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Flue Gas-Fired LiBr Absorption Water Chiller & Heat

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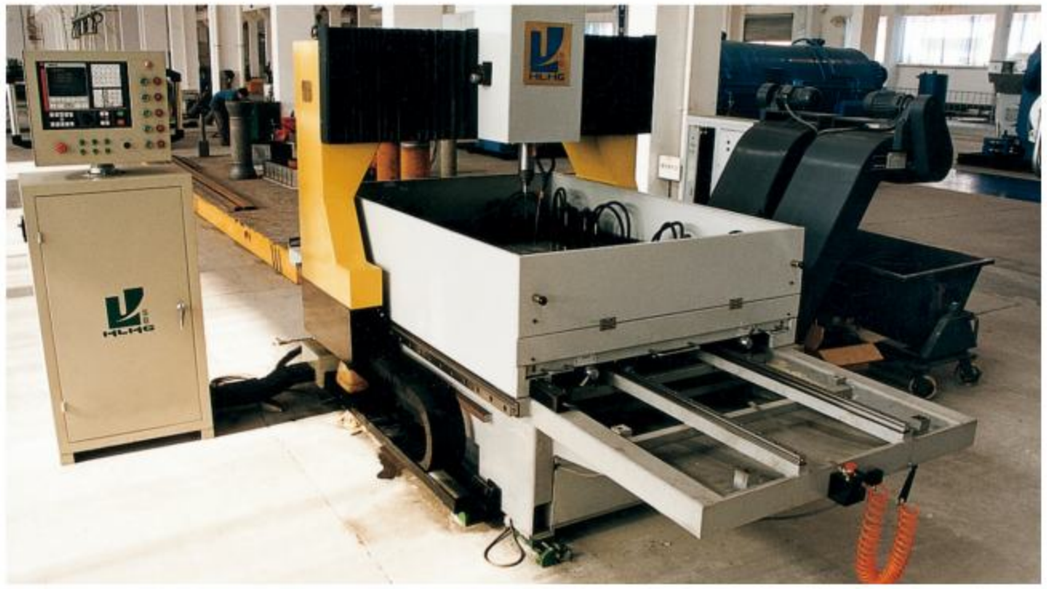


Flue Gas-Fired LiBr Absorption Water Chiller&Heater

The flue gas-fired LiBr absorption water chiller & heater is used to supply cold in summer and heat in winter utilizing flue gas emissions from gas turbines, industrial furnaces and kilns as a source of heat. This system involves no expenses in terms of thermal energy. When the flue gas emissions are insufficient to supply the required quantities of cold or heat, a flue gas-supplementation system may be adopted as a substitute.

Cooling cycle

The diluted solution, transferred by the solution pump , through the low temperature heat exchanger, condensate water heat exchanger, high temperature heat exchanger heating after entering in the high-pressure generator. In the high-pressure generator, the dilute solution is heated by the flame there to generate high-temperature refrigerant vapor, and then condensed into intermediate solution .The intermediate solution entered into the low-pressure generator though the high-temperature heat exchanger and is heated by the high pressure, high temperature refrigerant steam coming from the high pressure generator to generate the refrigerant vapor, and then further become concentrated solution.

The high-temperature refrigerant vapor(water) generated in the high-pressure-generator is heated the intermediate solution of the low-pressure generator and then cooled into refrigerant water .The refrigerant water, after throttled, pressure reducing, with the refrigerant vapor generated in the low-pressure generator entered into the condenser to be cooled by the cooling water, and become refrigerant water which is correspond with condensing pressure

The liquid coolant of the condenser through the throttle, then enters the evaporator. Due to the low pressure of the evaporator, so that the refrigerant water in low temperature can evaporation boiling, when the coolant water is usedPump for conveying, spraying in submerged tube evaporator is immediately, evaporation, absorption evaporator tube inner cooling waterHeat, so that the inner tube water temperature decrease, achieve the purpose of refrigeration

By the low pressure generator out of the concentrated solution flows through the low temperature heat exchanger into the absorber, sprayed in the evaporator tube bank, is cooled by the cooling water within the pipe, temperature reducing, absorbed the refrigerant vapor from the evaporator become a dilute solution. So,the concentrated solution constantly absorbed the refrigerant vapor generated in the evaporator made the evaporator evaporation process constantly. Due to absorbed the refrigerant vapor from the evaporator to become diluted solution, and then is transferred into the high pressuregenerator by the solution pump to boiling and concentrated. Thus completing a cooling cycle

Heating cycle

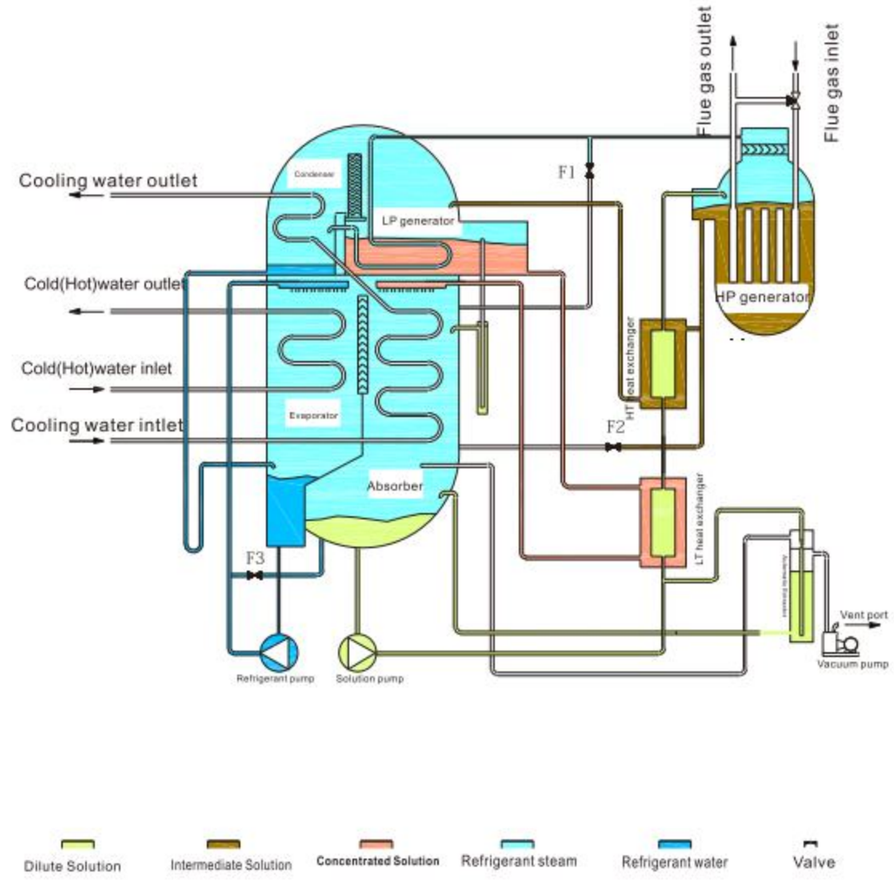
The dilute solution is heated and condensed by the KPG generated the refrigerant vapor. Then the refrigerant vapor is directly transferred into the evaporator and absorber. In the evaporator heat exchange, preparation of warm water. In addition ,The absorption liquid is concentrated into high concentrations entered into the absorber and mixed with the refrigerant water become the diluted solution, and then through the low temperature heat exchanger、 low- temperature heat exchanger to the high pressure generator. Through the above cycle, to achieve the warming.

Product Model No. Format

KYX-16D

- Cold Water Outlet Temperature: D (7℃), Z (10℃), H (13℃) and T (16℃)
- Nominal Refrigeration Capacity: 116×10kW
- KYX (flue gas-fired LiBr absorption water chiller & heater)
- KYZX (flue gas-supplementation LiBr absorption water chiller & heater)

WORKING FLOWCHART



Features

1. Automatic air extraction system combining multi-ejector & water head technology: Speedy vacuum pumping and high vacuum degree maintenance

This is a new, high-efficiency automatic air extraction system. The ejector functions as a small air extraction pump. Shenlan automatic air extraction system adopts multiple ejectors to increase the air extraction & exhaust rate of the chiller. The water head design can help to elevate the vacuum limits and maintain a high vacuum degree. The design, which features "rapidity" and "highness", can provide a high vacuum degree for every part of the chiller at any time. Therefore, oxygen corrosion is precluded, service life is prolonged and an optimal operating status is maintained for the chiller.

2. Self-purging multiply-guided drip-spray device: Stemming blockage

This is a novel structure that precludes blockage effectively. Liquid comes out of the upper pores and branches into three directions. The barbed liquid distribution design can realize self-purging and sedimentation, therefore eradicating the likeliness of absorber sprayer blockage and minimizing refrigeration capacity deterioration.

3. Fine separation device: Stemming contamination

The concentration process for the LiBr solution in the generator is composed of two stages: flash evaporation and generation. Flash evaporation is the root cause for contamination. The fine separation unit conducts fine separation for the refrigerant water (containing parts of the solution) in the flash evaporation stage, and purifies and delivers the refrigerant water to the next refrigeration cycle. By eliminating the source of contamination, the fine separation unit radically addresses refrigeration water contamination.

4. Automatic anti-crystallization system combining potential difference-based dilution and crystal dissolution: Stemming crystallization

A self-contained temperature & potential difference detection system enables the chiller to monitor excessively high concentration of the thick solution. On the one hand, upon detecting an overly high concentration, the chiller automatically feeds refrigerant water to the thick solution for dilution; on the other hand, the chiller utilizes the HT LiBr solution in the generator to heat the thick solution to a higher temperature. The two-pronged solution helps to prevent crystallization-induced failure by keeping the thick solution concentration well below the critical point of crystallization.

In the event of a sudden power failure or abnormal system shutdown, the potential difference-based dilution system will start rapidly to dilute the LiBr solution and to ensure rapid dilution after power supply is restored.

5. Mixed-process refrigeration cycling: An innovative refrigeration process

By combining the merits of the serial process and the parallel process, mixed-process refrigeration cycling can effectively reduce the circulated solution volume and heat loss. Meanwhile, the mixed solution helps to improve chiller operation, minimize crystallization and ensure more stable and energy-efficient chiller operation.

6. Economizer: Energy output boosting

Isooctanol with a conventional chemical structure, as an energy-boosting agent added to the LiBr solution, is normally an insoluble chemical that has only a limited energy boosting effect. The economizer can prepare the mixture of isooctanol and the LiBr solution in a special way to guide isooctanol into the generation & absorption process, therefore enhancing the energy boosting effect of isooctanol, effectively reducing energy consumption and realizing energy efficiency.

7. Interlocked mechanical & electrical anti-freezing system: Multiple anti-freezing protection

The coordinated anti-freezing system features the following merits: a lowered primary sprayer design for the evaporator; an interlock mechanism which links the secondary sprayer of the evaporator with the supply of refrigerant water/cold water; a pipe blockage prevention device; a two-hierarchy old water flow regulating valve; and an interlock mechanism designed for the cold water circulating pump and the cooling water circulating pump. A sextuple anti-freezing design ensures timely detection of cutoff, underflow and under-temperature of cold water supply. Meanwhile, automatic steps will be taken to prevent pipe freezing.

8.Fine flash drum: Recovery of residual heat in the refrigerant

The residual heat of the refrigerant water in the chiller is used to heat the thin LiBr solution. By reducing the thermal load of the absorber, the fine flash drum achieves the end of residual heat recovery and energy efficiency.


canned pump

9. Self-adaptive refrigerant storage unit: Improving part of the load characteristics and shortening startup/shutdown time

The refrigerant water storage capacity can be automatically adjusted according to external load changes, particularly when the chiller works under only partial load. The refrigerant storage unit has an evident energy-saving effect in that it can automatically control the solution concentration and maintain optimal performance parameters. The adoption of the refrigerant storage unit can shorten the start/shutdown time substantially and reduce idle work.

10. Plate heat exchanger: Saving more than 10% of energy

A corrugated stainless steel plate heat exchanger is adopted. This type of plate heat exchanger has a very sound effect, a high residual heat recovery rate and a remarkable energy-saving performance. Meanwhile, the stainless steel plate has a service life of over 20 years.

11. Special surface treatment for heat-conducting tubes: High performance in heat exchanging & less energy consumption

The evaporator and absorber have been hydrophilically treated to ensure even liquid film distribution on the tube surface. This design can improve the heat exchange effect and lower energy consumption.

12. Li_2MoO_4 corrosion inhibitor: An environment-friendly corrosion inhibitor

Lithium molybdate (Li_2MoO_4), an environment-friendly corrosion inhibitor, is used to replace Li_2CrO_4 (containing heavy metals) during the preparation of the LiBr solution.

13. Wholly welded structure: Secure sealing performance

All the sealed places are treated by submerged arc-welding, CO_2 gas-shielded welding or argon arc-welding to prevent chiller leaks that are caused by bolt connection or flat sealing.

14. Frequency-variable operation: An energy-saving technology

The chiller can adjust its operation condition automatically and maintain optimal working according to changes in refrigeration capacity. This technology ensures the least energy consumption for prolonged chiller operation.

Artificial Intelligence (AI) Control System (V3.0)

1. Fully-Automatic Control Functions

The AI control system (V3.0) is featured by powerful and complete functions, such as one-key startup /shutdown, timed startup/shutdown, a mature safety protection system, multiple automatic adjustment options, system interlock, an expert system, human-machine dialogue, building automation interfaces, etc. These functions help to enable simple operation, stable performance and high working efficiency.

2. Unique Load Adjustment Function

The AI control system (V3.0) has a unique load adjustment function, which enables automatic adjustment of chiller output load according to the actual load of the user. The function not only helps to reduce startup /shutdown time and dilution time, but also contributes to less idle work and energy consumption.

3. Unique Circulated Solution Volume Control Technology

The AI control system (V3.0) employs an innovative ternary control technology to adjust the circulated solution volume. Traditionally, only parameters of the generator liquid level are used for control of the circulated solution volume. By contrast, the new technology combines the merits of the concentration & temperature of a thick solution and the liquid level in the generator. Meanwhile, an advanced frequency-variable control technology is applied to the solution pump to enable the chiller to achieve an optimal circulated solution volume. The technology improves operating efficiency and reduces startup time & energy consumption.

4. Cooling Water Temperature Limits Control Technology

The AI control system (V3.0) can control and adapt the hot water volume to the temperature changes of the inlet cooling water. By maintaining the cooling water inlet temperature within 18-34℃, the chiller can operate safely and efficiently.

5. Solution Concentration Limits Control Technology

The AI control system (V3.0) uses a unique concentration control technology to enable real-time monitoring/control of the concentration and circulated volume of a thick solution as well as the hot water volume. The system can maintain the chiller under safe and stable high-concentration condition, improve chiller operating efficiency and prevent crystallization.

6. Complete Chiller Abnormality Self-Diagnosis & Protection Function

The AI control system (V3.0) features 34 abnormality self-diagnosis & protection functions. Automatic steps will be taken by the system according to the level of an abnormality. This is intended to prevent accidents, minimize human labor and ensures a sustained, safe and stable operation of the chiller.

7. Intelligent Automatic Air Extraction Function

The AI control system (V3.0) can realize real-time monitoring of non-condensable gas volumes inside the chiller. The system can automatically start up or shut down the air extractor, or give prompts of manual operation

8. Unique Shutdown Dilution Control Technology

The AI control system (V3.0) can control the operation time of different pumps requiring dilution, according to the thick solution concentration, ambient temperature and remaining refrigerant water volume (in the case of refrigeration). Therefore, an optimal concentration can be maintained for the chiller after shutdown. Crystallization is precluded and chiller re-start time is shortened.

9. Unit Working Parameter Management System

Through the interface of the AI control system (V3.0), the operator can perform any of the following operations for 12 critical parameters relating to chiller performance: real-time display, correction and configuration. Also, records can be kept of historical operation events.

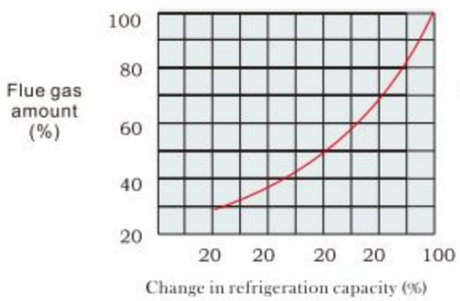
10. Chiller Fault Management System

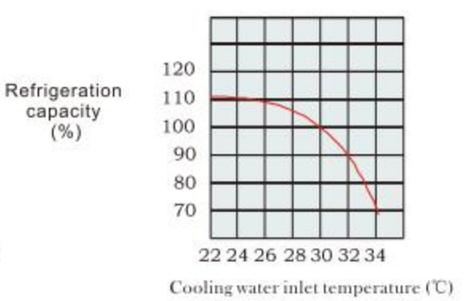
If any accurate prompt of any occasional fault is displayed on the operation interface, the AI control system (V3.0) can locate and detail the fault, and propose a solution or cautionary tips. Classification and statistical analyses of historical faults can be conducted to facilitate maintenance service provided by operators.

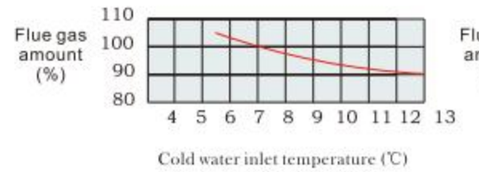
Cooperation and Communion

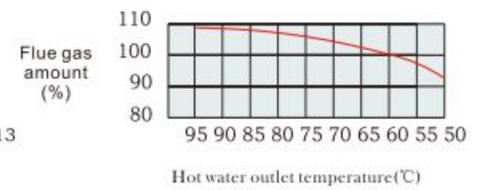
Leaders' Mien

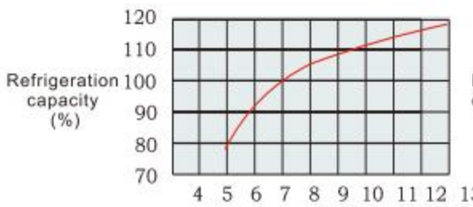
Performance curve

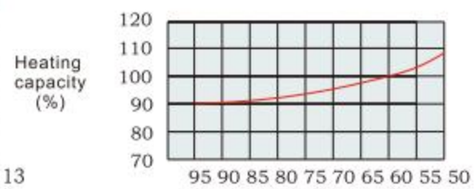












Nominal Parameters of a Flue Gas-Fired LiBr AbsorptionWater Chiller & Heater

Model Number		KYX-	58	70	81	93	105	116	145	174	204	233	262	291	349	407	465	523	582	698
Cooling capacity		KW	580	700	810	930	1050	1163	1450	1740	2040	2330	2620	2910	3490	4070	4650	5230	5820	6980
		×10⁴Kcal/h	50	60	70	80	90	100	125	150	175	200	225	250	300	350	400	450	500	600
		USRt	165	198	231	265	299	331	413	496	579	661	744	827	992	1157	1323	1488	1653	1984
Heating capacity		KW	407	582	686	779	884	814	1018	1221	1425	1628	1832	2035	2442	2849	3256	3663	4070	4884
		×10⁴Kcal/h	35	42	49	56	63	70	88	105	123	140	158	175	210	245	280	315	350	420
Chilled (Hot) water	Inlet/Outlet temperature	℃	Chilled water 12 →7/Heating 55 →60							Chilled water 12 →7/Heating 55 →60										
	Cooling flow rate	m³/h	100	120	140	160	180	200	250	300	350	400	450	500	600	700	800	900	1000	1200
	Heating flow rate	m³/h	70	84	98	112	126	140	175	210	245	280	315	350	420	490	560	630	700	840
	Pressure drop	KPa	85.1	85.4	52.3	52.3	36.0	52.5	52.5	73.2	73.0	98.8	73.1	98.6	29.3	49.3	49.3	93.9	93.8	93.8
	Pipe diameter	DN(mm)	125	125	150	150	150	150	200	200	200	250	250	250	250	300	300	350	350	400
Cooling water	Inlet/Outlet temperature	℃	30→36							30→36										
	Flow rate	m³/h	143	171	200	228	257	285	356	428	499	570	581	713	855	998	1140	1283	1425	1710
	Pressure drop	KPa	58	58	84	84	58	84	84	118	50	67	50	67	113	113	113	64	64	64
	Pipe diameter	DN(mm)	150	150	200	200	200	200	250	250	250	300	300	350	350	350	400	400	400	450
Flue Gas	Inlet/Outlet temperature	℃	500→170							500→170										
	Consumption	Nm³/h	3188	3825	4463	5100	5738	6375	7969	9563	11156	12750	14344	15938	19125	22313	25500	28688	31875	38250
	Pipe diameter	DN(mm)	450	500	500	550	600	600	700	800	850	900	950	1000	1100	1200	1200	1400	1400	1500
Electric	Total power	KW	2.8	3.8	3.8	3.8	4.2	4.2	4.4	5.4	5.8	6.4	6.4	7.4	7.7	8.2	8.7	9.7	12.2	13.2
	Power supply		3-phase/380V/50HZ							3-phase/380V/50HZ										
Dimension	Length	mm	2980	4030	4030	4030	4640	4640	4658	5740	5740	5770	5870	5920	6720	6720	6800	7800	7800	9610
	Width	mm	1960	2010	2100	2210	2270	2420	2465	2510	2675	2810	2890	2975	3120	3530	3975	4140	4250	4530
	Height	mm	2100	2160	2180	2320	2350	2438	2640	2640	2740	2890	3200	3360	3380	3600	3712	3740	3720	3745
Shipment			Assembled							Assembled										
Total shipment weight		t	7.7	9.1	10.4	10.6	12.8	14.1	16.3	17.9	20.3	24.6	26.1	29.1	34.0	38.4	42.6	49.7	54.3	63.8
Operating weight		t	9.2	10.5	10.6	12.1	14	16.2	19.4	20.7	24	27.8	29.3	32.2	37.9	42.3	48.5	53.4	58.8	70.6

Nominal Parameters of a Flue Gas-Supplementation Water Chiller & Heater

Model Number		KYZX-	58	70	81	93	105	116	145	174	204	233	262	291	349	407	465	523	582	698
Cooling capacity		KW	580	700	810	930	1050	1163	1450	1740	2040	2330	2620	2910	3490	4070	4650	5230	5820	6980
		$\times 10^4$Kcal/h	50	60	70	80	90	100	125	150	175	200	225	250	300	350	400	450	500	600
		USRt	165	198	231	265	299	331	413	496	579	661	744	827	992	1157	1323	1488	1653	1984
Heating capacity		KW	488	582	686	779	884	977	1221	1465	1710	1954	2196	2442	2931	3419	3908	4396	4885	5862
		$\times 10^4$Kcal/h	42	50	59	67	76	84	105	126	147	168	180	210	252	294	336	378	420	504
Chilled(Hot) water	Inlet/Outlet temperature	℃	Chilled water 12 →7/Heating 55 →60							Chilled water 12 →7/Heating 55 →60										
	Flow rate	m^3/h	100	120	140	160	180	200	250	300	350	400	450	500	600	700	800	90.0	1000	1200
	Pressure drop	KPa	85.1	85.4	52.3	52.3	36.0	52.5	52.5	73.2	73.0	98.8	73.1	98.6	49.3	49.3	49.3	93.9	93.8	93.8
	Pipe diameter	DN(mm)	125	125	150	150	150	150	200	200	200	250	250	250	250	300	300	350	350	400
Cooling water	Inlet/Outlet temperature	℃	30→36							30→36										
	Flow rate	m^3/h	142.5	171	199.5	228	256.5	285	356.3	427.5	498.8	570	641.3	712.5	855	997.5	1140	1282.5	1425	1710
	Pressure drop	KPa	58	58	84	84	58	84	84	118	50	67	50	67	113	113	113	64	64	64
	Pipe diameter	DN(mm)	150	150	200	200	200	200	250	250	250	300	300	350	350	350	400	400	400	450
Flue	Flue Gas Inlet/Outlet temperature	℃	500→170							500→170										
	Flue Gas Refrigeration consumption	Nm^3/h	1594	1913	2232	2550	2869	3188	3985	4782	5579	6376	7173	7970	9564	11158	12752	14346	15940	19128
	Flue Gas Heating consumption	Nm^3/h	1875	2250	2625	3000	3375	3750	4688	5625	6563	7500	8438	9375	11250	13125	15000	16875	18750	22500
	Flue Gas Pipe diameter	DN(mm)	350	350	400	450	450	500	550	600	650	700	700	750	850	900	950	1000	1000	1200
	Max. supplementation for refrigeration	$\times 10^4$Kcal/h	18.4	22.1	25.8	29.4	33.1	36.8	46.0	55.2	64.4	73.6	82.8	92.0	110.4	128.8	147.2	165.6	184.0	220.8
	Max. supplementation for heating	$\times 10^4$Kcal/h	20.4	24.4	28.5	32.6	36.6	40.7	50.9	61.1	71.2	81.4	91.6	101.8	122.1	142.5	162.8	183.2	203.5	244.2
	Fuel gas adaptor diameter	DN(mm)	32	32	32	32	32	32.0	40.0	40	50	50.0	50	50	50.0	50	50.0	65	65.0	80.0
	Fuel oil adaptor diameter	DN(mm)	25							25										
Electric	Total power	KW	3.6	4.2	4.2	4.2	4.6	5.0	5.0	6.5	7.3	7.9	7.9	8.9	10.0	10.4	13.2	14.2	16.7	20.7
	Power supply		3-phase/380V/50HZ							3-phase/380V/50HZ										
Dimension	Length	mm	2980	4030	4030	4030	4640	4640	4658	5740	5740	5770	5870	5020	6720	6720	6800	7800	7800	9610
	Width	mm	2050	2105	2105	2310	2360	2420	2570	2625	2760	2910	2985	3070	3240	3685	4070	4275	4360	4670
	Height	mm	2100	2160	2180	2320	2350	2438	2640	2640	2740	2890	3200	3360	3380	3600	3712	3740	3720	3745
Shipment			Assembled							Assembled										
Total shipment weight		t	7.1	8.3	9.5	10.6	11.7	12.8	15.5	18.1	20.6	23.1	25.5	27.9	32.6	37.2	41.7	46.0	50.4	58.8
Operating weight		t	8.0	9.3	10.6	11.9	13.2	14.4	17.4	20.3	23.2	25.9	28.7	31.4	36.6	41.7	46.8	51.7	56.5	66.0

Model Selection Guide

Model No. Selection

Load Determination

The refrigeration/heating capacity of a flue gas-fired LiBr absorption water chiller & heater should be selected in accordance with the refrigeration load of a building (or a process) and the flue gas supply.

System Description

A flue gas-fired LiBr absorption water chiller & heater may be of any of the following types, depending on the flue gas temperature and the form of thermal energy: flue gas-fired type, flue gas-supplementation type, and flue gas-and-hot water-supplementation type (specifically used for power generation systems).

Source of Flue Gas

For a flue gas-fired LiBr absorption water chiller&heater, the following exploitable sources of flue gas may be used as thermal energy: waste gas emissions from power generation systems, residue heat emissions from various industrial furnaces & kilns (gas melting furnaces and cement kilns), and residual heat emissions from a garbage incinerator. As a result of the different industrial processes and compositions of flue gas emissions, special heat recovery units should be adopted for flue gas emissions containing corrosive, viscous or dusty substances.

Cold Water Outlet Temperature

Besides the specified cold water outlet temperature of a standard chiller, other outlet temperature values (min.: 6℃) may also be selected.

Pressure Bearing Requirements

The design pressure bearing standard capacity of the cold water/cooling water system of the chiller is 0.8MPa. If the actual pressure of the water system exceeds this standard value, a HP-type chiller should be used.

Chiller Qty

The selection of the right type of chiller is based on the calculations of the cooling load of the processes or of the air-conditioner in the building. If more than one chiller is used, the determination of the single unit refrigeration capacity and of the number of chillers should take into account maximum load operation and partial load operation.

Control Mode

The hot water-powered LiBr absorption chiller is supported by an AI (artificial intelligence) control system that enables automatic operation. Mean while, there are a number of options available for the customers, such as control interfaces for the cold water pump, cooling water pump, cooling tower fan & buildings, centralized control system and dial-up internet access.

List of Selectable Models

Flue Gas-Fired LiBr Absorption Water Chiller & Heater

Item	Type	Feature	Remarks
Function	Standard type	Used for refrigeration or heating	
	Single effect type (refrigeration-only type)	Used for refrigeration only	
Form of Energy	Flue gas-fired type	Flue gas (200-600℃)	
	Flue gas-supplementation type	Flue gas+fuel gas (or fuel oil) (200-600℃)	
	Flue gas and hot water -supplementation type	Flue gas (200-600℃)+fuel gas (or fuel oil)+hot water (90℃)	Used for residual heat recovery from power generation systems
Special	Type on Demand HP-boosted type	The heat supply capacity of the system can be boosted. The heat supply capacity of the system can be boosted.	
	HP type	If the cold water (or cooling water) system pressure is equal to or above 0.8MPa, a HP water chamber may be used. The pressure level may be 0.8-1.6MPa, or1.6- 2.0MPa	
	Separately-handled type	Given the limited dimensions of the access way leading to the user's machine room, the main body and the HP generator can be transported separately	

Machine Room Design and Constructin

Scope of Delivery and Construction

Item	Description	Scope of Delivery and Construction		Remarks
		Shenlan Company	User	
Unit	Chiller and accessories	○		Please refer to Scope of Supply.
Debugging test	Ex-factory debugging test	○		
	Site debugging test	○		One (1) debugging test for refrigeration
Transportation to the site	From the factory to the worksite		○	
	From the worksite to the mounting base		○	
	Installation in place		○	
	Chiller assembly (separate delivery)	○		The user must provide welding equipment, nitrogen and other necessary tools
Electrical engineering	Sensors and meters	○		The user must be responsible for laying remote control cables
	External electrical wiring engineering		○	The wires extend till the outlet of the wiring terminal of the control cabinet.
Other engineering	Mounting base construction		○	
	External tubing engineering		○	
	Air extraction system		○	
	Tubing system anti-freezing measures		○	During winter shutdowns, please adopt anti-freezing measures for the water tubing.
	Cooling water quality management		○	Please set the cooling water discharge valve or other unit to enable proper water quality management
	Thermal insulation engineering		○	
Other	LiBr solution	○		
	Operation training & instructions	○		

Civil Works for the Machine Room

Site Selection of the Machine Room:

Location: A flue gas-fired LiBr absorption water chiller & heater should be installed as closely to the flue gas discharge system as possible to minimize the resistant force in the discharging process.

Ventilation

The machine room must be ventilated adequately to ensure the quantities of air required for a flue gas-supplementation water chiller & heater. Normally, the generation of 10,000kcal of heat by combustion requires at least 15m3 of air.

Drainage:

The machine room should be equipped with good drainage facilities: ① drains covered by cast iron grates should be available around the chiller. Water in the drains can flow out of the machine room without difficulty; ② all the discharge pipes and signal pipes in the machine room should be installed at a visible place above the drains. They should not be installed in the drains; ③ Sump pits and submerged pumps should be available in a machine room located in the basement. Automatic control devices should be provided to enable automatic drainage.

Machine Room Arrangement:

The installation location of the machine room should ensure handy operation and adequate maintenance space. A 1-meter-wide operation space (minimum) should be left at the front of the electrical control cabinet; a 0.3m distance (minimum) should be reserved between the top of the chiller and the bottom of the beam of the machine room; a 1.2-meter-wide space (minimum) should be left for the other sides of the chiller. A space for drawing heat conducting tubes (length: no less than the tube length) should be reserved at any end of the lengthwise direction of the chiller. If this space can not be reserved, a window or door may be designed for tube drawing.

Chiller Mounting Base:

The mounting base may be designed on the basis of the dead load of the chiller. The design should ensure a stable, firm and unsinkable base; otherwise the chiller may suffer damage or a shortened service life.

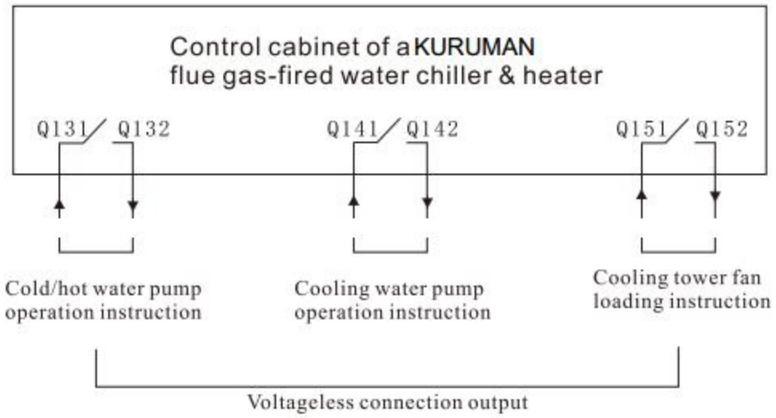
Tubing System

The tubing system should be designed and planned as a whole in compliance with the requirements of the applicable standards and regulations. The tubes should be arranged in an orderly and neat way. Try to adopt overhead installation. The tubes should be firmly supported. The gravity of external tubing must not be applied to the chiller.

Water Supply System

Flexible joints must be fitted for cold water/cooling water supply to the chiller. A filter must be fitted for the inlet end at a place easy for uninstallation. If the hydrostatic pressure of the water supply system is more than 30mH2O, it is recommended that the water pump be installed on the outlet side so as to relieve unnecessary pressure load. Tubes at both inlet and outlet ends should be easy to uninstall. This is intended to facilitate the cleaning of heat conducting tubes by opening the watertight cover.

Power Distribution Diagram of the External Interlock Mechanism of a Flue Gas-Fired Water Chiller & Heater System



NOTE:

1. The capacitance of the output relays of the interlocked water pump terminal is AC250V and the amperage is 5A (resistive load).
2. Q131, Q132, Q141, Q151, Q161 and Q162 are the wiring numbers of the conductors in the control cabinet of a KURUMAN OPT directly-fired water chiller & heater.
3. The operation of a cold water pump and a cooling water pump must be interlocked.

The control system of KURUMAN hot water-powered LiBr absorption chiller supports multiple communication protocols.

Point-to-point interface: PPI protocol
Multi-point interface: MPI protocol
Process field bus (PROFIBUS): PROFIBUS protocol
Freeport communication: User-defined protocol

The pin distribution of the communication port as the following table

Pin ()	Profibus	System Communication Port
1	Shielding	Logic ground
2	24V; return	Logic ground
3	RS-485; Signal B	RS-485; Signal B
4	Sending of a request	RTS (TTL)
5	55V; return	Logic ground
6	+5V	+5V, 100Ω
7	+24V	+24V
8	RS-485; Signal A	RS-485; Signal A
9	Inapplicable	10-bit protocol selection (input)

Handling and Installation in Place

Delivery Status:

Delivery usually takes the form of whole-unit delivery. If handling is restricted by the user's access way, the chiller may be delivered in two parts: the principal part and the HP generator. After the chiller is installed in place, KURUMAN Company will be responsible for internal tubing connection and the user will be responsible for providing welding equipment and assistance. Recommendations on Transportation: The chiller should be hoisted in place and transported as per Corporate Specification for Chiller Hoisting & Transportation provided by KURUMAN Company. The slings and fasteners must be fixed to the indicated positions of the chiller. KURUMAN is ready to seek transportation service & insurance for the user.

Installation in Place:

A steel plate and a rubber plate should be laid on the surface of the mounting base. After the chiller is installed in place, the small holes (ϕ4) on the two sides should be used as reference points for horizontal adjustment in the length and width direction. The levelness of the chiller should be controlled within 1/1000. To achieve an even pressure load, there should be no gaps between the bracket and the mounting base.

Protective measures must be taken for the chiller during the hoisting, transportation, installation and project construction stage. To prevent a chiller breakdown, never impact the chiller with heavy objects or twist the valves at will.

Water Quality Management Tips

As cooling water in the cooling tower evaporates continuously, its salinity will increase and its quality will deteriorate, thus causing corrosion and scaling in the heat conducting tubes. Also, the summer heat will conduce to algae propagation, impurities accumulation and scaling, therefore raising the thermal resistance of copper tubes and compromising the refrigeration capacity substantially.

Pictures of Citys Central Air-Conditioning System

Water Quality Management Tips

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See the following table for the water quality requirements on cooling water as a make-up:

Item	Unit	Makeup Water Requirements	Cooling Water Requirements	Tendency	
				Corrosion	Scaling
pH value (25° C)		6.5-8.0	6.5-8.0	△	△
Conductivity (25° C)	US/cm	<200	<200	△	△
Chloride ion Cl^-	mg$C1^-$/L	<50	<200	△	
Sulfate ion $SO4^{2-}$	mgSO_4^{2-}/L	<50	<200	△	
Acid consumption (pH: 4.8)	mg$CaCo_3$/L	<50	<100		△
Total hardness	mg$CaCo_3$/L	<50	<200		△
Ferric ion (Fe)	mgFe/L	<0.3	<1.0	△	△
Sulfide ion S^{2-}	mgS^{2-}/L	Undetectable	Undetectable	△	
Ammonium ion NH_4^+	mgNH_4^+/L	<0.2	<1.0	△	
Silicon dioxide SiO_2	mgSiO_2/L	<30	<50		△