tube, No option</td>
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<tr>
<td>Water quality</td>
<td>Refer to JRA-GL02E-1994, No option</td>
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<tr>
<td>Structure of water header</td>
<td>Hinged type and epoxy treated, Carrier-Sanyo standard, No option</td>
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<tr>
<td>Manufacturing standard of water header</td>
<td>Carrier-Sanyo standard, Non standard number of passes</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel type</td>
<td>Natural gas, LPG, kerosene, Diesel oil, different pressures</td>
<td></td>
</tr>
<tr>
<td>Supply gas pressure</td>
<td>Refer to specification table, Contact Carrier-Sanyo representative</td>
<td></td>
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<tr>
<td><strong>Electricity</strong></td>
<td></td>
<td></td>
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<tr>
<td>Nox</td>
<td>80 mg/m³, 80 ppm (02 = 0%) Contact Carrier-Sanyo representative</td>
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<tr>
<td>Voltage - phase - frequency</td>
<td>400V - 3 phase - 50Hz (Voltage control within ±10%, frequency control within ±5%)</td>
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<tr>
<td><strong>Shipment</strong></td>
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<tr>
<td>One section: DJ-11 through DJ-53</td>
<td>Multi-shipment</td>
<td></td>
</tr>
<tr>
<td>Two sections: DJ-51 through DJ-82</td>
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<tr>
<td><strong>Control</strong></td>
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<tr>
<td>Safety functions</td>
<td>Refrigerant temperature, Cooling water flow switch</td>
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<tr>
<td>Parts</td>
<td>Chilled water freeze protection, Chilled water flow switch, Hot water temperature</td>
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<td></td>
<td>Cooling water temperature, HT generator temperature, HT generator pressure</td>
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<td>HT generator solution level, Exhaust gas temperature, Crystallization protection</td>
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<tr>
<td>Capacity control</td>
<td>Motor protection</td>
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<td>Digital PID control by chilled-water temperature, Inverter control of No. 1 absorber pump</td>
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</tr>
<tr>
<td>Parts</td>
<td>Selected by Carrier-Sanyo, No option</td>
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<tr>
<td><strong>Control panel</strong></td>
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<td>Paint finish</td>
<td>Munsell 5Y-7/1, No option</td>
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<td>Indication lights</td>
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<td></td>
<td>Stop, No option</td>
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<td>Alarm, No option</td>
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<td>Display</td>
<td>LED, No option</td>
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<tr>
<td>External terminals</td>
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<tr>
<td>(voltage normally open contact)</td>
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<td>Alarm indication</td>
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<td>Ventilation fan operation, Feedback indication</td>
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<td>Combustion indication</td>
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<tr>
<td><strong>Electrical wiring and piping</strong></td>
<td>Wire: 600 V grade polyvinyl chloride-insulated wires, No option pipe: Plicatube (flexible metal conduits), No option</td>
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<td><strong>Insulation condition</strong></td>
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<td>Location</td>
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<td>Ambient temperature</td>
<td>5°C through 40°C, No option</td>
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<tr>
<td>Ambient humidity</td>
<td>Relative humidity: Max. 90 % at 45°C, No option</td>
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<tr>
<td>Atmosphere</td>
<td>Corrosive gas, Explosive gas, Poisonous gas</td>
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### Pass arrangement

<table>
<thead>
<tr>
<th>16DJ</th>
<th>Evaporator</th>
<th>Absorber</th>
<th>Condenser</th>
</tr>
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<tbody>
<tr>
<td>11</td>
<td>2</td>
<td>4</td>
<td>6</td>
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<tr>
<td>12</td>
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</tr>
<tr>
<td>82</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

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. $\bullet$ indicates the position of anchor bolts.
3. All external water piping must be provided with welded ANSI 150 LB flanges by the customer.
4. $\uparrow$ 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.
### Dimensional drawings, mm (continued)

**16DJ 13 through 16DJ 14**

<table>
<thead>
<tr>
<th>16DJ</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>350</td>
<td>1000</td>
</tr>
<tr>
<td>14</td>
<td>750</td>
<td>800</td>
</tr>
</tbody>
</table>

**16DJ 21 through 16DJ 22**

<table>
<thead>
<tr>
<th>16DJ</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>350</td>
<td>975</td>
</tr>
<tr>
<td>22</td>
<td>150</td>
<td>775</td>
</tr>
</tbody>
</table>

**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.

**Wire connection Ø52 hole**

- **Fuel connection 1-1/2 inch PT1**
- **Chamber drain**
- **Flue connection 280 x 2110**

**Rupture disk (2 inch)**

**Chilled-water out**

- **Tube removal**

**Cooling water in**

**NOTES: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.**
NOTE: Dimensions for guidance only. Always refer to the certified drawings supplied upon request when designing an installation.
16DJ 41 through 16DJ 42

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.

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 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.

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

<table>
<thead>
<tr>
<th>16DJ A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>4951</td>
<td>5091</td>
<td>5621</td>
<td>5970</td>
<td>5780</td>
<td>5995</td>
<td>4220</td>
<td>6200</td>
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<tr>
<td>82</td>
<td>5451</td>
<td>5591</td>
<td>6121</td>
<td>6470</td>
<td>3960</td>
<td>4195</td>
<td>4420</td>
<td>6700</td>
</tr>
</tbody>
</table>

- Cooling water outlet (16 inch)
- Chilled-water outlet (14 inch)
- Chilled-water inlet (14 inch)
- Cooling water inlet (16 inch)
- Fuel connection
- Chamber drain
- Flue connection
- Wire connection Ø52 hole
- Wire connection Ø4 inch
- Chilled-water in/out
- Cooling water in/out
- Ø52 hole

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

<table>
<thead>
<tr>
<th>16DJ</th>
<th>Foundation weights (kg)</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ope-</td>
<td>AA BB CC</td>
<td>A  B  C  D  E  F  G  H  I  K  L  M  N  P  Q  R  S  T  U</td>
</tr>
<tr>
<td></td>
<td></td>
<td>865 850 1896</td>
</tr>
<tr>
<td>11</td>
<td>5200 1750 900 800</td>
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<td>26300 9500 3900 3400</td>
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<td>37900 13400 5800 5300</td>
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<tr>
<td>71</td>
<td>46100 16400 6900 6400</td>
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<td>72</td>
<td>49500 17500 7600 6900</td>
<td>81</td>
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</table>
Control panel dimensions, mm

<table>
<thead>
<tr>
<th>Hole size for wiring</th>
<th>Ø A</th>
<th>11-61</th>
<th>62-72</th>
<th>73-82</th>
</tr>
</thead>
<tbody>
<tr>
<td>16DJ</td>
<td></td>
<td>35</td>
<td>44</td>
<td>50</td>
</tr>
</tbody>
</table>

Power supply
OA
Remote control
Ø22

16DJ-11 through 16DJ-42

16DJ-51 through 16DJ-82
Figure 13 - Typical electrical field connection diagram

**Chiller/Heater Control Panel**

**Terminal Strips on the Control Panel**

1. **Prealarm Signal**
2. **Remote Check Signal**
3. **For Operation Indication**
4. **For Stop Indication**
5. **For Alarm Indication**
6. **Run/Stop Signal**
   - For Chilled/Hot Water Pump
   - For Cooling Water Pump
   - For Cooling Tower Fan
   - For Feedback Signal
7. **Feedback Signal**
8. **Remote Signal**
9. **Field Signals**
10. **Control Panel**
11. **Power Source**

**Field Wiring Connection**
- **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).

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

**For Emergency Stop Signal**
- These terminals are connected.

**Chilled/Hot Water Pump Interlock**
- Synchronized with the pump running signal.

**Cooling Water Pump Interlock**
- Synchronized with the pump running signal.

**Cooling Tower Fan Interlock**
- Synchronized with the pump running signal.

Remote [source: 3 ph 60 Hz 208 V, 460V] [CE: 3 ph 50 Hz 400 V] 24 V a.c. 10 mA 24 V d.c. 10 mA
Sequence of cooling operation

- Figure 14 illustrates the typical operating sequence of a Carrier-Sanyo 16D1 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)**

<table>
<thead>
<tr>
<th>Start signal</th>
<th>Stop signal</th>
<th>Chiller stop</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Burner</strong></td>
<td>ON 36 seconds</td>
<td>ON 12 seconds</td>
</tr>
<tr>
<td><strong>Blower</strong></td>
<td>OFF 4 s</td>
<td>OFF 12 s</td>
</tr>
<tr>
<td><strong>Gas control valve</strong></td>
<td>Open 5 s</td>
<td>Close 8 seconds</td>
</tr>
<tr>
<td><strong>Ignition</strong></td>
<td>ON 2 s</td>
<td>OFF Post-purge 2 s</td>
</tr>
<tr>
<td><strong>Solenoid valve</strong></td>
<td>ON Control area</td>
<td>OFF</td>
</tr>
<tr>
<td><strong>Ignition gas</strong></td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td><strong>No. 1 absorbent pump</strong></td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td><strong>No. 2 absorbent pump</strong></td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Approx. 5 minutes

Dilution cycle Approx. 6-15 minutes
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.

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 H₂O).

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
Flue flange dimensional data (mm)

Figure 17 - Flue flange

Table 2 - Dimensions, mm

<table>
<thead>
<tr>
<th>16DJ</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
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<tr>
<td>11</td>
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<td>81</td>
<td>15</td>
</tr>
<tr>
<td>82</td>
<td>15</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>16DJ Burner model</th>
<th>Burner model oil (kerosene)</th>
<th>Burner model dual fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>RL3-A-ZMD</td>
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<td>12</td>
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<td>RL3-A-ZMD</td>
<td>RGL3/1-E-ZMD</td>
</tr>
<tr>
<td>14</td>
<td>RL5-ZMD</td>
<td>RGL5/1-D-ZMD</td>
</tr>
<tr>
<td>21</td>
<td>G5/1-D-ZMD</td>
<td>RGL5/1-D-ZMD</td>
</tr>
<tr>
<td>22</td>
<td>RL5-ZMD</td>
<td>RGL5/1-D-ZMD</td>
</tr>
<tr>
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<td>RL7-ZMD</td>
<td>RGL7/1-D-ZMD</td>
</tr>
<tr>
<td>24</td>
<td>RL7-ZMD</td>
<td>RGL7/1-D-ZMD</td>
</tr>
<tr>
<td>31</td>
<td>G7/1-D-ZMD</td>
<td>RGL7/1-D-ZMD</td>
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<tr>
<td>32</td>
<td>RL7-ZMD</td>
<td>RGL7/1-D-ZMD</td>
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<td>41</td>
<td>G30/2-A-ZM</td>
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<td>RL30/2-A-ZM</td>
<td>RGL30/2-A-ZM</td>
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<tr>
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<td>G40/1-B-ZM</td>
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<tr>
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<td>RGL40/2-A-ZM</td>
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<tr>
<td>61</td>
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<td>RGL50/1-B-ZM</td>
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<td>RGL50/1-B-ZM</td>
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<tr>
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<td>RL50/2-A-ZM</td>
<td>RGL50/2-A-ZM</td>
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<tr>
<td>73</td>
<td>RL60/2-A-ZM</td>
<td>RGL60/2-A-ZM</td>
</tr>
<tr>
<td>81</td>
<td>G70/1-A-ZM</td>
<td>RGL70/1-A-ZM</td>
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<tr>
<td>82</td>
<td>RL70/1-A-ZM</td>
<td>RGL70/1-A-ZM</td>
</tr>
</tbody>
</table>

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
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.

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.
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.