



烟台冰轮  
YANTAI MOON

致力于人类生活质量的提高  
Making a better life

## LS系列螺杆冷水机组

LS Series Screw Water Chiller Units

环保节能

Environment  
-friendly and  
energy-saving

操作简单

Simple  
operation

稳定可靠

Stable and  
reliable



烟台冰轮股份有限公司  
YANTAI MOON CO.,LTD.



烟台冰轮集团创建于 1956 年，是以工商业制冷成套设备、中央空调、精密铸件、密封材料、电站设备、塑料型材、换热设备等为主导产业的跨行业，国际化经营的大型集团企业。

烟台冰轮股份有限公司（股票代码 000811）是冰轮集团的核心企业，以制冷空调设备、气体压缩设备的研发、制造，制冷空调应用系统集成、制冷空调节能服务、工程成套服务为主业，是中国民族制冷空调行业的领军企业。

烟台冰轮拥有国家认定的企业技术中心，建有国内最先进的制冷性能实验室，掌握了以螺杆压缩机技术为代表的具有国际先进水平的核心技术，拥有发明专利 28 项，实用新型专利 35 项。是中国唯一拥有半封闭螺杆压缩机制造资质的企业，也是世界上唯一能够同时生产开启式、半封闭式和全封闭式螺杆压缩机的企业。烟台冰轮的活塞式压缩机 1988 年获得中国制冷产品最高质量奖 - 国家质量银质奖章，开启式螺杆压缩机的“理论技术及产品研发” 2006 年荣获中国制冷行业最高科技奖 - 国家科技进步二等奖。

烟台冰轮生产的 8 个系列，500 多种制冷空调产品覆盖了食品冷冻冷藏、化工工艺制冷（冷却）、人工智能环境等领域。凭借先进的技术、可靠的品质和良好的服务为中国和全球超过 65 个国家的用户提供了“节能、环保、安全”的使用体验，帮助客户实现业务的成长。烟台冰轮全资子公司——具有综合甲级资质的鲁商冰轮建筑设计有限公司，可为用户提供专业的工程项目整体规划及系统综合设计服务。

烟台冰轮在中国各地拥有 35 个营销服务机构，在全球 21 个国家设有 22 个海外营销服务机构，在越南设有海外工厂，构建了比较完善的营销服务网络，可快速响应用户从技术咨询、项目规划、系统设计、设备采购、工程施工，到技术培训、维护保养、系统改造升级等全过程的服务需求，承诺为用户提供产品全生命周期的服务保障。





Yantai Moon Group was founded in 1956, which is a cross-industry and international operations of large enterprise groups with industrial and commercial refrigeration equipment, central air-conditioning systems, precision castings, sealing materials, power plant equipment, plastic moldings, heat transfer equipment as its leading industries.

Yantai Moon Co., Ltd. (stock code of 000811) is the core business unit of Moon Group, with research and development and manufacturing of refrigeration conditioning equipment and gas compression equipment, integration of refrigeration air-conditioning application systems, refrigeration air-conditioning energy-saving services, engineering service packages as its main business, and it is an industry leader of China refrigeration conditioning industry.

Yantai Moon Group has a state-certified enterprise technology center, and built the most advanced refrigeration performance lab in China. The company mastered the international advanced core technology with the screw compressor technology as its representative, and hold 28 invention patents and 35 utility model patents. It is the only enterprise with manufacturing qualification of semi-hermetic screw compressor in China, and also is the world's only enterprise who can produce open-type, semi-hermetic type and hermetic type screw compressors. The reciprocating compressor manufactured by Yantai Moon Group achieved the highest quality award in China refrigeration products - National Quality Silver Medal in 1988 and the "theory and product research and development" of open-type screw compressor achieved the highest technology award in China Refrigeration

industry - Second-class National Science and Technology Progress Prize in 2006.

8 series, over 500 kinds of refrigeration & air-conditioning products from Yantai Moon Group have covered the food refrigeration, chemical process refrigeration (cooling), artificial intelligence environment and other fields. With advanced technology, reliable quality and good service, it has provided the user experiences of "energy-saving, environmental protection, safety" for customers in China and more than 65 countries around the world, and assisted customers to achieve the business growth. The wholly-owned subsidiary of Yantai Moon Group - Lushang Binglun Architectural Design Co., Ltd. with Class A integration qualification can provide customers with the professional overall project planning and system design services.

Yantai Moon Group owns 35 marketing services agencies in China and 22 overseas marketing services agencies in 21 countries, and has set up an overseas factory in Vietnam. It has build a comprehensive marketing and service network, which can make quick response to customers for the technical advisory, project planning, system design, equipment procurement, project construction, technical training, maintenance and repair, system upgrading and other services. The company is committed to provide customers with service support within the whole product life cycle.

## 产品介绍

烟台冰轮股份有限公司凭籍五十多年来制冷空调设备的制造经验和持续的技术研发能力，并与西安交通大学、世界业内知名企业经过多年的技术合作与交流，对压缩机的热、动力性能的理论研究和实际工作过程、压力脉动、转子受力和油分布可视化等进行了创新试验研究，研制出拥有 10 余项自主知识产权和核心技术的新型 LG 系列高效螺杆压缩机及 BF 系列半封闭螺杆压缩机。

LS 系列螺杆冷水机组即配置了上述 LG 系列开启式螺杆压缩机和 BF 系列半封闭式螺杆压缩机，形成了开启式螺杆冷水机组和半封闭式螺杆冷水机组两大系列。经综合考虑所有功耗点和潜在故障点，以及长期的性能试验和工业性运转试验，从而进行了全面优化设计。该系列产品广泛应用于禽畜肉类、水产加工、酿酒、乳业、果汁饮料、化工、电子、纺织等行业所需工艺性空调或生产工艺用冷水的场合。

## Product introduction

Depending upon its manufacturing experience and sustainable technical R&D capability in refrigeration and air conditioning equipment for more than 50 years and through many years of technical cooperation and exchange with Xi'an Jiaotong University and the world well-known enterprises in the industry, Yantai Moon Co., Ltd. (hereinafter abbreviated to Yantai Moon) has conducted theoretical research on the thermal and dynamic performance of compressors and innovative experimental research on their actual working process, pressure fluctuation, rotor stress and oil distribution visualization and developed new LG series high-efficiency screw compressors and BF series semi-hermetic screw compressors with over 10 independent intellectual property rights and core technologies.

LS series screw water chiller units are fitted with the above LG series open type screw compressors and BF series semi-hermetic screw compressors and include two major series such as open type screw water chiller units and semi-hermetic screw water chiller units. The series products have been optimally designed comprehensively in overall consideration of all power consumption points and potential fault points and through long-term performance tests and industrial running tests. The series products are widely applied in the needed technological air-conditioning or cold water for production process in the industries involving poultry & meat, aquatic products processing, brewing, dairy industry, fruit drink, chemical industry, electronic industry, textile industry, etc.

## 开启式螺杆冷水机组 Open type screw water chiller units

### 机组特点

- 可靠性高，加工精度高，使用寿命长。
- 以 R22 为制冷剂，也可以采用 R134a 等其它制冷工质（需非标订货）。
- 冷凝器为水冷壳管式，采用高效换热管，体积小，重量轻。
- 蒸发器结构为壳管满液式，采用高效换热管，换热效率高。
- 机组回油采用引射回油，操作简捷方便，可靠性高。
- 开启式系列螺杆冷水机组油冷却器采用液冷油冷，换热效果好，运行可靠。
- 机组液位控制采用国际最先进的 PMFL+SV 控制，可实现连续的自动调节，可靠性好。
- 小型机组为整机结构，大型机组采用撬装，安装现场总体组装，连接水电，充入适量制冷剂和冷冻机油即可投入使用。
- 整个机组运转平稳、振动小、噪音低、安全可靠。



## Features of the units

- High reliability, high machining precision, long service life
- The units use R22 as refrigerant and can also use other refrigerants including R134a etc. (needing to order non-standard products).
- Condensers are water-cooled shell-and-tube condensers, use high efficiency heat exchange tubes and have small volume and small weight.
- The evaporators have a shell-and-tube flooded structure and use high efficiency heat exchange tubes with high heat exchange efficiency.
- The injection oil return mode is used in unit oil return, thus realizing simple and convenient operation and high reliability.
- Open type screw water chiller units use liquid-cooled oil coolers with good heat exchange effect and reliable operation.
- The unit uses the international most advanced PMFL+SV control mode in liquid level control, which can realize continuous automatic regulation and good reliability.
- A small unit is an integral structure and a large unit is skid-mounted. The unit is generally assembled at installation site; after being connected with water and power and charged with an appropriate quantity of refrigerant and refrigerant oil, the unit can be put into use.
- Smooth and stable operation, small vibration, low noise and high safety and reliability of the whole unit



## 电气控制

LS 系列开启式螺杆冷水机组分为远程自动型（A）、本地自动型（B）两种型式。

### 远程自动型（A）

- 采用 PLC 作为控制核心，可靠性高，功能强大。采用进口控制元件，控制灵敏可靠。
- 自动检测冷水出水温度，通过 PLC 自动控制增减载电磁阀上卸载，降低能耗，控制出水温度精度高。
- PLC 采用闭环直接数字控制（DDC），可实现全过程、全自动电脑调节控制，使机组控制更精确、可靠。
- 能够根据用户的需求迅速调整 PLC 程序，控制程序灵活便捷，最大限度的满足用户的实际需求。
- 参照说明书便能很快掌握控制系统使用技巧，人机界面采用触摸屏，操作简捷、方便。
- 具有自诊断功能，在一些参数接近极限值时，会自动采取一定的保护措施，并发出警报，使机组不受损伤，尽量减少非计划停机。
- 自动记录、保存机组故障的报警情况及发生时间，并发出故障处理提示。
- 可选配置：机组除具有上述功能外，还具有开放的网络通讯接口。
  - 可实现与楼宇自控系统或上位机系统双向通讯；
  - 可实现多台机组协调运行实现多机控制（群控）；
  - 通过电话网络或因特网，可实现在不同的城市或地域对单台或多台机组进行远程监控。



## Electrical control

LS series open type screw water chiller units include two types such as remote automatic type (A) and local automatic type (B).

### Remote automatic type (A)

- PLC is used as the control core, thus realizing high reliability and powerful function. Imported control components are used to realize sensitive and reliable control.
- Automatically monitor cold water outlet temperature; automatically control, increase and decrease the loads on solenoid valves via the PLC, reduce energy consumption and control water outlet temperature with high accuracy.
- The closed-loop direct digital control (DDC) mode is used for PLC, which can thus realize fully automatic computerized regulation and control in the whole process as well as more accurate and reliable control of units.
- The PLC program can be adjusted rapidly as needed by users, and the control program is flexible and convenient, thus meeting the user's actual demand to the greatest extent possible.
- The use skill in the control system can be mastered very quickly by referring to the specification; the man-machine interface uses a touch screen to realize simple and convenient operation.
- The unit has self-diagnosis function; when some parameters approach their limit values, the unit will take certain protective measures and give an alarm to prevent the unit from being damaged and minimize nonscheduled downtime.
- Automatic recording and saving of fault alarming and occurrence time of units, giving a fault treatment prompt.
- Optional configuration: units have open network communication interfaces in addition to the above functions.
  - Two-way communication with automatic building control system or upper machine system;
  - Coordinated operation of multiple units and multi-machine control (group control);
  - Remote monitoring of a single unit or multiple units can be realized in different cities or regions via telephone network or Internet.



### 本地自动型 (B)

- 采用国产知名品牌元件，可靠性高。
- 应用冰轮自主研发的节能控制器，在机组运行过程中自动监测冷水出水温度，调节压缩机载位。
- 控制台、控制柜故障保护齐全，性能稳定、质量可靠、操作方便。

### Local automatic type (B)

- The components of domestic well-known brands are used to realize high reliability.
- By using the energy saving controller independently developed by Yantai Moon, the cold water outlet temperature is automatically monitored and the loading level of compressors is regulated during operation of units.
- Complete fault protection measures, stable performance, reliable quality and convenient operation of consoles and control cabinets.



## 自动保护

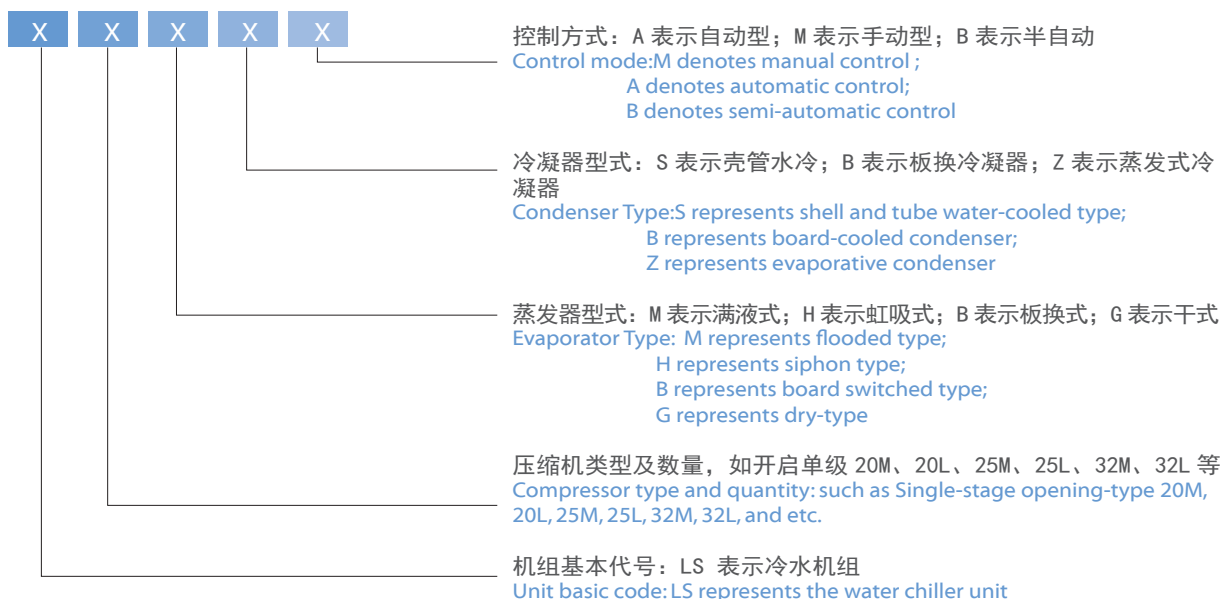
- 排气压力高
- 油压低
- 吸气压力低
- 蒸发器断水
- 油温超高
- 主机过载
- 油泵过载
- 超低温保护

## Automatic protection

- High exhaust pressure
- Low oil pressure
- Low suction pressure
- Evaporator water break
- Ultra-high oil temperature
- Main motor overload
- Oil pump overload
- Ultra-low temperature protection

## 机组型号标示释义

### Interpretation of model marks of units



## 适用范围

### Scope of application

项目 Item	单位 Unit	数值 Numerical value
冷媒水出口温度 Chilled water outlet temperature	°C	5 ~ 10
冷却水进口温度 Cooling water inlet temperature		19 ~ 33

## 注意事项

- 技术参数表中制冷量是标定工况下的制冷量, 其余工况下的制冷量参照机组性能参数表。
- 换热器水侧流量最大偏差不得超过最高运行工况下流量的 10%。
- 若采用其它工质或运行工况不在适用范围内, 需非标设计。
- 为保证系统可靠运行, 系统水泵选型时总扬程应该比计算扬程大 10% ~ 20%。
- 水质要求不能满足《工业循环冷却水的处理规范》时, 请特殊注明。

## Attentions

- The refrigeration capacity in the table of specifications is the refrigeration capacity under the nominal working conditions. For the refrigeration capacity under other working conditions, refer to the table of performance parameters of units.
- The maximum deviation of the flow rate on the heat exchanger water side doesn't exceed 10% of the flow rate under the maximum operating conditions.
- A nonstandard design is needed if other refrigerants are used or operating conditions are not within the scope of application.
- The total head of the selected system water pump shall be 10%~20% larger than the calculated head in order to ensure reliable operation of the system.
- When water quality requirements cannot meet the Code for Design of Industrial Recirculating Cooling Water Treatment, this shall be specified.

## 开启式螺杆冷水机组技术参数表

Table of specifications of Open type screw water chiller units

项目 Item		单位 Unit	LS20MMSA(B)	LS20LMSA(B)	LS25MMSA(B)
制冷量 Refrigeration capacity		kw	1211	1588	2489
冷媒水品种 Chilled water varieties			水 Water		
能量调节范围 Capacity control range		%	15 ~ 100		
制冷剂 Refrigerant	品种 Varieties		R22		
	充注量 Charge	kg	~ 650	~ 750	~ 1200
	标准 Standard		GB7373 《工业用二氟一氯甲烷 (F22)》 GB7373 Industrial CHClF <sub>2</sub> (F22)		
冷冻机油 Refrigerant oil	牌号 Brand		M-K4001		
	充注量 Charge	l	~ 370	~ 470	~ 760
	标准 Standard		Q/YB00J08.21.1 《冷冻机油 (矿物型)》		
压缩机型号 Compressor model			LG20M	LG20L	LG25M
电机额定功率 Rated power of motor		kw	250	315	500
使用电制 Electrical system			3N 50Hz 380V	3N 50Hz 10kV	
冷凝器 Condenser	型式 Type		壳管式 Shell-and-tube type		
	进水温度 Water inlet temperature	°C	30		
	冷却水循环量 Cooling water circulation volume	m <sup>3</sup> /h	240	320	500
	冷却水进水管径 Cooling water inlet and outlet pipe diameter	mm	DN200	DN250	DN300
	冷却水侧设计压力 Cooling water-side design pressure	MPa	0.6		



项目 Item		单位 Unit	LS20MMSA(B)	LS20LMSA(B)	LS25MMSA(B)
蒸发器 Evaporator	型式 Type		满液式 Flooded type		
	出水温度 Output water temperature	°C	7		
	冷媒水循环量 Chilled water circulation volume	m <sup>3</sup> /h	210	270	430
	冷媒进出口通径 Drift diameter of chilled water inlet and outlet	mm	DN200	DN200	DN250
	冷媒水侧设计压力 Chilled water-side design pressure	MPa	1.0		
冷媒水、冷却水污垢系数 Fouling factor of chilled water and cooling water		m <sup>2</sup> .k/kw	0.086		
冷凝器、蒸发器水程阻力 Resistance of condenser and evaporator on water path		MPa	≤0.1		
冷却水水质标准 Cooling water quality standard			GB50050 《工业循环冷却水的处理规范》 GB50050 Code for Design of Industrial Recirculating Cooling Water Treatment		
外形尺寸 (长 * 宽 * 高) Outline dimension (L * W * H)		mm	~ 3840*2720*2700	~ 4198*3190*3279	~ 4890*3400*3150
净重 Net weight		kg	~ 8200	~ 9700	~ 15000

注:

①本表中的设计工况为: 冷凝器冷却水进水温度 30°C, 进出水温差 5°C; 冷媒水出水温度 7°C, 进出水温差 5°C。机组不带经济器。  
②其他工况的制冷量, 参照机组性能参数表。

Note:

1. The designed working conditions in the table: the cooling water inlet temperature of the condenser is 30°C and the difference between the water inlet temperature and the water outlet temperature is 5°C; the chilled water outlet temperature is 7°C and the difference between the water inlet temperature and the water outlet temperature is 5°C. Unit without economizer  
2. Refer to the performance parameter table of units for the refrigeration capacity in other working conditions.

## 开启式螺杆冷水机组技术参数表

Table of specifications of Open type screw water chiller units

项目 Item		单位 Unit	LS25LMSA(B)	LS32MMSA(B)	LS32LMSA(B)
制冷量 Refrigeration capacity		kw	3101	4724	5645
冷媒水品种 Chilled water varieties			水 Water		
能量调节范围 Capacity control range		%	15 ~ 100		
制冷剂 Refrigerant	品种 Varieties		R22		
	充注量 Charge	kg	~ 1500	~ 2500	~ 3200
	标准 Standard		GB7373 《工业用二氟一氯甲烷 (F22)》 GB7373 Industrial CHClF2 (F22)		
冷冻机油 Refrigerant oil	牌号 Brand		M-K4001		
	充注量 Charge	l	~ 800	~ 1200	
	标准 Standard		Q/YB00J08.21.1 《冷冻机油 (矿物型)》		
压缩机型号 Compressor model			LG25L	LG32M	LG32L
电机额定功率 Rated power of motor		kw	630	1000	1120
使用电制 Electrical system			3N 50Hz 10kV		
冷凝器 Condenser	型式 Type		壳管式 Shell-tube		
	进水温度 Water inlet temperature	°C	30		
	冷却水循环量 Cooling water circulation volume	m <sup>3</sup> /h	620	950	1130
	冷却水进水管径 and outlet pipe diameter	mm	DN300	DN400	DN400
	冷却水侧设计压力 Cooling water-side design pressure	MPa	0.6		

项目 Item		单位 Unit	LS25LMSA(B)	LS32MMSA(B)	LS32LMSA(B)
蒸发器 Evaporator	型式 Type		满液式 Flooded type		
	出水温度 Output water temperature	°C	7		
	冷媒水循环量 Chilled water circulation volume	m <sup>3</sup> /h	530	810	970
	冷媒进出口通径 Drift diameter of chilled water inlet and outlet	mm	DN300	DN400	DN400
	冷媒水侧设计压力 Chilled water side design pressure	MPa	1.0		
冷媒水、冷却水污垢系数 Fouling factor of chilled water and cooling water	m <sup>2</sup> .k/kW	0.086			
冷凝器、蒸发器水程阻力 Resistance of condenser and evaporator on water path	MPa	≤0.1			
冷却水水质标准 Cooling water quality standard		GB50050 《工业循环冷却水的处理规范》 GB50050 Code for Design of Industrial Recirculating Cooling Water Treatment			
外形尺寸 (长*宽*高) Outline dimension (L*W*H)	mm	~ 4890*3450*3200	~ 8150*5100*3900	~ 8150*5100*4000	
净重 Net weight	kg	~ 17000	~ 32000	~ 37000	

注:

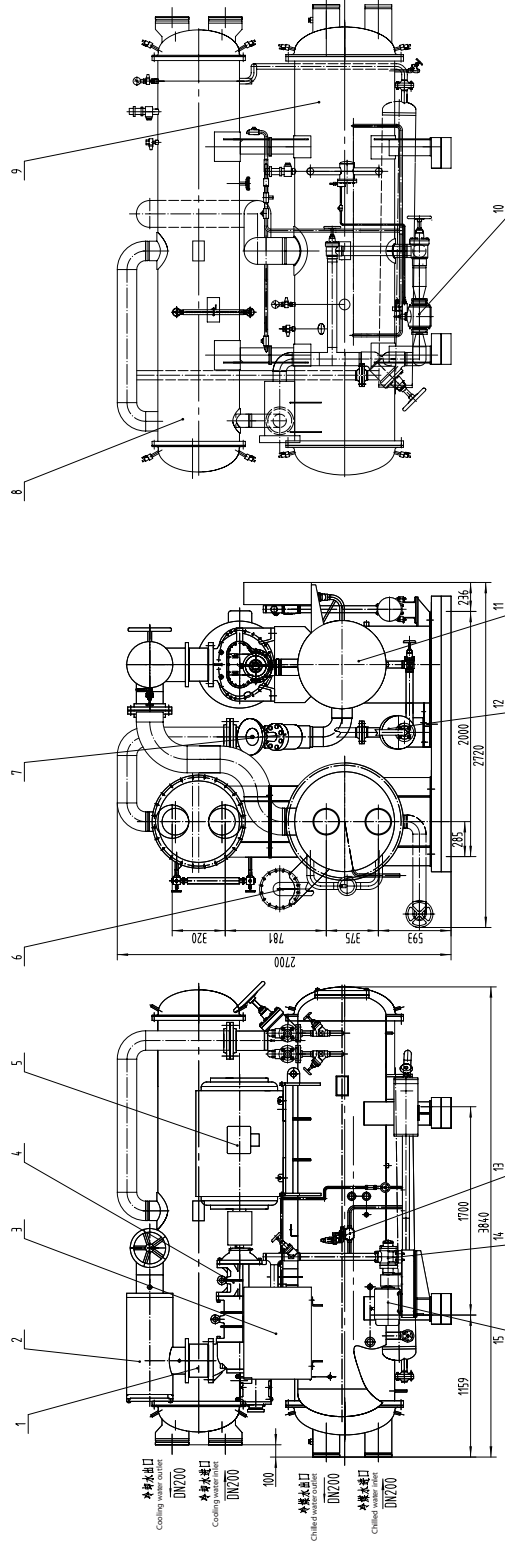
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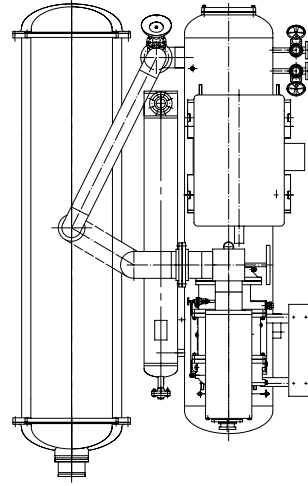
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2. Refer to the performance parameter table of units for the refrigeration capacity in other working conditions.

# LS20MMSA (B) 螺杆冷水机组外形图

## Outline drawing of LS20MMSA(B) screw water chiller units

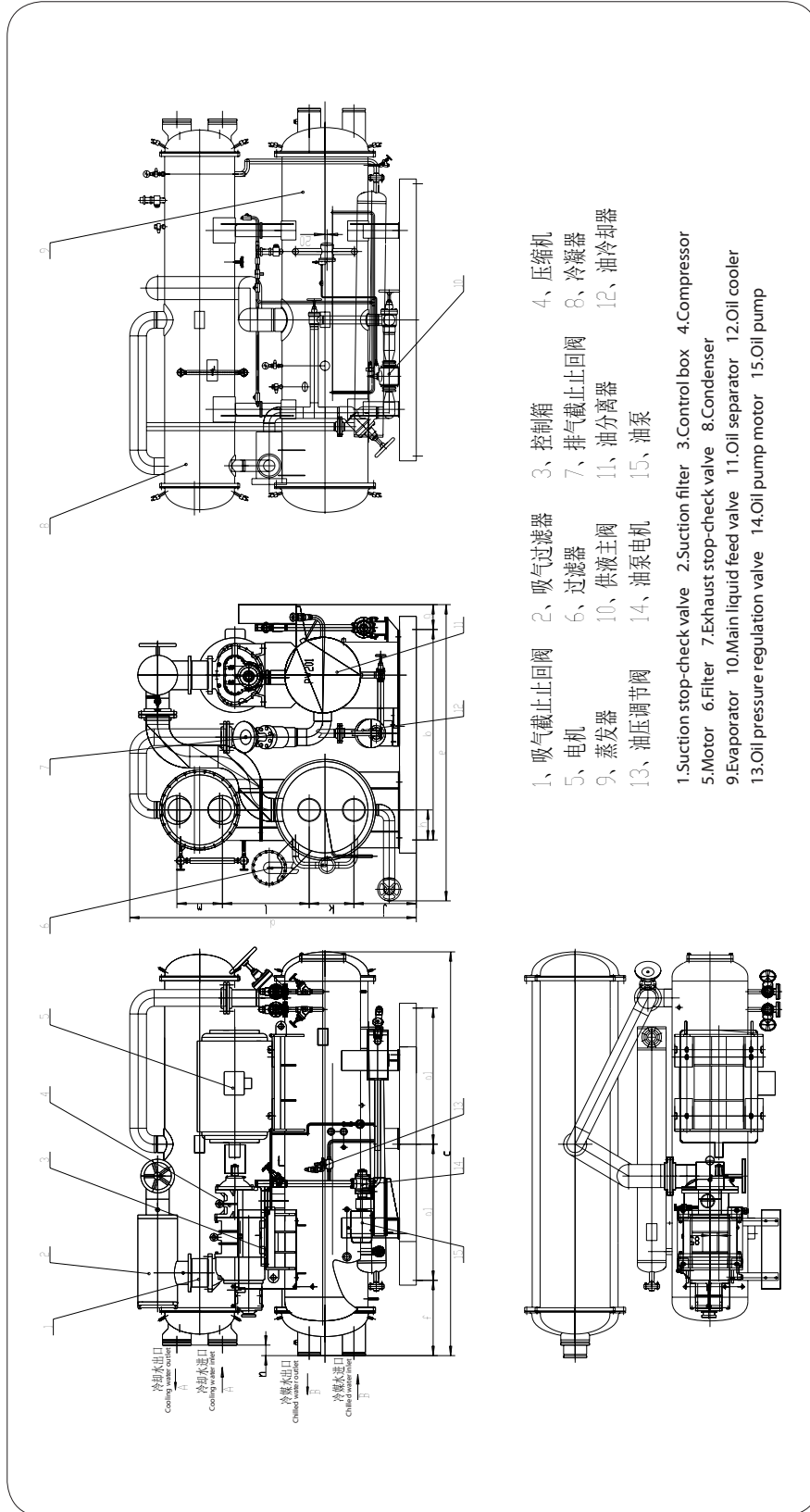


- |          |         |          |         |
|----------|---------|----------|---------|
| 1、吸气截止回阀 | 2、吸气过滤器 | 3、控制箱    | 4、压缩机   |
| 5、电机     | 6、过滤器   | 7、排气截止回阀 | 8、冷凝器   |
| 9、蒸发器    | 10、供液主阀 | 11、油分离器  | 12、油冷却器 |
| 13、油压调节阀 | 14、油泵电机 | 15、油泵    |         |
- 
- |                                  |                           |                            |               |
|----------------------------------|---------------------------|----------------------------|---------------|
| 1.Suction stop-check valve       | 2.Suction filter          | 3.Control box              | 4.Compressor  |
| 5.Motor                          | 6.Filter                  | 7.Exhaust stop-check valve | 8.Condenser   |
| 9.Evaporator                     | 10.Main liquid feed valve | 11.Oil separator           | 12.Oil cooler |
| 13.Oil pressure regulation valve | 14.Oil pump motor         | 15.Oil pump                |               |



# LS 系列螺杆冷水机组外形图

## Outline drawing of LS series screw water chiller units



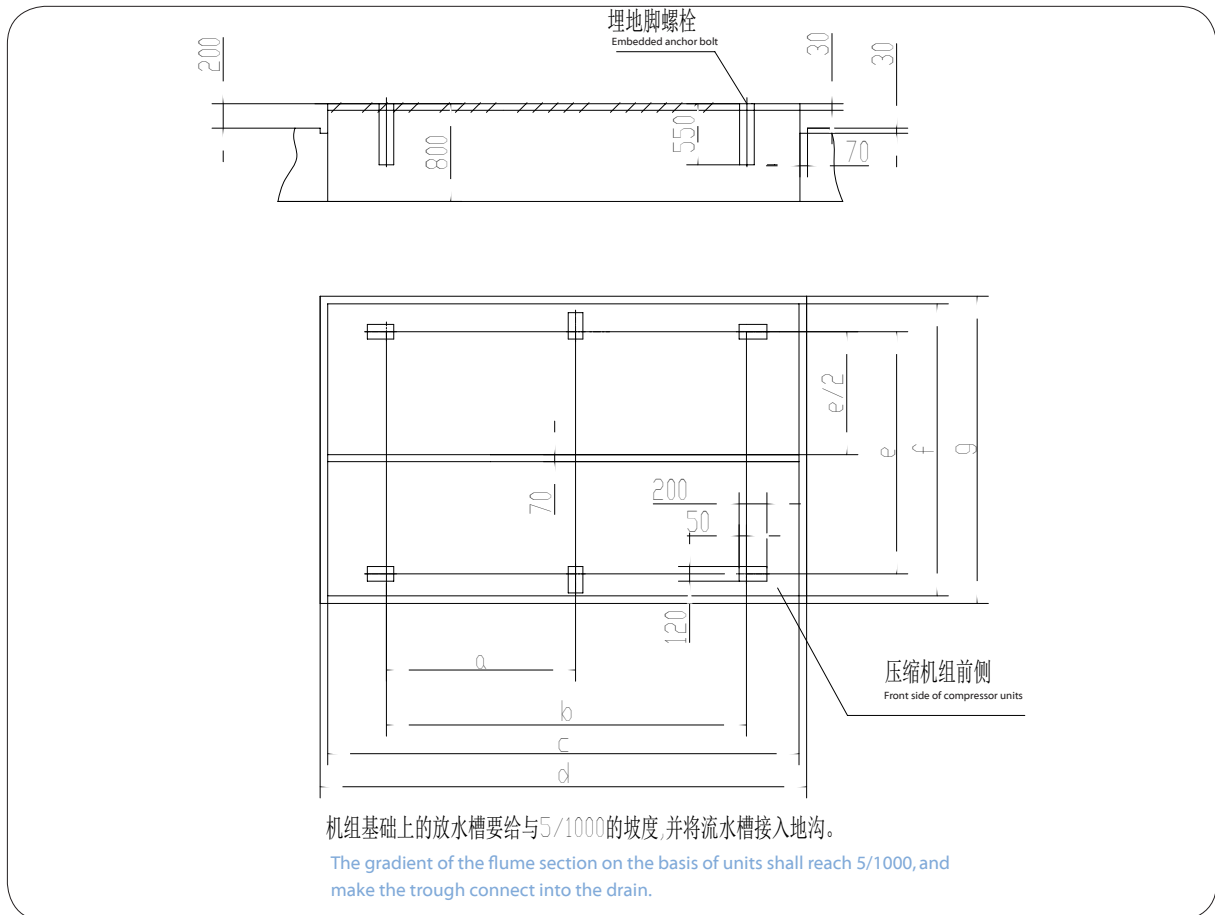
- 1、吸气截止回阀 2、吸气过滤器 3、控制箱 4、压缩机
  - 5、电机 6、过滤器 7、排气截止回阀 8、冷凝器
  - 9、蒸发器 10、供液主阀 11、油分离器 12、油冷却器
  - 13、油压调节阀 14、油泵电机 15、油泵
- 1.Suction stop-check valve 2.Suction filter 3.Control box 4.Compressor  
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 9.Evaporator 10.Main liquid feed valve 11.Oil separator 12.Oil cooler  
 13.Oil pressure regulation valve 14.Oil pump motor 15.Oil pump

项目 Item	a1	b	c	d	e	f	g	h	j	k	l	m	n	A	B
LS20LMSA(B)	1200	2700	4198	3279	3190	809	300	400	633	425	824	434	60	DN250	DN200
LS25MMSA(B)	1200	3000	4890	3150	3400	1342	225	640	770	520	770	550	0	DN300	DN250
LS25LMSA(B)	1200	3000	4890	3200	3450	1342	225	640	800	520	795	520	0	DN300	DN300



## 机组基础图

### Foundation drawing of units



机组名称 Unit name	a	b	c	d	e	f	g
LS20MMSA(B)		1600	3000	3140	1900	2500	2640
LS20LMSA(B)	1200	2400	3700	3840	2700	3200	3340
LS25MMSA(B)	1200	2400	3700	3840	3000	3500	3640
LS25LMSA(B)	1200	2400	3700	3840	3000	3500	3640





不同的冷却水进水温度和冷媒水出水温度下，机组的性能参数表  
 At different temperature degrees of cooling water inlet and chilled water outlet, the table of performance parameters of the units

制冷量 Refrigeration capacity	LS20MMSA (B)						LS20LMSA (B)					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
T2												
T1	27	30	33	27	30	33	27	30	33	27	30	33
5	1174	1134	1104	192	204	217	1539	1487	1448	251	267	284
7	1248	1211	1186	193	207	218	1637	1588	1555	253	271	285
10	1364	1333	1300	194	206	219	1789	1748	1705	254	270	287

制冷量 Refrigeration capacity	LS25MMSA (B)						LS25LMSA (B)					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
T2												
T1	27	30	33	27	30	33	27	30	33	27	30	33
5	2413	2331	2269	387	411	437	3006	2904	2827	480	510	543
7	2565	2489	2438	389	417	439	3196	3101	3037	483	518	546
10	2803	2740	2672	391	415	441	3493	3413	3329	485	515	548

制冷量 Refrigeration capacity	LS32MMSA (B)						LS32LMSA (B)					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
T2												
T1	27	30	33	27	30	33	27	30	33	27	30	33
5	4580	4424	4307	732	778	827	5473	5287	5147	875	929	989
7	4868	4724	4626	736	789	831	5819	5646	5529	879	943	993
10	5321	5200	5071	739	785	835	6359	6215	6061	884	938	998

## 半封闭螺杆冷水机组

### Semi-hermetic screw water chiller units

#### 机组特点

- 可靠性高，加工精度高，使用寿命长。
- 以 R22 为制冷剂，也可以采用 R134a 等其它制冷工质（需非标订货）。
- 冷凝器为水冷壳管式，采用高效换热管，体积小，重量轻。
- 蒸发器结构为壳管满液式，采用高效换热管，换热效率高。
- 机组回油采用引射回油，操作简捷方便，可靠性高。
- 采用压差式供油。
- 机组液位控制采用国际最先进的 PMFL+SV 控制，可实现连续的自动调节，可靠性好。
- 小型机组为整机结构，大型机组采用撬装，安装现场总体组装，连接水电，充入适量制冷剂和冷冻机油即可投入使用。
- 整个机组运转平稳、振动小、噪音低、安全可靠。



#### Features of Semi-hermetic screw water chiller units

- High reliability, high machining precision, long service life
- The units use R22 as refrigerant and can also use other refrigerants including R134a etc. (needing to order non-standard products).
- Condensers are water-cooled shell-and-tube condensers, use high efficiency heat exchange tubes and have small volume and small weight.
- The evaporators have a shell-and-tube flooded structure and use high efficiency heat exchange tubes with high heat exchange efficiency.
- The injection oil return mode is used in unit oil return, thus realizing simple and convenient operation and high reliability.
- Semi-hermetic series screw water chiller units use the pressure differential oil feeding mode.
- The unit uses the international most advanced PMFL+SV control mode in liquid level control, which can realize continuous automatic regulation and good reliability.
- A small unit is an integral structure and a large unit is skid-mounted. The unit is generally assembled at installation site; after being connected with water and power and charged with an appropriate quantity of refrigerant and refrigerant oil, the unit can be put into use.
- Smooth and stable operation, small vibration, low noise and high safety and reliability of the whole unit



#### 电气控制

##### 远程自动型 (A)

- 采用 PLC 作为控制核心，可靠性高，功能强大。采用进口控制元件，控制灵敏可靠。
- 自动检测冷水出水温度，通过 PLC 自动控制增减载电磁阀上卸载，降低能耗，控制出水温度精度高。
- PLC 采用闭环直接数字控制 (DDC)，可实现全过程、全自动电脑调节控制，使机组控制更精确、可靠。
- 能够根据用户的需求迅速调整 PLC 程序，控制程序灵活便捷，最大限度的满足用户的实际需求。
- 参照说明书便能很快掌握控制系统使用技巧，人机界面采用触摸屏，操作简捷、方便。
- 具有自诊断功能，在一些参数接近极限值时，会自动采取一定的保护措施，并发出警报，使机组不受损伤，尽量减少非计划停机。



- 自动记录、保存机组故障的报警情况及发生时间，并发出故障处理提示。
- 可选配置：机组除具有上述功能外，还具有开放的网络通讯接口。
  - 可实现与楼宇自控系统或上位机系统双向通讯；
  - 可实现多台机组协调运行实现多机控制（群控）；
  - 通过电话网络或因特网，可实现在不同的城市或地域对单台或多台机组进行远程监控。

## Electrical control

### Remote automatic type (A)

- PLC is used as the control core, thus realizing high reliability and powerful function. Imported control components are used to realize sensitive and reliable control.
- Automatically monitor cold water outlet temperature; automatically control, increase and decrease the loads on solenoid valves via the PLC, reduce energy consumption and control water outlet temperature with high accuracy.
- The closed-loop direct digital control (DDC) mode is used for PLC, which can thus realize fully automatic computerized regulation and control in the whole process as well as more accurate and reliable control of units.
- The PLC program can be adjusted rapidly as needed by users, and the control program is flexible and convenient, thus meeting the user's actual demand to the greatest extent possible.
- The use skill in the control system can be mastered very quickly by referring to the specification; the man-machine interface uses a touch screen to realize simple and convenient operation.
- The unit has self-diagnosis function; when some parameters approach their limit values, the unit will take certain protective measures and give an alarm to prevent the unit from being damaged and minimize nonscheduled downtime.
- Automatic recording and saving of fault alarming and occurrence time of units, giving a fault treatment prompt.
- Optional configuration: units have open network communication interfaces in addition to the above functions.
  - Two-way communication with automatic building control system or upper machine system;
  - Coordinated operation of multiple units and multi-machine control (group control);
  - Remote monitoring of a single unit or multiple units can be realized in different cities or regions via telephone network or Internet.



## 自动保护

- 排气压力高
- 排气温度高
- 吸气压力低
- 蒸发器断水
- 主电机过载
- 主电机过热
- 电源故障（过压、欠压、缺相、相序错等）
- 油路阻力大（或油压差低）
- 超低温保护

## Automatic protection

- High exhaust pressure
- High exhaust temperature
- Low suction pressure
- Evaporator water break
- Main motor overload
- Main motor overheating
- Power failure (over-voltage, under-voltage, open phase, wrong phase sequence, etc.)
- Large oil way resistance (or low oil pressure difference)
- Ultra-low temperature protection



## 机组型号标示释义

### Interpretation of model marks of units

X X X X X

控制方式: A 表示自动型; M 表示手动型; B 表示半自动  
Control mode: M denotes manual control;  
A denotes automatic control;  
B denotes semi-automatic control

冷凝器型式: S 表示壳管水冷; B 表示板换冷凝器; Z 表示蒸发式  
冷凝器

Condenser Type: S represents shell and tube water-cooled type;  
B represents board-cooled condenser;  
Z represents evaporative condenser

蒸发器型式: M 表示满液式; H 表示虹吸式; B 表示板换式; G 表示干  
式

Evaporator Type: M represents flooded type;  
H represents siphon type;  
B represents board switched type;  
G represents dry-type

压缩机类型及数量, 半封系列: 11、12、15、17、18、12 II、  
15 II、1517、17 II、18 II 等

Compressor type and quantity: such as Semi-hermetic series: 11、12、  
15、17、18、12 II、15 II、1517、17 II、18 II ,and etc.

机组基本代号: LS 表示冷水机组

Unit basic code: LS represents the water chiller unit



## 适用范围

### Scope of application

项目 Item	单位 Unit	数值 Numerical value
冷媒水出口温度 Chilled water outlet temperature	°C	5 ~ 10
冷却水进口温度 Cooling water inlet temperature		19 ~ 33

## 注意事项

- 技术参数表中制冷量是标定工况下的制冷量，其余工况下的制冷量参照机组性能参数表。
- 换热器水侧流量最大偏差不超过最高运行工况下流量的 10%。
- 若采用其它工质或运行工况不在适用范围内，需非标设计。
- 为保证系统可靠运行，系统水泵选型时总扬程应该比计算扬程大 10% ~ 20%。
- 水质要求不能满足《工业循环冷却水的处理规范》时，请特殊注明。

## Attentions

- The refrigeration capacity in the table of specifications is the refrigeration capacity under the nominal working conditions. For the refrigeration capacity under other working conditions, refer to the table of performance parameters of units.
- The maximum deviation of the flow rate on the heat exchanger water side doesn't exceed 10% of the flow rate under the maximum operating conditions.
- A nonstandard design is needed if other refrigerants are used or operating conditions are not within the scope of application.
- The total head of the selected system water pump shall be 10%~20% larger than the calculated head in order to ensure reliable operation of the system.
- When water quality requirements cannot meet the Code for Design of Industrial Recirculating Cooling Water Treatment, this shall be specified.

## 半封闭螺杆冷水机组主要技术参数

Table of specifications of Semi-hermetic screw water chiller units

项目 Item		单位 Unit	LS11MSA	LS12MSA	LS15MSA	LS12 II MSA
订货代号 Order code			013101010000	013102010000	013103010000	013106010000
制冷量 Refrigeration capacity		kw	135	203	333	406
冷媒水品种 Chilled water varieties			水 Water			
能量调节方式 Capacity control mode			自动 Automatic			
能量调节范围 Capacity control range		%	30~100	30~100	30~100	15~100
制冷剂 Refrigerant	品种 Varieties		R22			
	充注量 Charge	kg	~130	~150	~190	~220
	标准 Standard		GB/T7373 《工业用二氟一氯甲烷 (F22)》 GB/T7373 Industrial CHClF <sub>2</sub> (F22)			
冷冻机油 Refrigerant oil	牌号 Brand		4GS			
	充注量 Charge	l	~12	~15	~16	~90
压缩机型号 Compressor model			BF11	BF12	BF15	BF12*2
电机额定功率 Rated power of motor		kw	30	42	65	42*2
使用电制 Electrical system			3N ~50HZ 380V			
冷凝器 Condenser	型式 Type		壳管式 Shell-and-tube type			
	冷却水循环量 Cooling water circulation volume	m <sup>3</sup> /h	~28	~42	~70	~85
	冷却水进出水管径 Cooling water inlet and outlet pipe diameter	mm	DN65	DN100	DN100	DN125
	冷却水侧设计压力 Cooling water-side design pressure	MPa	0.6			

项目 Item		单位 Unit	LS11MSA	LS12MSA	LS15MSA	LS12 II MSA
蒸发器 Evaporator	型式 Type		满液式 Flooded type			
	冷媒水循环量 Chilled water circulation volume	m <sup>3</sup> /h	~23	~35	~57	~70
	冷媒进出口口径 Drift diameter of chilled water inlet and outlet	mm	DN65	DN80	DN100	DN125
	冷媒水侧设计压力 Chilled water-side design pressure	MPa	1.0			
冷媒水、冷却水污垢系数 Fouling factor of chilled water and cooling water	m <sup>2</sup> .k/kw	0.086				
冷凝器、蒸发器水程阻力 Resistance of condenser and evaporator on water path	MPa	≤0.1				
冷却水水质标准 Cooling water quality standard		GB50050《工业循环冷却水处理设计规范》 GB50050 Code for Design of Industrial Recirculating Cooling Water Treatment				
外形尺寸（长*宽*高） Outline dimension (L*W*H)	mm	~3000*1220*1844	~3000*1220*1844	~3633*1250*2000	~3633*1300*2000	
净重 Net weight	kg	~1600	~1800	~3000	~3000	
运行重量 Operating weight	kg	~2000	~2300	~3600	~3600	

注：

- ①本表中的设计工况为，冷凝器冷却水进水温度 +30℃，进出水温差 5℃；冷媒水出水温度 7℃，进出水温差 5℃。  
②其他工况的制冷量，参照机组性能参数表。

Note:

1. The designed working conditions in the table: the cooling water inlet temperature of the condenser is 30℃ and the difference between the water inlet temperature and the water outlet temperature is 5℃ ; the chilled water outlet temperature is 7℃ and the difference between the water inlet temperature and the water outlet temperature is 5℃ .  
2. Refer to the performance parameter table of units for the refrigeration capacity in other working conditions.

## 半封闭螺杆冷水机组主要技术参数

Table of specifications of Semi-hermetic screw water chiller units

项目 Item		单位 Unit	LS17MSA	LS18MSA	LS15 II MSA	LS1517MSA
订货代号 Order code			013104010000	013105010000	013107010000	013110010000
制冷量 Refrigeration capacity		kw	474	665	665	807
冷媒水品种 Chilled water varieties			水 Water			
能量调节方式 Capacity control mode			自动 Automatic			
能量调节范围 Energy range		%	30~100	30~100	15~100	15~100
制冷剂 Refrigerant	品种 Varieties		R22			
	充注量 Charge	kg	~240	~270	~320	~350
	标准 Standard		GB/T7373 《工业用二氟一氯甲烷 (F22)》 GB/T7373 Industrial CHClF2 (F22)			
冷冻机油 Refrigerant oil	牌号 Brand		4GS			
	充注量 Charge	l	~20	~25	~110	~170
压缩机型号 Compressor model			BF17	BF18	BF15*2	BF15 +BF17
电机额定功率 Rated power of motor		kw	100	132	65*2	65+100
使用电制 Electrical system			3N ~50HZ 380V			
冷凝器 Condenser	型式 Type		壳管式 Shell-and-tube type			
	冷却水循环量 Cooling water circulation volume	m <sup>3</sup> /h	~100	~140	~140	~168
	冷却水进出水管径 and outlet pipe diameter	mm	DN125	DN150	DN150	DN150
	冷却水侧设计压力 Cooling water-side design pressure	MPa	0.6			



项目 Item		单位 Unit	LS17MSA	LS18MSA	LS15 II MSA	LS1517MSA
蒸发器 Evaporator	型式 Type		满液式 Flooded type			
	冷媒水循环量 Chilled water circulation volume	m <sup>3</sup> /h	~80	~115	~115	~140
	冷媒进出口通径 Drift diameter of chilled water inlet and outlet	mm	DN125	DN150	DN150	DN150
	冷媒水侧设计压力 Chilled water-side design pressure	MPa	1.0			
冷媒水、冷却水污垢系数 Fouling factor of chilled water and cooling water		m <sup>2</sup> .k/kw	0.086			
冷凝器、蒸发器水程阻力 Resistance of condenser and evaporator on water path		MPa	≤0.1			
冷却水水质标准 Cooling water quality standard			GB50050 《工业循环冷却水处理设计规范》 GB50050 Code for Design of Industrial Recirculating Cooling Water Treatment			
外形尺寸 (长 * 宽 * 高) Outline dimension (L * W * H)		mm	~3650*1400*2000	~3650*1400*2000	~3633*1400*2000	~3633*1600*2100
净重 Net weight		kg	~3600	~4000	~4000	~6000
运行重量 Operating weight		kg	~4300	~4800	~4800	~7000

注:

- ①本表中的设计工况为, 冷凝器冷却水进水温度 +30℃, 进出水温差 5℃; 冷媒水出水温度 7℃, 进出水温差 5℃。  
②其他工况的制冷量, 参照机组性能参数表。

Note:

1. The designed working conditions in the table: the cooling water inlet temperature of the condenser is +30℃ and the difference between the water inlet temperature and the water outlet temperature is 5℃; the chilled water outlet temperature is 7℃ and the difference between the water inlet temperature and the water outlet temperature is 5℃.  
2. Refer to the performance parameter table of units for the refrigeration capacity in other working conditions.

## 半封闭螺杆冷水机组主要技术参数

Table of specifications of Semi-hermetic screw water chiller units

项目 Item		单位 Unit	LS17 II MSA	LS18 II MSA
订货代号 Order code			013108010000	013109010000
制冷量 Refrigeration capacity		kw	948	1330
冷媒水品种 Chilled water varieties			水 Water	
能量调节方式 Capacity control mode			自动 Automatic	
能量调节范围 Capacity control range		%	15~100	15~100
制冷剂 Refrigerant	品种 Varieties		R22	
	充注量 Charge	kg	~400	~500
	标准 Standard		GB/T7373《工业用二氟一氯甲烷(F22)》 GB/T7373 Industrial CHClF <sub>2</sub> (F22)	
冷冻机油 Refrigerant oil	牌号 Brand		4GS	
	充注量 Charge	l	~220	~260
压缩机型号 Compressor model			BF17*2	BF18*2
电机额定功率 Rated power of motor		kw	100*2	132*2
使用电制 Electrical system			3N ~50HZ 380V	
冷凝器 Condenser	型式 Type		壳管式 Shell-and-tube type	
	冷却水循环量 Cooling water circulation volume	m <sup>3</sup> /h	~200	~275
	冷却水进水管径 Cooling water inlet and outlet pipe diameter	mm	DN200	DN200
	冷却水侧设计压力 Cooling water-side design pressure	MPa	0.6	

项目 Item		单位 Unit	LS17 II MSA	LS18 II MSA
蒸发器 Evaporator	型式 Type		满液式 Flooded type	
	冷媒水循环量 Chilled water circulation volume	m <sup>3</sup> /h	~163	~229
	冷媒进出口口径 Drift diameter of chilled water inlet and outlet	mm	DN200	DN200
	冷媒水侧设计压力 Chilled water-side design pressure	MPa	1.0	
冷媒水、冷却水污垢系数 Fouling factor of chilled water and cooling water		m <sup>2</sup> .k/kw	0.086	
冷凝器、蒸发器水程阻力 Resistance of condenser and evaporator on water path		MPa	≤0.1	
冷却水水质标准 Cooling water quality standard			GB50050 《工业循环冷却水处理设计规范》 GB50050 Code for Design of Industrial Recirculating Cooling Water Treatment	
外形尺寸（长*宽*高） Outline dimension (L*W*H)		mm	~3633*1760*2200	~3633*2000*2300
净重 Net weight		kg	~6500	~7600
运行重量 Operating weight		kg	~7500	~8800

注：

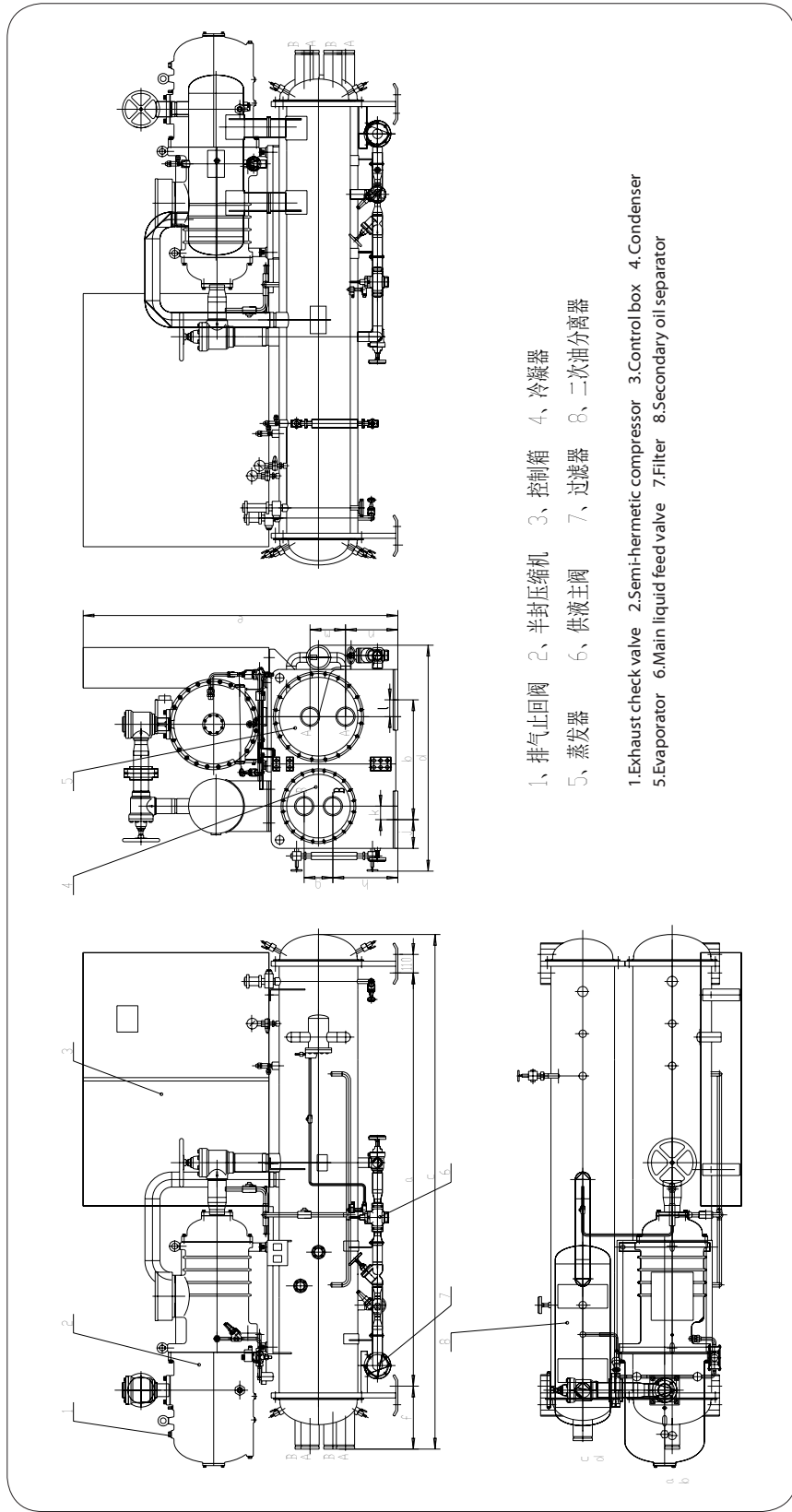
- ①本表中的设计工况为，冷凝器冷却水进水温度 +30℃，进出水温差 5℃；冷媒水出水温度 7℃，进出水温差 5℃。  
②其他工况的制冷量，参照机组性能参数表。

Note:

1. The designed working conditions in the table: the cooling water inlet temperature of the condenser is +30℃ and the difference between the water inlet temperature and the water outlet temperature is 5℃; the chilled water outlet temperature is 7℃ and the difference between the water inlet temperature and the water outlet temperature is 5℃.  
2. Refer to the performance parameter table of units for the refrigeration capacity in other working conditions.

# LS 系列螺杆冷水机组外形图

## Outline drawing of LS series screw water chiller units

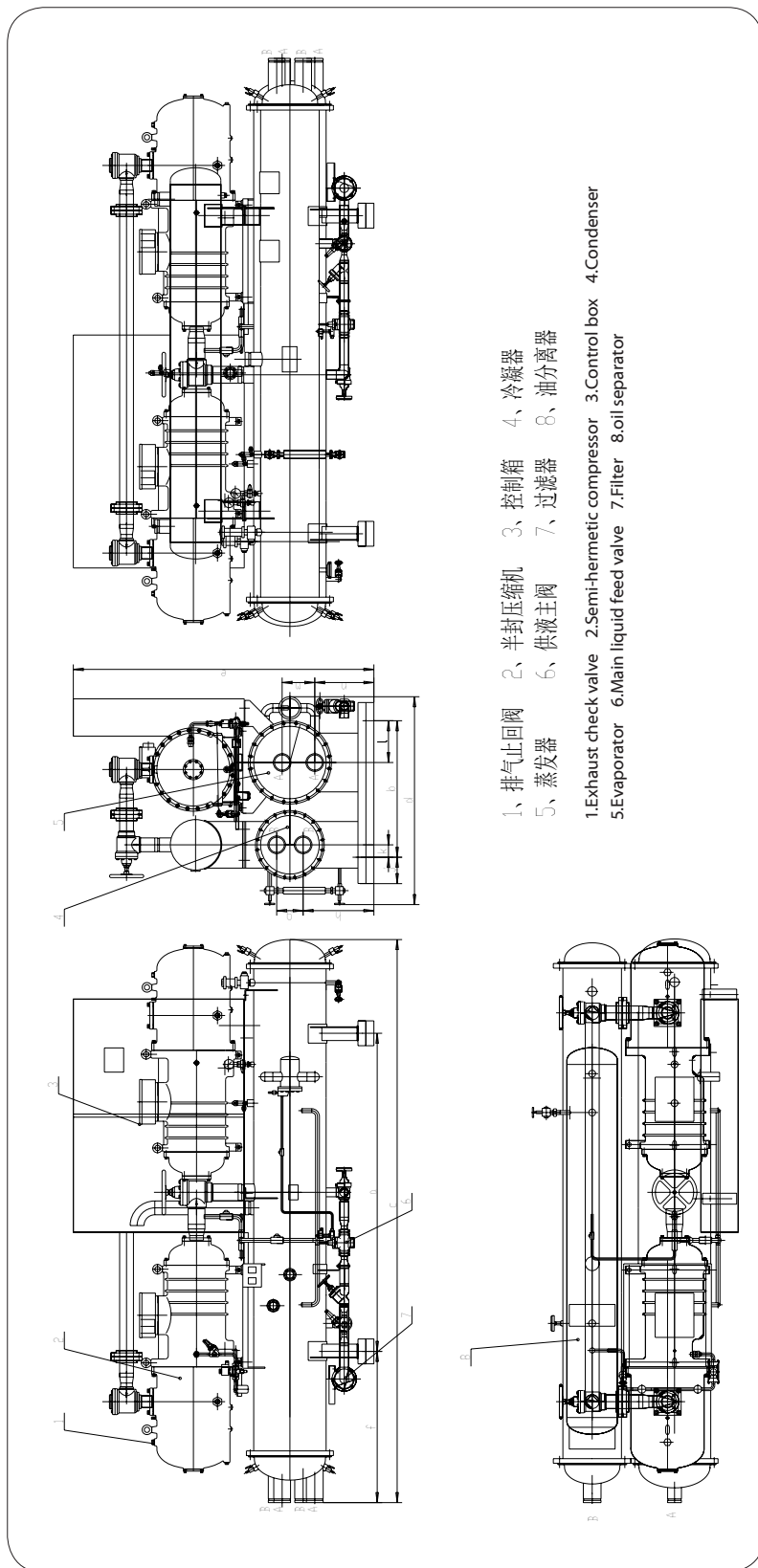


- 1. 排气止回阀 2. 半封压缩机 3. 控制箱 4. 冷凝器
  - 5. 蒸发器 6. 供液主阀 7. 过滤器 8. 二次油分离器
- 1.Exhaust check valve 2.Semi-hermetic compressor 3.Control box 4.Condenser  
5.Evaporator 6.Main liquid feed valve 7.Filter 8.Secondary oil separator

项目 Item	a	b	c	d	e	f	g	h	j	k	l	m	n	A	B
LS11MSA	2448	710	3000	1220	1844	373	160	370	150	95	105	200	200	DN65	DN65
LS12MSA	2448	710	3000	1220	1844	373	160	370	150	95	105	200	200	DN100	DN80
LS15MSA	2448	710	3000	1250	2000	373	200	452	170	108	110	240	290	DN100	DN100
LS17MSA	3032	920	3650	1400	2000	373	200	340	170	135	142	240	308	DN125	DN125
LS18MSA	3032	920	3650	1400	2000	373	220	348	170	135	142	240	308	DN150	DN150

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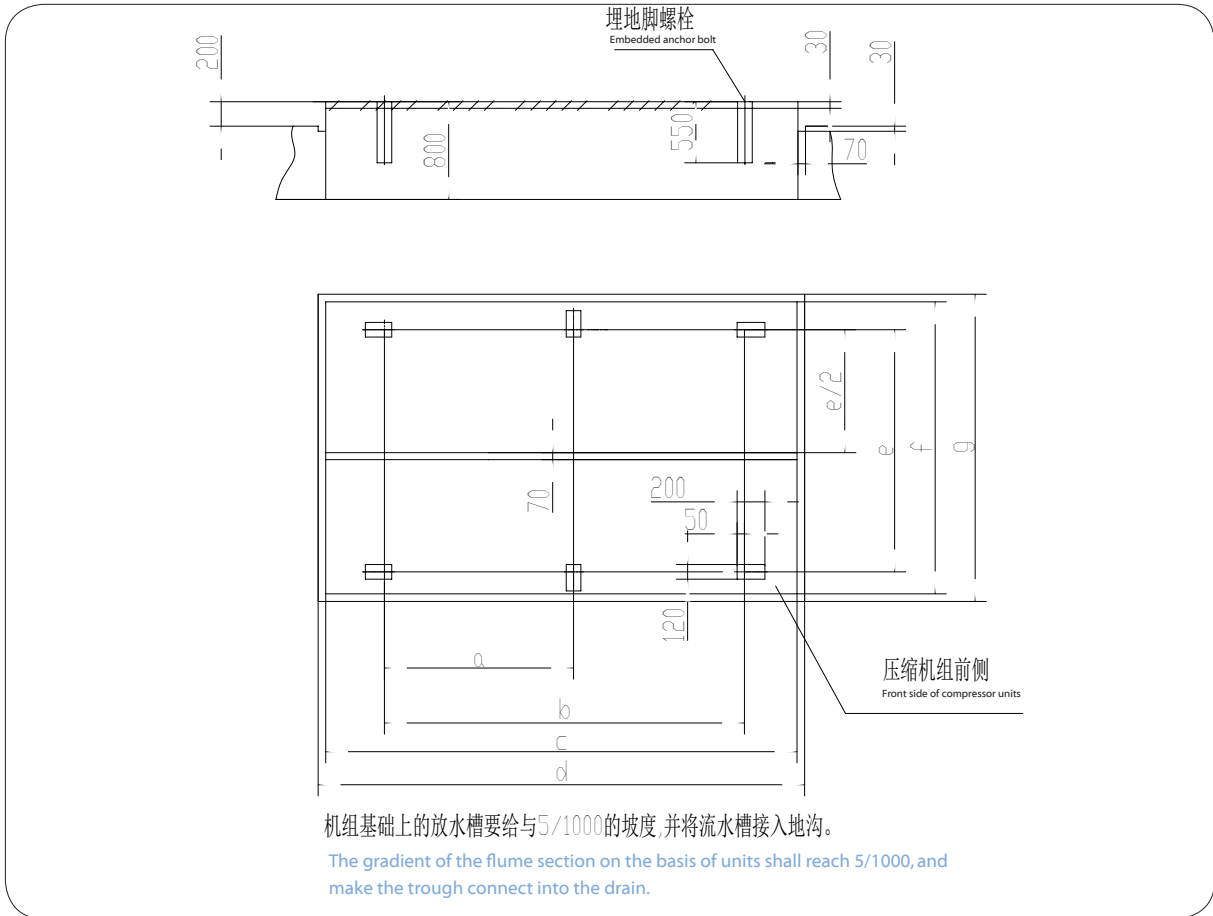
## Outline drawing of LS series screw water chiller units



项目 Item	a	b	c	d	e	f	g	h	j	k	l	m	n	A	B
LS12 II MSA	1600	1000	3050	1300	2000	670	240	457	50	163	177	240	442	DN125	DN125
LS15 II MSA	1600	1000	3633	1400	2000	1440	240	472	85	165	215	270	472	DN150	DN150
LS1517MSA	2400	1300	3633	1600	2100	1040	280	482	87	210	270	330	482	DN150	DN150
LS17 II MSA	2400	1300	3633	1760	2200	1040	280	507	100	225	255	370	512	DN200	DN200
LS18 II MSA	2400	1600	3633	2000	2300	1040	380	507	90	290	390	450	522	DN200	DN200

# 机组基础图

## Foundation drawing of units



机组名称 Unit name	a	b	c	d	e	f	g
LS11MSA		2448	3000	3140	710	1100	1240
LS12MSA		2448	3000	3140	710	1100	1240
LS15MSA		2448	3000	3140	710	1100	1240
LS17MSA		3032	3600	3740	920	1300	1440
LS18MSA		3032	3600	3740	920	1300	1440
LS12 II MSA		1600	3000	3140	1000	1300	1440
LS15 II MSA		1600	3000	3140	1000	1300	1440
LS1517MSA		2400	3000	3140	1300	1600	1740
LS17 II MSA		2400	3000	3140	1300	1600	1740
LS18 II MSA		2400	3000	3140	1600	1900	2040

不同的冷却水进水温度和冷媒水出水温度下，机组的性能参数表  
At different temperature degrees of cooling water inlet and chilled water outlet, the table of performance parameters of the units

制冷量 Refrigeration capacity	LS11MSA						LS12MSA					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
	T2	T1										
	27	30	33	27	30	33	27	30	33	27	30	33
5	130	127	123	26.9	28.8	30.8	195	191	185	39.4	42.3	45.1
7	140	135	127	27.3	29	31	211	203	191	40	42.5	45.4
10	153	148	144	27.9	29.4	31.2	230	223	219	40.9	43.1	45.7

制冷量 Refrigeration capacity	LS15MSA						LS17MSA					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
	T2	T1										
	27	30	33	27	30	33	27	30	33	27	30	33
5	321	313	303	62.1	66.5	71.2	456	446	432	97.4	104	112
7	345	333	313	63.1	67	71.6	492	474	446	98.8	105	112
10	377	365	355	64.5	67.9	72.1	537	520	506	101	106	113

制冷量 Refrigeration capacity	LS18MSA						LS12 II MSA					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
	T2	T1										
	27	30	33	27	30	33	27	30	33	27	30	33
5	640	626	606	123	132	141	391	382	370	78.8	84.4	90.3
7	690	665	626	125	133	142	421	406	382	80	85	90.9
10	754	729	709	128	135	143	460	445	433	81.8	86.2	91.4

制冷量 Refrigeration capacity	LS15 II MSA						LS1517MSA					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
	T2	T1										
	27	30	33	27	30	33	27	30	33	27	30	33
5	641	627	607	124	133	142	777	759	735	160	171	183
7	691	666	627	126	134	143	837	807	759	162	172	184
10	755	730	710	129	136	144	915	885	861	165	174	185

制冷量 Refrigeration capacity	LS17 II MSA						LS18 II MSA					
	制冷量 Refrigeration capacity			轴功率 Shaft power			制冷量 Refrigeration capacity			轴功率 Shaft power		
	T2	T1										
	27	30	33	27	30	33	27	30	33	27	30	33
5	913	892	864	195	209	223	1281	1251	1212	247	264	283
7	983	948	892	198	210	224	1379	1330	1251	250	266	284
10	1074	1039	1011	202	213	226	1507	1458	1419	256	270	286

## 开启式螺杆冷水机组订货代号表

Table of units order code of Open type screw water chiller units

产品型号 Product model	订货代号 Order code	压缩机型号 compressor model	控制方式 Control type
LS20MMSA	013213050000	LG20M	远程自动 Remote auto type
LS20MMSB	013213070000		本地自动 local auto-type
LS20LMSA	013213020001	LG20L	远程自动 Remote auto type
LS20LMSB	013213090000		本地自动 local auto-type
LS25MMSA	013214010000	LG25M	远程自动 Remote auto type
LS25MMSB	013214060000		本地自动 local auto-type
LS25LMSA	013214070000	LG25L	远程自动 Remote auto type
LS25LMSB	013214090000		本地自动 local auto-type
LS32MMSA	013215040000	LG32M	远程自动 Remote auto type
LS32MMSB	013215060000		本地自动 local auto-type
LS32LMSA	013215070000	LG32L	远程自动 Remote auto type
LS32LMSB	013215090000		本地自动 local auto-type

注：控制柜需单独订货，订货代号见控制柜订货代号表。

Note: Control Cabinets need separate orders. Order Code should be found in the table of control cabinet order code.

## 开启式螺杆冷水机组控制柜订货代号表

Table of control cabinet order code of Open type screw water chiller units

机组产品型号 Unit product model	控制柜型号 Control Cabinet model	订货代号 Order code	压缩机型号 compressor model	控制方式 Control type	电机功率 kW Motor power kW	油泵功率 kW Pump power kW
LS20MMSA	LA250-2.2	016505260000	LG20M	远程自动 Remote auto type	250	2.2
LS20MMSB	LM250-2.2	016507170000		本地自动 local auto-type		
LS20LMSA			LG20L	远程自动 Remote auto type	315	2.2
LS20LMSB				本地自动 local auto-type		
LS25MMSA			LG25M	远程自动 Remote auto type	500	4
LS25MMSB				本地自动 local auto-type		
LS25LMSA			LG25L	远程自动 Remote auto type	630	4
LS25LMSB				本地自动 local auto-type		
LS32MMSA			LG32M	远程自动 Remote auto type	1000	7.5
LS32MMSB				本地自动 local auto-type		
LS32LMSA			LG32L	远程自动 Remote auto type	1120	7.5
LS32LMSB				本地自动 local auto-type		

注：高压柜一般为外购件，暂时没有型号及订货代号。

Note: Its high-voltage switchgear is generally a purchased part, without any model and order code.



## 螺杆制冷机组系列产品 Series products of screw refrigeration unit



LG 系列螺杆式制冷压缩机组  
LG Series Screw Refrigeration Compressor  
Units



LG 系列双级撬块螺杆制冷压缩机组  
LG Series Skid-mounted Two-stage Screw  
Refrigeration Compressor Units



YS 系列满液式低温盐水机组  
YS Series Flooded Low Temperature Brine  
Chiller Units



YS 系列虹吸式低温盐水机组  
YS Series Siphon Low Temperature Brine  
Chiller Units



LS 系列螺杆冷水机组  
LS Series Screw Water Chiller Units



开启式氟利昂螺杆压缩冷凝机组  
LG Series Open Type Screw Compressor  
Condensing Units

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