Chapter 3 Operation Check and Trouble Shooting

3.1 List of check items for the system operation conditions

3.1.1 Check the record prior to adjustment

Installation	Location (roof/indoor)				Min. distance to the surrounding obstacle						Recommended value＞2m	
	Base (cement/steel frame)				Shock absorber (pad)							
	Protection type (V type/inverse V type)				Air duct max. point and sun shade min. point						Recommended value＞2m	
User affiliated facilities, routine check.	Cool pipe sub-system	Pump flow (T/h)		Stop valve mode (ON/OFF)		Dirt discharge valve mode (ON/OFF)		Water filter mode (ON/OFF)	Air evacuate valve mode (ON/OFF)			
				Inlet	Outlet							
		Hydraulic pressure gauge value		Thermometer value		Water flow tap normal or not	Heat insulation status	Stop valve status of water piping	Flashing times for piping	Water quality		
		Inlet	Outlet	Inlet	Outlet							
	Load	Fan coil connected		Outlet vent smooth and through	Air discharge completely	Space enclosure and heat insulation of the user's air conditioner		Cooling capacity matching with the system				
	Power (tested from power cable end)	Power supply voltage (V)			Allowable value	380~400V		Voltage fluctuation	%	Allowable value	＜ 3%	
		Insulation resistance *M*Ω between phases				Insulation resistance *M*Ω between 3-phase and the ground						
		Rab	Rbc	Rac	Allowable value (min.)	Rag	Rbg	Rcg	Allowable value (min.)			
					20 *M*Ω				20 *M*Ω			
	System insulation (tested ahead of main air switch)	Insulation resistance *M*Ω between phases				Insulation resistance *M*Ω between 3-phase and the ground						
		R12	R23	R13	Allowable value (min.)	R1g	R2g	R3g	Allowable value (min.)			
					20 *M*Ω				20 *M*Ω			
	Compressor insulation (tested from connection cable socket)	Insulation resistance between phases				Insulation resistance between 3 phases and the ground						
		R12	R23	R13	Allowable value (min.)	R1g	R2g	R3g	Allowable value (min.)			
					20 *M*Ω				20 *M*Ω			
	Cooling sub-system	Pipe welded complement		Evacuate (MPa)		Allowable value (max.)	0.0096MPa	Maintain time min		＞ 30min		
		System I balanced pressure (MPa)			System II balanced pressure (MPa)			Environmental temperature (℃)				
	Control and protect component setup and adjust	Low pressure controller			High pressure controller		Three-phase power supply monitor	Water outlet temperature (℃)		evacuate stop time		
		Setting value (Mpa)		Moving error (Mpa)	Setting value (Mpa)	Moving error (Mpa)	Setting value	Setting value	amplitude	Setting value		
		0.2		0.05	2.65	0.2	380~400V				5S	

Remarks: Please check the system prior to adjustment according to the list given above**.**

3.1.2 Debug and trial operation record

Trial running	Regular check prior to operation	Water system	Flow direction		Water temp. (℃)			Air fully evacuated (Y/N)	
			flow volume (T/h)		Water pressure (Pa)	Inlet		Load fully ON (Y/N)	
			90% flow capacity			Outlet		Environmental temperature (℃)	
	Test at start up	Start current (A)					Start status (normal/abnormal)		
	Test after turning on 10min.		High pressure	Low pressure	Failure record		Freeze temperature (℃)	Water inlet	
		system Ⅰ						Water outlet	
		system Ⅱ					Air inlet temperature (℃)		
	(Recover water volume to the system requirements) Test after turning on 30min.		High pressure	Low pressure	Failure record		Freeze temperature (℃)	Water inlet	
		system Ⅰ						Water outlet	
		system Ⅱ					Air inlet temperature (℃)		
	Status of system in operation								
	Failure remedy								
Test	Cooling flow volume adjust	Adjust the final water volume as per inlet water temperature and user air condition load (T/h)				Water inlet and outlet temperature (℃)			Name value 12/7℃
	Status without load	Outlet water temperature when system I stops (℃)		Stop time (S)		Outlet water temperature at re-start up (℃)		Interval for re-stop (min)	
		Outlet water temperature when system II stops (℃)		Operation time (min)			Evacuated stop time (S)		5S
	Site adjust record for Outlet water temperature control	Outlet water temperature when system I stops (℃)		Stop time (S)		Outlet water temperature at re-start up (℃)		Interval for re-stop (min)	
		Outlet water temperature when system II stops (℃)		Operation time (min)			Evacuated stop time (S)		5S
Delivery	Train operator in brief	Remarks			Emergency stop		Special maintenance		
Sum up									

Remarks: Please fulfill the list during the test operation and adjustment.

3.2 List of parameter variation for system operation

3.2.1 List of parameter variation for cooling operation

Refer to the list below for system pressure and current value at cooling operation mode and under a suitable water flow for the system (for reference only):

Model	Inlet water temp℃	Environment temperature℃	High/low-pressure (kgf/cm^2)	Current value (A)
LSQWRF40M/B	12	35	18.1/4.3	25
	20	43	22/4.5	29
	20	48	26/5.6	32
	9.5	21	12.9/3.7	20
LSQWRF60M/B	12	35	18.1/4.3	37
	20	43	21.6/5.2	42
	20	48	24/5.5	43
	9.5	20	12/3.8	28
LSQWRF80M/B	12	35	18.1/4.3	46
	20	43	22/5	56
	10	21	12/3.5	36
LSQWRF130M/B	12	35	18/4.1	78
	20	43	22/5.0	95
	10	21	12.9/3.7	62

3.2.2 The trend of parameter variation for heating operation

The system pressure and current value at heating operation mode are not only related to the environmental temperature and water temperature, but are also affected greatly by the environmental humidity. Hence no specific data can be given.

3.3 List of trouble shooting

Malfunction	Possible causes	Remedies
Too high an air discharge pressure	Air or other non-condensed gas in the system. A dirty condenser wing plate or foreign object blocking. Short of condensed air volume or failure in condenser. Too high an air sucking pressure. Filled with too much refrigerant. Too high an environmental temperature.	Discharge the gas from the freon filling nozzle and evacuate it again if necessary. Clean condenser wing plate. Repair condenser fan to recover the operation. See “Too high a sucking pressure” Discharge part of refrigerant.

Too low an air discharge pressure	Too low a sucking pressure. Refrigerant is leak or not filled enough.	See “Too low a sucking pressure” Check the leakage and fill freon.
Too high an air sucking pressure	Too high an air discharge pressure Filled with too much refrigerant. Liquid refrigerant flows from evaporator to the compressor. The cooling inlet water with a temperature higher than the allowable value.	See “Too high a discharge pressure” Discharge part of refrigerant. Check and adjust expansion valve so that its temperature sensor is tightly contact with the inlet pipe and heat insulated completely with outside.
Too low an air sucking pressure	To low an environment temperature. Block in one way valve or dehumidified filter. The expansion valve is not properly adjusted or with failure. Not sufficient refrigerant in the system. The cooling inlet water with a temperature higher than the allowable value The cooling water flow is not sufficient. See if 4-way valve is changed over to position. See if the defrost is normal.	Replace one way valve or dehumidified filter. Adjust to a proper overheat temperature or check if the expansion valve sensor is leaked. Check for leakage and fill with freon. Check the installation. Check if the pressure for inlet/outlet water pipe of evaporator is too low and adjust the cooling water flow.
The compressor stops due to high-pressure protection device.	Too high an environmental temperature. The condensed cooling air volume is not sufficient, or cooling fan fails. Incorrect setting for high-pressure stopping. Too much freon filled.	Check the cooling fan. Check the high-pressure switch. Check the freon volume filled and discharge part of the refrigerant.

The compressor stops due to motor overload.	Too high or too low a voltage. Too high or too low an air discharge pressure. Too high a returning water temperature. Failure in overload component. Too high an environmental temperature. Short-circuit for motor or connection terminals.	Check that the voltage should not exceed the rated voltage ±10% and the phase difference should not exceed±10%. Check the air discharge pressure and find out the cause. Check the returning water temperature and find out the cause. Check the compressor current and compare it with the full load current specified in the operation manual. Improve the ventilation. Check the corresponding resistance for motor or connection terminals.
The compressor stops due to built-in temperature controller.	Too high or too low a voltage. Too high an air discharge pressure. Too high a cooling inlet water temperature. The compressor fails due to the failure of built-in temperature controller. Refrigerant is not sufficient in the system.	Check the voltage, which should not exceed the specified range as described above. Check the air discharge pressure and find out the cause. Check the cooling water inlet temperature and find out the cause. Check for freon leakage.
The compressor stops due to low-pressure protection device.	Block in one way valve or dehumidified filter. Failure in expansion valve The compressor is with an incorrect setting for stop. Refrigerant is not sufficient in the system.	Change the one way valve or dehumidified filter. Adjust or replace the expansion valve Check the low-pressure switch. Filled with refrigerant.
The compressor is with too much noise.	Liquid refrigerant flows from evaporator to the compressor, resulting in liquid impulse.	Adjust refrigerant filling volume. Check for a normal expansion valve and normal sucked air overheating.

The compressor may not start.	Over-current relay is released and fuse is blast.	Replace the damaged component.
	The control circuit is not connected.	Check the connection for the control sub-system.
	No current.	Check the power supply.
	High or low pressure protection	Refer to the failure of air sucking/discharging pressure described above.
	contactor coil is damaged.	Replace the damaged component.
	A wrong phase sequence connection for the power.	Connect again, and adjust two connection lines among them.
	Failure in water sub-system, the water flow switch is of a broken circuit.	Check the water sub-system.
	Alarm signal exists in remote controller.	Check the alarm type and adopt the corresponding measure.
	A wrong setting for start/stop time of remote controller.	Check and set up again.
	The detected temperature of temperature sensor exceeds the setting value.	

3.4 Common failures of the project

Example 1:

System application site:

Factory at a certain site

System type used:

2 sets of LSQWRF60M/B unit module

Adjustment symptoms:

The system can not operate due to water flow switch protection when the adjustment is carried out for the system.

Trouble shooting:

In general, the water flow switch protection is due to the following reasons:

1. The water sub-system is without water at all.
2. Failure in the water flow switch or incorrect installation of the water flow switch.
3. Failure in water pump.
4. The water sub-system is not completely evacuated.
5. The designed water flow volume is not sufficient and is lower than the protection value of the water flow switch；

Observation and remedy:

1. Open the discharge outlet of the water loop, there is water flowing out. It means that there is water inside the sub-system.

2. Open the cover at the top of the water flow switch and touch the contact. The contact of the water flow switch should be operating flexibly and there should be signal output after turning on. The failure of the water flow switch is thus eliminated. Ask the installation personnel and understand that the installation of water flow switch is in accordance with the requirements. Since it is troublesome to disassemble the switch, it is firstly assumed that there is no problem for the switch and leave it to be confirmed later. Enter the next step.
3. Check the water loop sub-system and find out that there is a manual air discharge valve at the water loop and it is opened. Open the switch and find out there is much air inside the water sub-system.
4. Turn on/off the water pump quickly for one time and it is found out that the water pump is able to operate normally and the blade rotation direction is correct. The pressure at the inlet of water pump reaches rapidly to 0kg. It means that the water is seriously short of in the water sub-system. The pump may be burnt out if the water pump is still operating. Turn off the water pump right away.

Therefore, the protection of water flow switch for the water sub-system is caused by the shortage of water in the system and the site remedy is to be carried out.

Site remedy:

1. Check if there is any negative pressure zone at the water sub-system design.
2. Open all the manual air discharge valves.
3. Complement the water sub-system with water. 30 min later, and turn on/off quickly again the water pump. The pressure at the inlet of water pump reaches rapidly to about 1kg. However, the pointers of the front and back pressure gauges are with a greater swinging. It means that there is still a lot of air inside the system. Go on running the water pump to carry out the water complement, until the pressure gauges recover to be with a slight swinging and there is not air discharged from the air discharge valve.
4. Open the water pump again and observe the expansion water tank. It is found out that the original water level is dropped down rapidly. It means that the system is seriously short of water so that the water inside the expansion water tank enters into the water pipe loop.

Operation after the remedy:

After the site remedy, open the water pump again and find that there is a pressure in the front and back pressure gauges, with the pressure at the inlet of water pump being 1.5kgf/cm^2. For the expansion water tank, the water level is basically unchanged. The operating current of the water pump is near to the rated value. Turn on the system. The system can be started normally. Thus, the problem is solved.

Example 2:

System application site:

Factory at a certain site in the northwest China

System type used:

2 sets of LSQWRF130M/B unit module

Adjustment symptoms:

The system can not operate due to high-pressure protection when the heating operation is carried out for the system.

Trouble shooting:

In general, the high-pressure protection is due to the following reasons:

1. The heating operation is actuated when there is a higher environmental temperature.
2. The system is in heating operation when there is a very small load at the terminal. Since the compressor has a minimum operating time, the water temperature rises very quickly at the time, causing the pressure protection of the system.
3. The valve in the water loop is adjusted by accident, causing a small flow volume.
4. For parallel operation of several systems, smaller water flow volume is provided to certain systems due to an improper design of the water sub-system.
5. Smaller water flow volume is caused due to dirt or block at the filter of the water sub-system.
6. The water sub-system has been cleaned for a long time and the scale is seriously accumulated on the heat exchanger, affecting the heat exchanging and leading to a high-pressure.
7. Failure in the system itself

Site observation:

1. If the heating operation is carried out at a very high environmental temperature, the high-pressure protection may happen to the system due to the pressure problem. However, it is clear that no high-pressure protection will appear and the system will be operating normally when the environmental temperature is lower than 21℃ and the water volume of the system is normal, without scale at the heat exchanger. The temperature of the site is 18℃ and hence the high-pressure has nothing to do with the environment temperature.
2. After checking in the site, it is found that the ends of the systems are already opened and the water temperature is basically unchanged.
3. Check the water loop valve. The position is coincident with the system at normal operation (it is required to record the opening volume of the water valve and mark given at the dial at the end of the adjustment). The valve problem is eliminated.
4. The water is inside the system. It is found that the operating pressures of two sets of system are with high values after starting the systems (inlet water, 30℃, high pressure, 25kg, and it is increasing). It indicates that the heat exchanging is bad for the two sets of system.
5. Check the filter for water loop. It is found that it is clean inside and is free of block. The filter problem is eliminated.
6. It is understood that the water source is from underground and the water loop has not been cleaned for more than one year ever since the installation of the systems. It is estimated that the problem is caused from the scale accumulated on the water loop.

It can be seen from the above analysis that the heat exchanging is affected by the scale on the heat exchanger of the system, in additional to a higher environment temperature, causing the high-pressure protection for the systems.

Site remedy:

1. Clear the scale on the surface of the pool for water complement. Clean Y filter of the cooling pipe and clean the dirt at the water collecting box for automatic air discharge valve of cooling water.
2. Carry out disinfecting/algae eliminating/cleaning→acid washing→neutralize→pre-foaming. The cleaning detergents used are normally B40, SWC-1 and SWC-2.
3. After cleaning, carry out acid washing and neutralizing. Then, change with new water and carry out water circulation for two to three times for pre-foam processing.
4. Take the water sample for check and the water should be clear and clean, with a proper taste.
5. Turn on the system again, the problem has already been solved.

Example 3:

System application site:

Factory at a certain site in the south China

System type used:

Multiple sets unit modules

Adjustment symptoms:

The temperature of outlet cooling water is too high for a set of system, not meeting the requirements.

Trouble shooting:

It may be that the design load is too large, meeting no requirements for outlet water. Or, it may be unbalanced water force distribution, affecting a set of system with too high a load.

Observation and trouble shooting:

1. It is found through calculation of operation area for air conditioner that the total capacity of the module system can meet the load requirements for the air conditioner. The possibility of too large a load is now eliminated.
2. Check the system pipe sub-system. It is found that the diameters for the general pipe and the branch pipe are the same due to the restriction of installation space for layout of the general and branch pipes for cooling water inlet/outlet. As a result, the water flow volume of one set of system is greater than that of the other.

Site remedy:

Lay again the general and branch pipes for cooling water inlet/outlet

Operation after the remedy:

After the site remedy and start the system again, the loads for various systems are balanced. The trouble has now been solved.