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1.Overview

The conventional single-stage screw compressor can only reach a minimum evaporation temperature of -40~-50℃ in refrigeration applications. If you want to break this application limit, you need to use a dual-machine or cascade system. At the same time, the high pressure ratio working condition brings problems such as excessive leakage and high exhaust temperature during compression to the traditional single-stage compressor, which in turn causes low efficiency and low reliability of the single-stage compressor operating under such harsh working conditions.

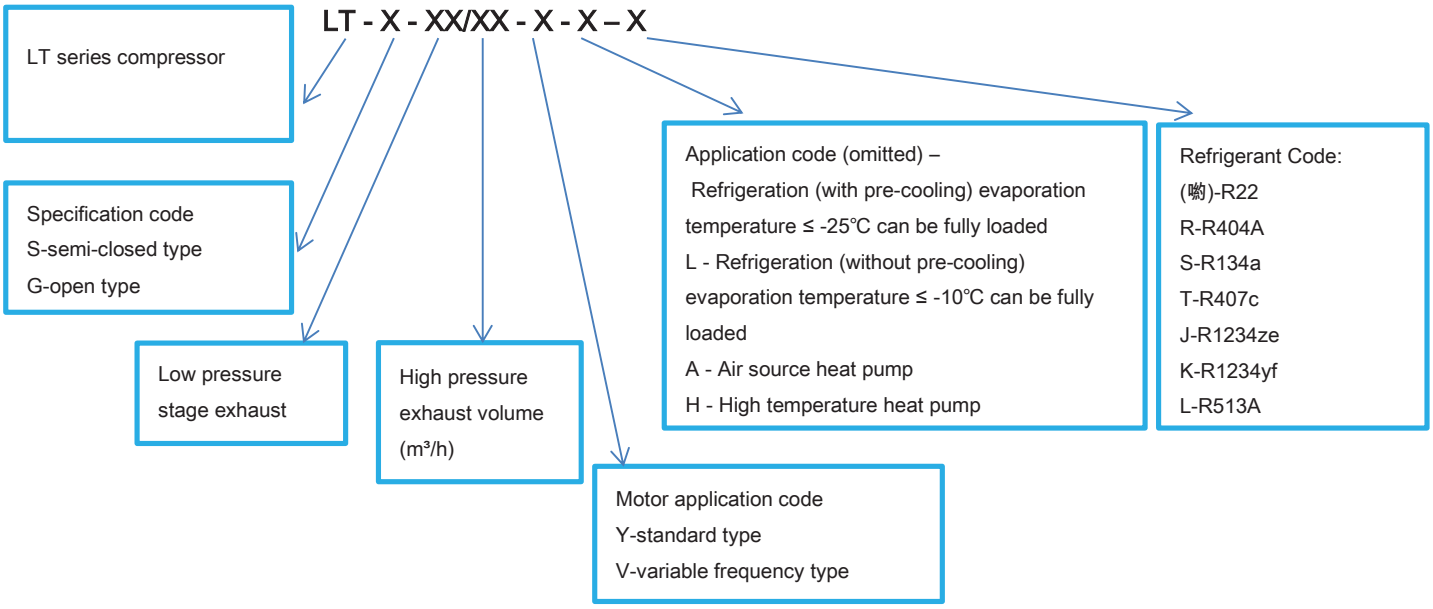
The single-machine two-stage compressor solves the above problems very well. Compared with the dual-machine or cascade system, it has significant advantages such as small footprint and simple control. Compared with the single-stage compressor, it has significant advantages such as high efficiency and high reliability.

The evaporation temperature of the LT-S single-machine two-stage low-temperature product can reach as low as -60~-65℃, and the full-load evaporation temperature is -25℃. The LT-S-L single-machine two-stage low-temperature product is based on LT-S. By modifying the internal structure and optimizing the motor matching, the full-load evaporation temperature of the compressor is increased to -10°C, meeting the needs of quick-freezing warehouses, quick-freezing tunnels and industrial refrigeration without pre-cooling.

Taking the above into consideration, Shanghai Hanzhong Precision Machinery Co., Ltd. has specially developed the LT series of low-temperature products. This product is mainly designed with high efficiency and high reliability under large pressure difference and large pressure ratio conditions as the main appeal. It is an elite product that combines Shanghai Hanzhong's rich technical accumulation and a lot of application experience in the field of screw compressors. This product can be widely used in many industries such as low-temperature frozen products, quick-freezing tunnels, quick-freezing warehouses, process cooling, process cooling, pharmaceutical and biochemical.

2. Product Specifications

2.1 Naming Principles



Low temperature product code	Application Areas
LT-S-XX/XX	R22 Refrigeration
LT-S-XX/XX- R&U	R404A&R507 Refrigeration
LT-S-XX/XX-L	R22 Refrigeration
LT-S-XX/XX-L- R&U	R404A&R507 Refrigeration

Table 2-1. LT low temperature series compressor naming

2.2 Product Series

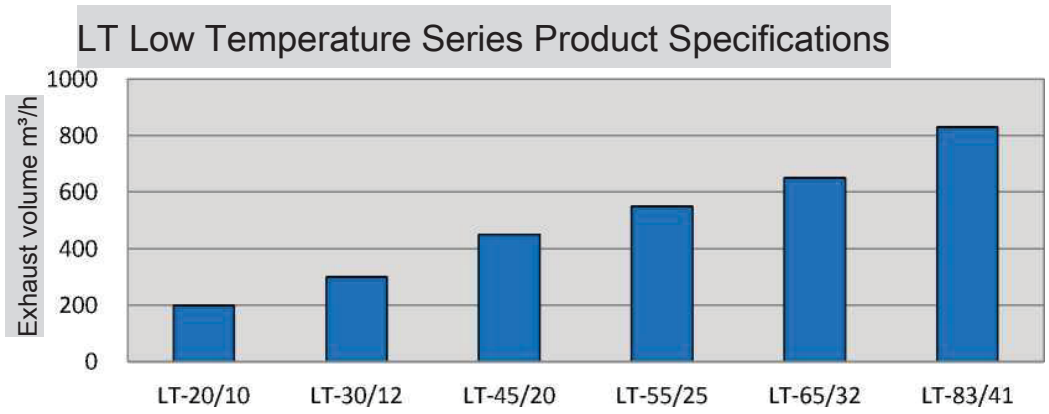


Table 2-2. LT low temperature series product specifications

Low temperature product code		Model range
LT-S-XX/XX	LT-S-XX/XX- R&U	LT-20/10~LT-83/41
LT-S-XX/XX-L	LT-S-XX/XX-L- R&U	LT-20/10、LT-45/20~LT-83/41

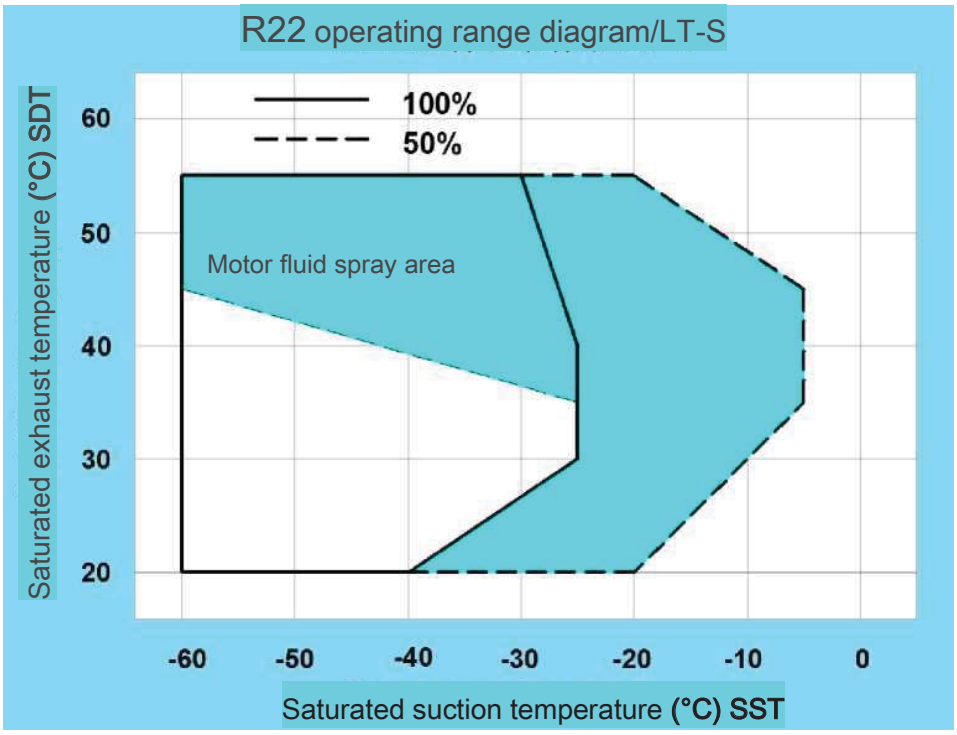
2.3 Compressor Specifications

Model	Compressor							
	Low voltage level	High pressure level	Speed 50Hz r/min	Capacity Control		Lubrication method	Noise	
	Exhaust volume	Exhaust volume					Refrigeration LT-S	Refrigeration LT-S-L
	50Hz	50Hz						
	m^3/h	m^3/h		There is a section	No segment		dB	
LT-20/10	224	99	2950	10%/50% 100%	10% ~ 100%	Differential pressure oil supply	80	81
LT-30/12	316	137					81	/
LT-45/20	450	207					83	84
LT-55/25	551	257					84	85
LT-65/32	651	313		10%/50% 75%/100%			86	88
LT-83/41	840	396					87	89

Model	Quality		Motor				Strength Test
	Kg		Category	Startup method	Voltage (V) 50Hz	Protect	Bar
	Refrigeration LT-S	Refrigeration LT-S-L					Refrigeration and freezingLT-S
LT-20/10	598	620	3-phase 2-pole squirrel cage induction motor	Star angle start	380	PTC+NTC	35
LT-30/12	620	/					
LT-45/20	1158	1200					
LT-55/25	1195	1230					
LT-65/32	1395	1450					
LT-83/41	1430	1490					

Table 2-3. LT series compressor specifications

2.4 Operating range diagram



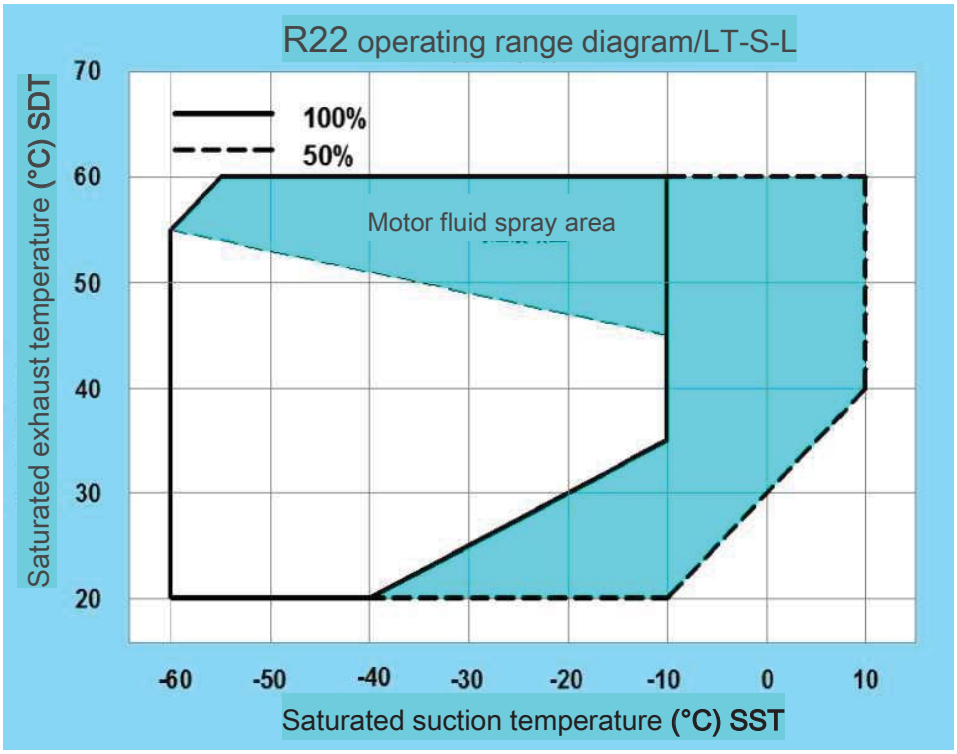
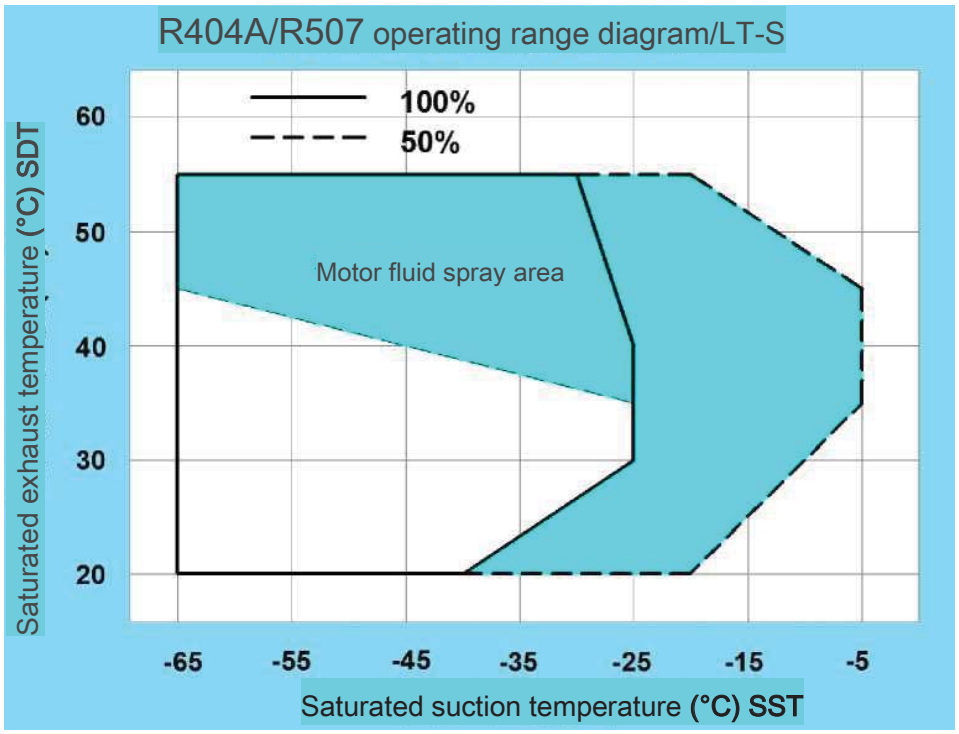


Figure 2-1. R22 operating range diagram



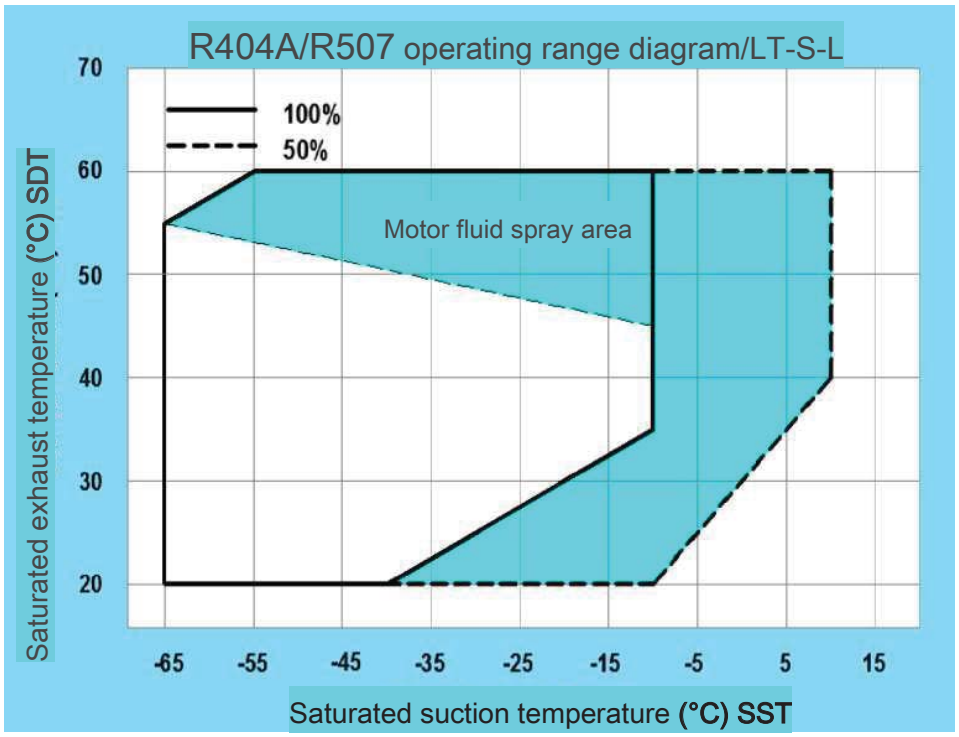


Figure 2-2. R404A operating range diagram

3. Structure and Function

3.1 Design Features

1) Starting Load

The light-load starting design makes the starting load equivalent to that of an ordinary single-stage compressor, thus avoiding a greater impact on the power grid.

2) Motor Cooling Channel

The excellent motor cooling channel design ensures high efficiency of the compressor while achieving reliable cooling of the motor, so that the compressor can operate in a very wide range and has stronger adaptability.

3) Integrated Design of System Accessories

Pre-installed medium-pressure check valve, shut-off valve and economizer filter to achieve reliable protection of the compressor and simplify customer system configuration.

4) Motor Temperature Visualization

The motor pre-buried temperature sensor is equipped with NTC as standard, which can directly read the motor temperature for motor temperature control and protection.

3.2 Capacity Adjustment System

The LT series screw compressor is equipped with a 3/4-stage capacity adjustment system or a continuous (stepless) capacity adjustment system.

Both capacity adjustment systems are composed of a capacity adjustment slide valve, a piston rod, a piston cylinder and a piston. As shown in Figure 3-1 below.

When the slide valve is close to the suction side, the screw rotor is in a full-load suction state, and the working volume of the compressor reaches 100%. As the slide valve moves away from the suction side and toward the exhaust side, a bypass cavity is formed between the slider and the suction side. Its existence causes the compressed gas in this range to bypass directly to the low pressure, and the actual suction volume of the screw rotor is reduced. The more the slide valve moves toward the exhaust side, the smaller the actual suction volume of the compressor, thereby reducing the cooling capacity of the system.

The capacity adjustment slide valve is driven by the pressure difference change inside the capacity adjustment system.

The lubricating oil first flows out of the external oil tank, enters the compressor from the compressor oil inlet after passing through the oil filter, and then enters the two sides of the piston in two ways. Therefore, by releasing the high-pressure lubricating oil on one side to the low pressure, the piston can be controlled to move to the side with low pressure, so the slide valve also moves with the piston to realize the loading and unloading of the compressor.

The piston spring is used to push the piston back to its starting position, that is, the 10% load position, so as to realize the automatic unloading start of the compressor. This not only reduces the load on the compressor parts at startup, but also significantly reduces the starting current of the compressor at startup, reducing the impact on the power grid.

Stepless capacity adjustment, the solenoid valve (SV1: unloading, SV3: 50%, SV5: 100%) is controlled by a microcontroller or temperature switch to smoothly adjust the position of the piston to stably control its output

cooling capacity.

If the oil filter, capillary or capacity adjustment solenoid valve in the capacity adjustment system does not work properly, it will cause abnormality and failure of the capacity adjustment system

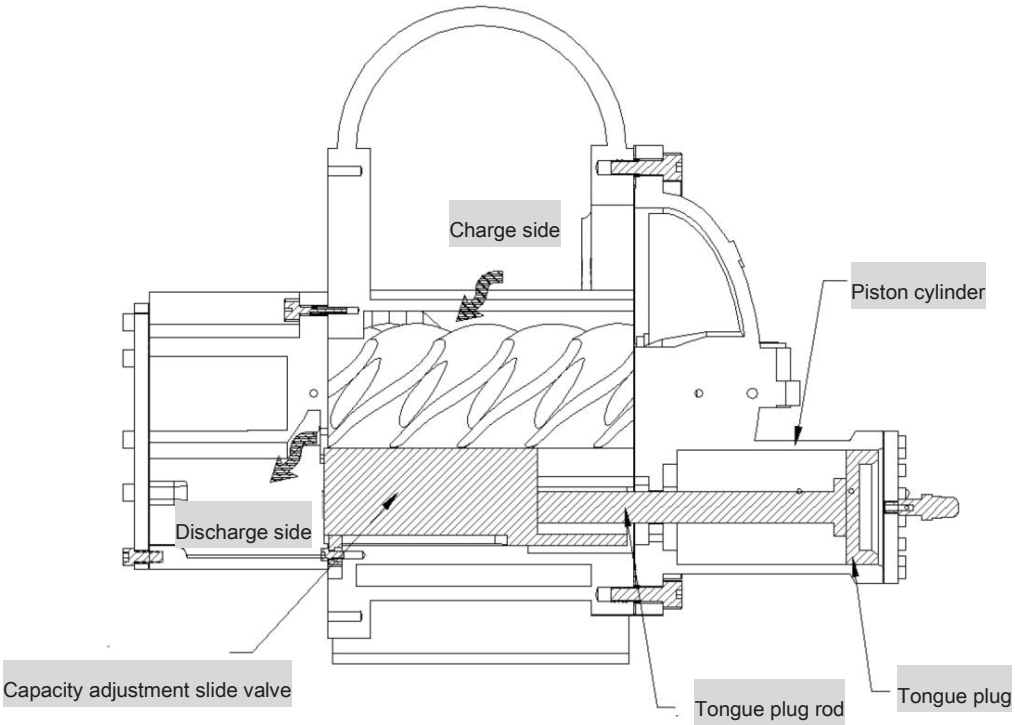


Figure 3-1. Capacity adjustment mechanism introduction3-1.

3.2.1.Segmented capacity adjustment system

1) Segmented control mode description

LT-83/41& 65/32 Capacity adjustment	SV1: Unload (NC)	SV2:10% (NC)	SV3:50% (NC)	SV4:75% (NC)	SV5:100% (NC)
100% load	Inactive	Inactive	Inactive	Inactive	Activation
75% load	Activation	Inactive	Inactive	Activation	Inactive
50% load	Activation	Inactive	Activation	Inactive	Inactive
10% Load (start and stop)	Activation	Activation	Inactive	Inactive	Inactive
LT-20/10&30/12 LT-45/20&55/25 Capacity Adjustment System	SV1: Unload (NC)	SV2:10% (NC)	SV3:50% (NC)	/	SV5:100% (NC)
100% load	Inactive	Inactive	Inactive	/	Activation
50% load	Activation	Inactive	Activation	/	Inactive
10% Load (start and stop))	Activation	Activation	Inactive	/	Inactive

Table 3-1. Segmented capacity regulation control logic

2) Schematic diagram of capacity adjustment

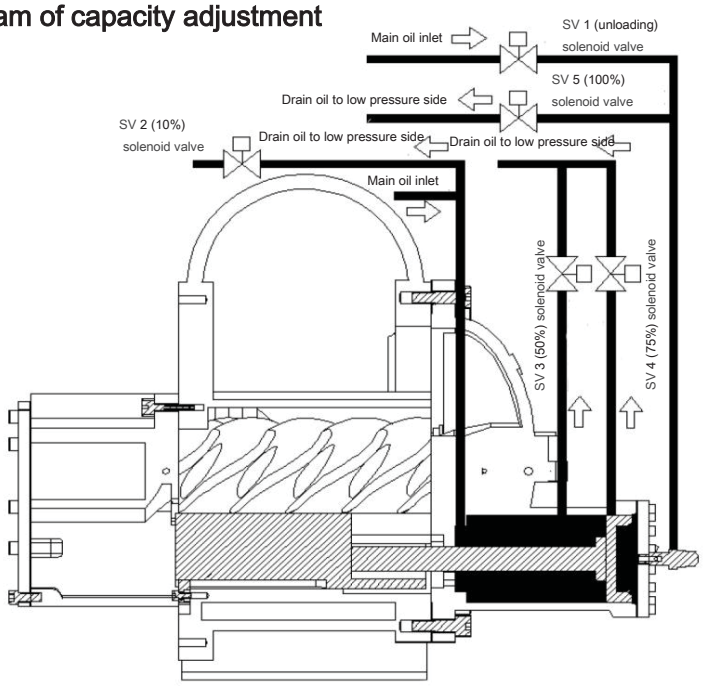


Figure 3-2. Principle of segmented capacity adjustment

3) Detailed description of segment control

⊙ 10% load

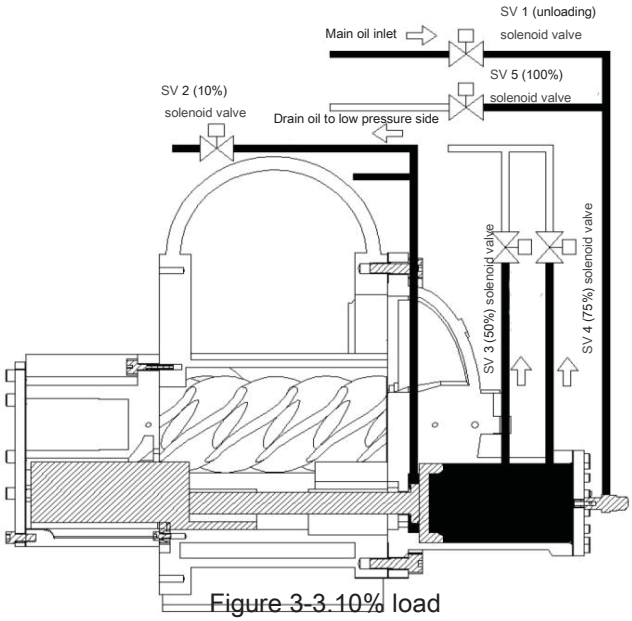


Figure 3-3.10% load

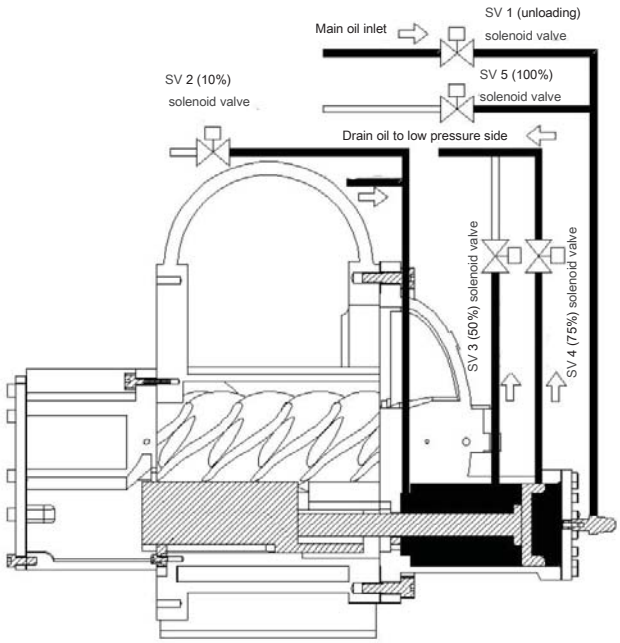
When the compressor is started, the capacity regulating solenoid valves SV1 (unloading) and SV2 (10%) are activated, and the piston is at the 10% load position (the far left).

In this state, the high-pressure oil from the oil tank is continuously sprayed into the right side of the piston through the solenoid valve SV1 (unloading), and the oil on the left side of the piston is discharged to the low-pressure side through the solenoid valve SV2 (10%). This ensures that the piston is always maintained at the far left, that is, the 10% load position

Figure 3-3. load 10%

★Note: The 10% load state is only designed for unloading startup. After the startup process is completed, do not run for a long time at the 10% load state, and load and run directly.

⊙ 50% load



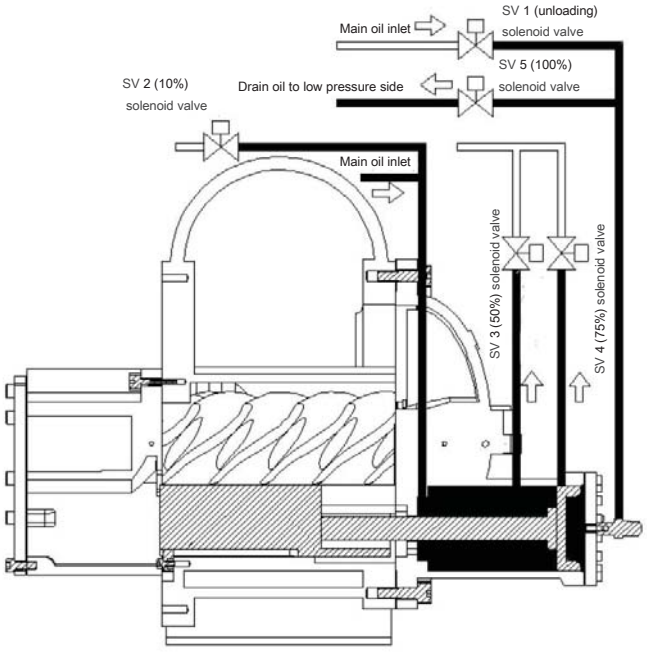
At this time, the capacity adjustment solenoid valves SV1 (unloading) and SV3 (50%) are activated.

In this state, the high-pressure oil from the oil tank is continuously sprayed into the left side of the piston, and is also continuously sprayed into the right side of the piston through the solenoid valve SV1 (unloading).

At this time, if the piston is on the left side of the 50% hole position (that is, the load is less than 50%), the oil on the right side of the piston will be discharged to the low-pressure side through the solenoid valve SV3 (50%), causing the piston to move right until the piston blocks the 50% hole position, and the compressor is successfully loaded to 50% load.

Figure 3-4. load 50%

⊙ 75% load



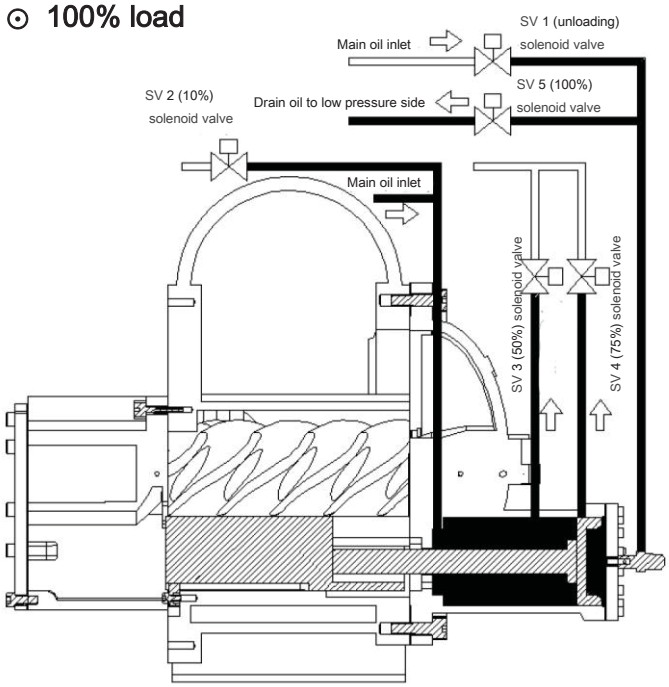
Similarly, if the piston is on the right side of the 50% hole position (that is, the load is greater than 50%), the oil on the left side of the piston will be discharged to the low-pressure side through the solenoid valve SV3 (50%), causing the piston to move left until the piston blocks the 50% hole position, and the compressor is successfully unloaded to 50% load.

At this time, the capacity adjustment solenoid valves SV1 (unloading) and SV4 (75%) are activated.

This state is similar to the 50% load state. By matching the 75% hole position, the piston can be maintained near the 75% hole position, so that the compressor can be adjusted and maintained at load.。

Figure 3-5. load 75%

⊙ 100% load



At this time, the capacity adjustment solenoid valve (SV5 100%) is in the activated state.

In this state, the high-pressure oil from the oil tank is continuously sprayed into the left side of the piston, and the oil on the right side of the piston is discharged to the low-pressure side through the solenoid valve SV5 (100%). This ensures that the piston is always maintained at the far right, that is, the 100% load position。

Figure 3-6. 100% load

4) Segmented capacity adjustment and storage temperature control

The following figure shows the load control mode when a single compressor is applied with step capacity adjustment

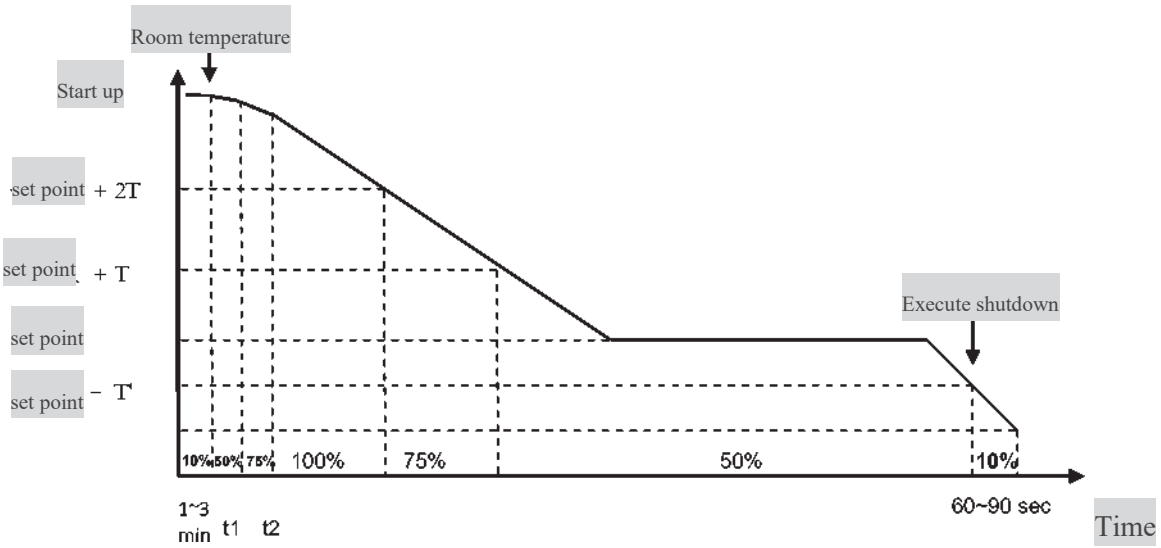


Figure 3-7. Segmented capacity adjustment and storage temperature control

★★Note: The values of T and T' should be set according to the experience of the system designer and the actual application of the customer.

3.2.2 Stepless capacity adjustment system

The stepless capacity adjustment system is suitable for situations where the refrigeration system needs to achieve precise cooling capacity control

1) Description of stepless control mode

LT Series Capacity Regulation System	SV1: Uninstall (NC)	SV2:10% (NC)	SV3:50% (NC)	SV5:100% (NC)
load	Inactive	Inactive	Inactive	Pulse Activation
uninstall	Pulse Activation	Inactive	Keep it active	Inactive
Maintaining load	Inactive	Inactive	Inactive	Inactive
10% load (start and stop)	Keep it active	Keep it active	Inactive	Inactive

Table 3-2. Stepless capacity adjustment control 50%~100%

2) Principle diagram of stepless capacity adjustment

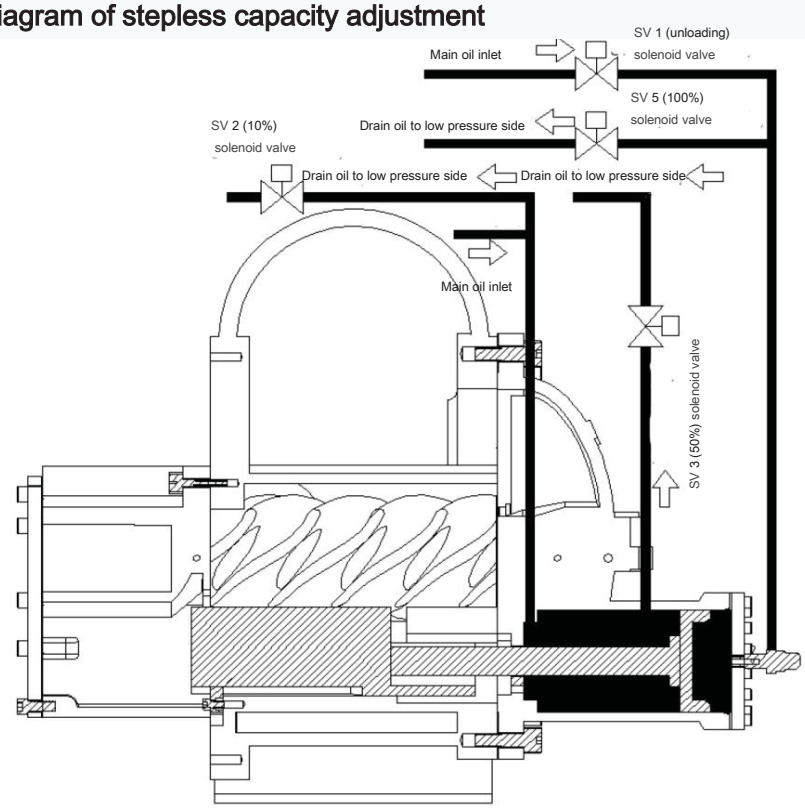


Figure 3-8. Principle of stepless capacity adjustment

3) Stepless control detailed description

In the stepless capacity adjustment system, the oil inlet on the left side of the piston is always open, and the oil drain on the left side of the piston is controlled by the solenoid valve SV3 (50%); the oil inlet on the right side of the piston is controlled by the solenoid valve SV1 (unloading), and the oil drain on the right side of the piston is controlled by the solenoid valve SV5 (100%). These three solenoid valves are controlled by a temperature controller or a microcontroller.

Through the coordinated work of these three solenoid valves, the cooling capacity can be continuously adjusted at any position between 50% and 100%. Therefore, by periodically adjusting the solenoid valves SV1, SV3, and SV5, the energy output can be stably controlled.

★Note: The SV2 (10%) solenoid valve is only used for starting and stopping. After the starting process is completed, do not run for a long time under the 10% load state, and should be directly loaded and run.

The stepless capacity adjustment system needs to be connected to a microcontroller (optional), such as a PLC, etc., to achieve the target work.

⊙ load

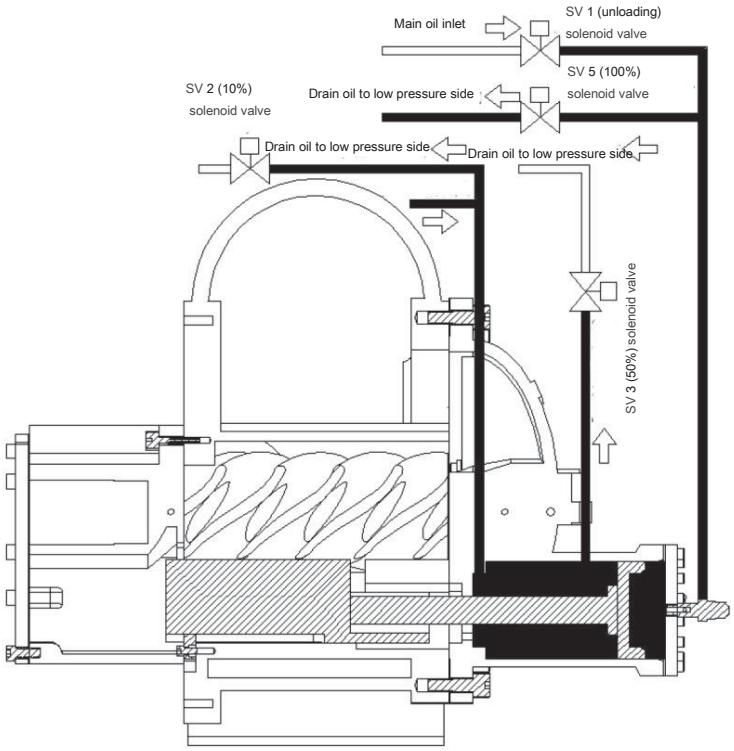


Figure 3-9. Loading

Under normal circumstances, the high-pressure oil from the control system is continuously sprayed into the left side of the piston, and at the same time, the oil on the right side of the piston is discharged to the low- pressureside through the solenoid valve SV5 (100%). At this time, the capacity adjustment solenoid valve SV5 (100%) is activated by pulse, and the other solenoid valves are not activated. In this state, the high- pressure oil from the oil tank is continuously sprayed into the left side of the piston, and the oil on the right side of the piston is discharged to the low-pressure side through the solenoid valve SV5 (100%). Therefore, the piston will continue to move to the right, and the compressor is oaded.。

⊙ Uninstall

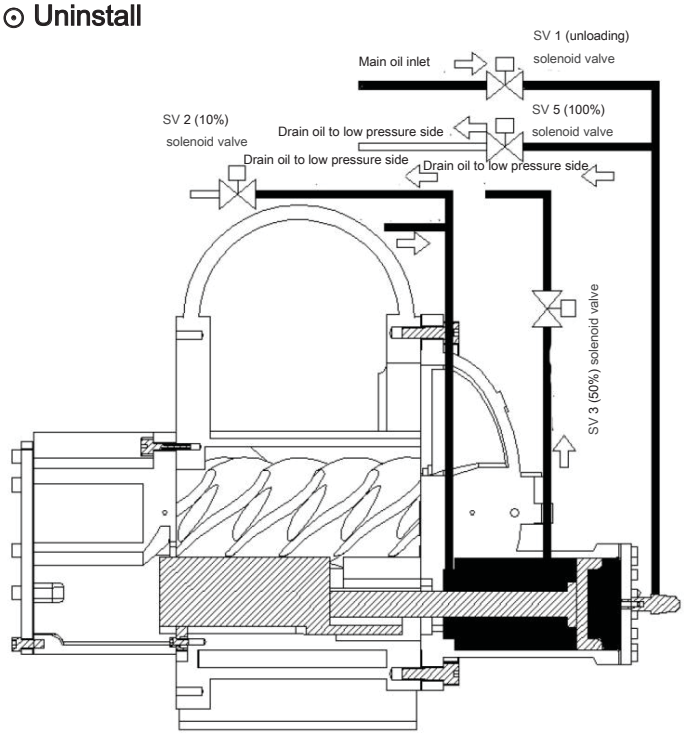


Figure 3-10.

At this time, the capacity adjustment solenoid valve SV3 (50%) remains activated, SV1 (unloading) is pulse activated, and the other solenoid valves are not activated.

In this state, the high-pressure oil from the oil tank is continuously sprayed into the left side of the piston, and is also continuously sprayed into the right side of the piston through the solenoid valve SV1 (unloading).

It is discharged to the low-pressure side through the solenoid valve SV3 (50%).

Therefore, the piston will continue to move to the left, and the compressor will be unloaded to the 50% position。

⊙ Stable/maintain

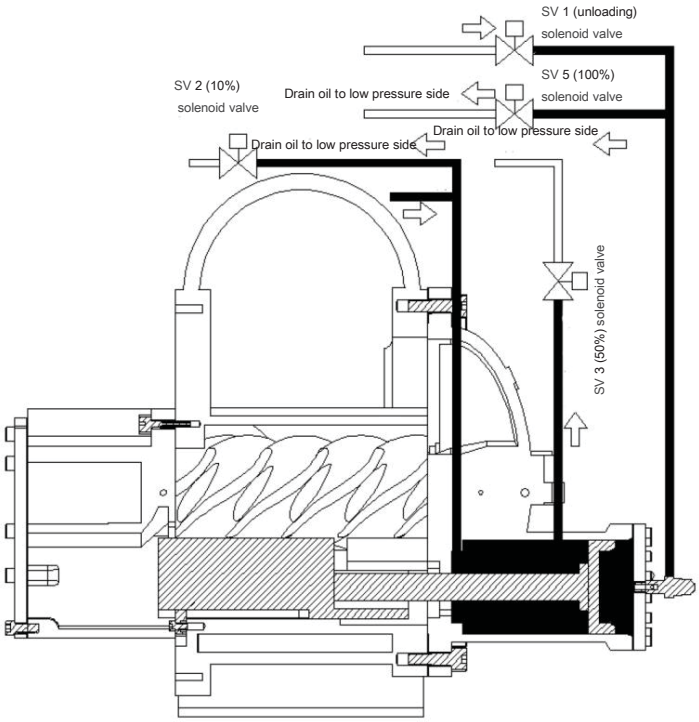


Figure 3-11. Stable/Hold

At this time, all the capacity adjustment solenoid valves are not activated.

In this state, the high-pressure oil from the oil tank continues to spray into the left side of the piston, and the oil inlet SV1 (unloading) and oil drain SV5 (100%) on the right side of the piston are closed to maintain the oil volume on the right side of the piston. The piston will not be able to move and remain in its original position, so the compressor capacity remains unchanged.。

⊙ Stepless capacity adjustment and storage temperature control

The following figure shows the load control mode when a single compressor is applied with stepless capacity regulation。

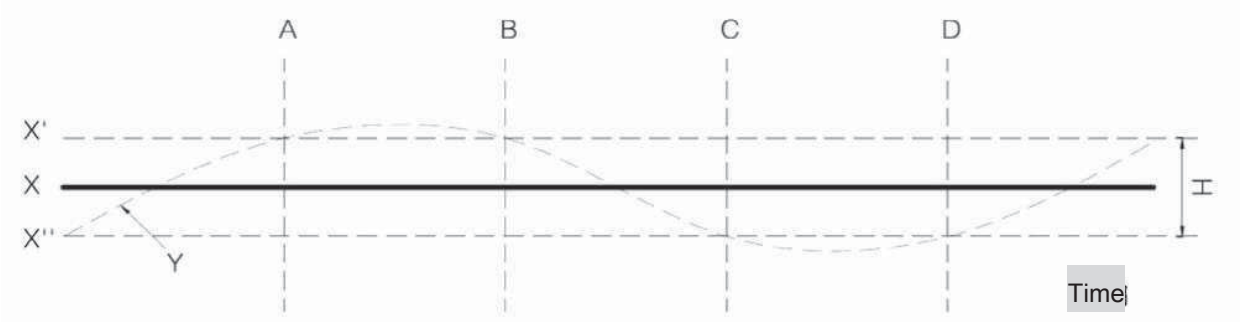


Figure 3-12. Schematic diagram of stepless capacity regulation

★Note: X′ upper limit; X″ lower limit; X set value; H control range; Y actual value

❄**Experience explanation**:

Between point A and point B, the actual room temperature value exceeds the upper limit, which means that the compressor must be loaded until the actual value re-enters the control range.

Between point C and point D, the actual room temperature value exceeds the lower limit, which means that the compressor must be unloaded until the actual value re-enters the control range.。

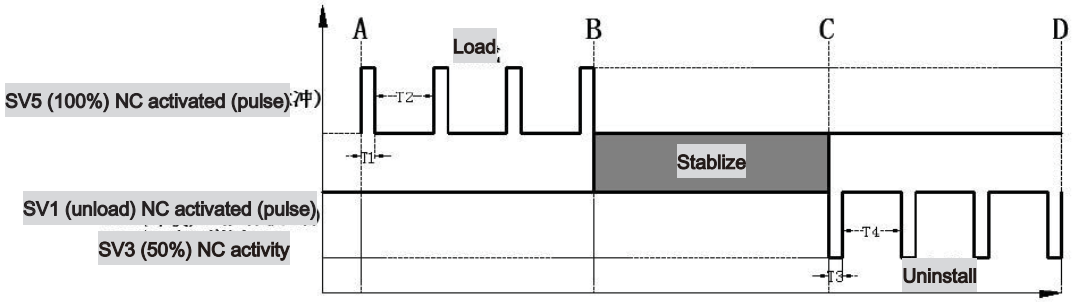


Figure 3-13. Solenoid valve actuation interval for stepless capacity regulation

★Note: For detailed stepless capacity regulation control logic, see Table 3-2。

❖ Load/unload function between points "A~B" and "C~D"

❖ Activate: The solenoid valve is activated when it is powered on

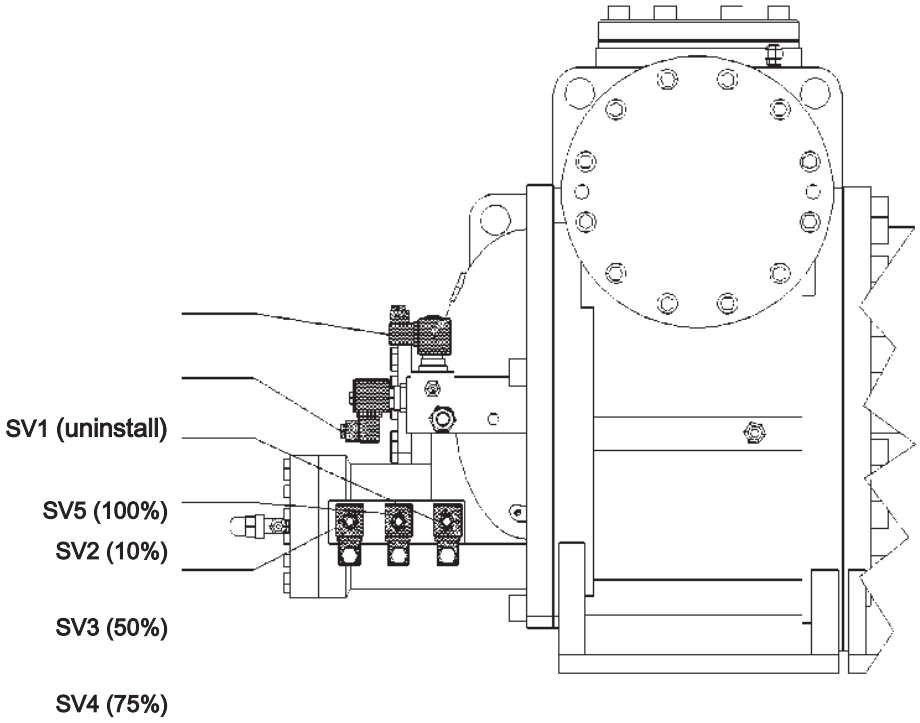
❖ Close: The solenoid valve is not activated when it is powered off

❖ T1, T3: Pulse time 0.5~1.5 seconds

❖ T2, T4: Pause time 10~20 seconds

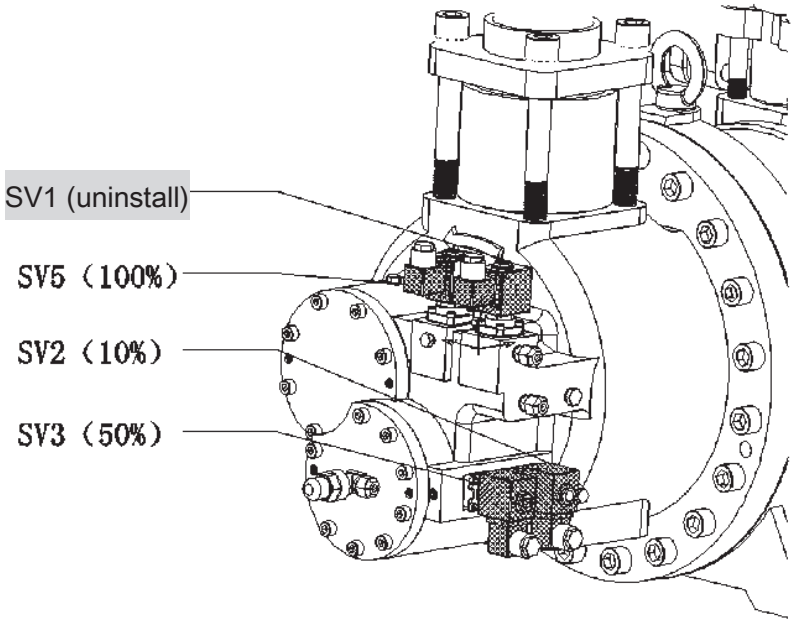
3.2.3 Position of each solenoid valve

1)LT-83/41&LT-65/32



ıre 3-14. Schematic diagram of the position of the solenoid valve of LT-83/41 & LT-65/32

20/10&LT-30/12&LT-45/20&LT-55/25



3-15. LT-20/10&LT-30/12&LT-45/20&LT-55/25 solenoid valve position diagram

3.3 Startup, loading and unloading of 3 compressors

In order to reduce the load on the compressor parts at startup, reduce the starting current of the compressor at startup and reduce the impact on the power grid, Hanbell has designed an unloading startup function for the LT compressor. In order to ensure the stable loading of the compressor, Hanbell requires that the loading process should be carried out step by step as shown in Figure 3-16.

When the compressor is to be shut down, the unloading action should also be performed to ensure that the slider is at the 10% load position when the compressor is started next time, and the compressor can be unloaded and started smoothly. Therefore, Hanbell requires that no matter what load state the compressor is in when it is ready to shut down, it should be gradually unloaded to the 10% load state as shown in Figure 3-16 before shutting down.。

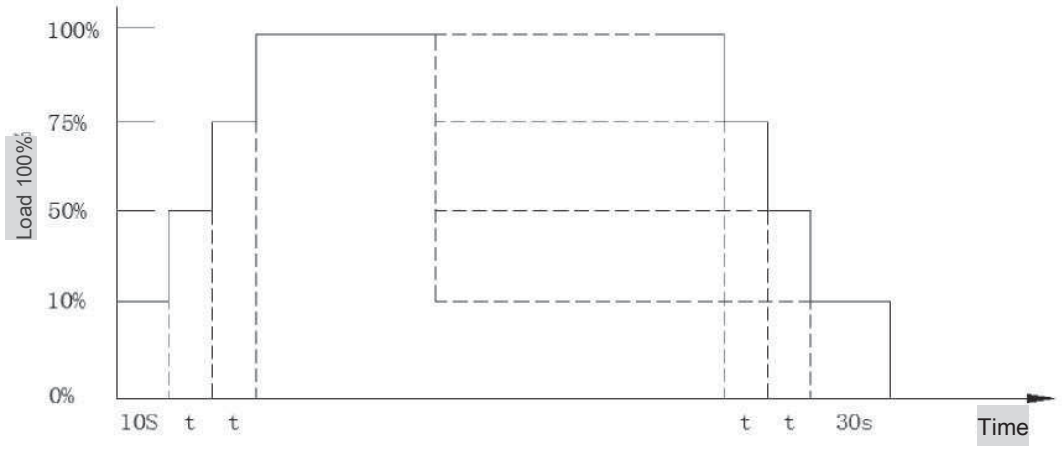


Figure 3-16. Compressor start and stop process

⚠☐Notes:

1) After the compressor is started, it should maintain a 10% load state delay for 10 seconds, and before stopping, it should maintain a 10% load state delay for 30 seconds. (The time can be set to 10~60 seconds)

2) After the compressor is started, when the pressure difference between the high pressure and the medium pressure is less than 3.5bar, the low pressure level must maintain 10% operation, and it must not be loaded or ECO turned on.

3) The value of t is 30 seconds. (The time can be set to 30~60 seconds)

4) After the compressor is stopped, the SV1 (unloading solenoid valve) and SV2 (10%) solenoid valves should be powered on for a delay of 3 minutes. To ensure that the compressor can be at a 10% load position when it is started next time.

5) Hanbell strongly recommends that the start and stop control logic of the compressor refer to the above figure for execution。

For details, please refer to the relevant provisions in "LT-S Control Requirements"

。

4. Lubricating oil

4.1 Lubricating oil configuration table

Applicable models	LT-S(-L)	
Refrigerant	R22	R404A&R507
Condensation temperature/℃	+20 ~ +60	+20 ~ +60
Evaporation temperature/℃	-60 ~ -10	-65 ~ -10
Exhaust temperature limit	110	110
Oil model	HBR-B03	HBR-B05
Specific gravity	0.87	0.957
Specific heat 40℃(Kcal/kg K)	0.43	0.43
Operating oil temperature	40~60	40~60

Table 4-1. Lubricating oil configuration table

⚠Notes:

1) Please select the appropriate lubricant for filling according to the lubricant configuration table in this technical manual. Note that you need to pay attention to the type of refrigerant and the temperature range of application.

2) Please only use the lubricant types specified in this manual. Other lubricants that have not been verified by Hanbell may seriously affect the reliability of the compressor even if there are slight differences in performance parameters.

3) This configuration table is only applicable to LT series low-temperature application products.

4) The compressor allowable starting oil temperature is recommended to be 5K higher than the corresponding saturation temperature of the oil separation at that time to avoid excessive refrigerant content in the oil affecting lubrication.

5) Please turn on the oil heater in the external oil separation when the compressor is stopped. If it is stopped for a long time, choose to turn off the oil heater. The lubricant must be heated for at least 2 hours before the next start.

4.2 Filling of lubricating oil

1) Before filling the lubricating oil, make sure that the system is clean and free of impurities such as welding slag.

2) In order to ensure that the system is dry enough, the system should be dehumidified before filling the lubricating oil. It is advisable to fill the system with dry nitrogen first, and then perform vacuum treatment. The vacuum treatment time should be as long as possible. It is strongly recommended to repeat the above steps several times to reduce the water content of the system as much as possible.

⚠Notes:

1) Do not use lubricants not approved by Hanbell, otherwise it may cause serious damage to the compressor.

2) Do not mix lubricants of different brands, otherwise it may cause serious damage to the compressor. This should also be paid special attention to when replacing the lubricant oil for the system later.

4.3 Lubricant replacement

4.3.1 Oil change cycle

1) The lubricant oil should be checked every 10,000 hours of continuous operation. When the compressor is running for the first time, it is recommended to replace the lubricant oil and clean the oil filter after 2,000 hours of operation. Check whether the system is clean. If the system is in good operating conditions, replace the lubricant oil every 20,000 hours or every 4 years.

2) The compressor runs at a high exhaust temperature (above 95°C) for a long time, which is easy to accelerate the deterioration of the lubricant oil. Please try to avoid it. If it is necessary to run for a long time under this condition, please shorten the oil change interval appropriately.

4.3.2 Notes

1) It is recommended to check the quality of the lubricating oil regularly to ensure that the performance of the lubricating oil meets the operating requirements.

2) The lubricating oil easily absorbs moisture in the air, and the lubricating oil should be avoided from being exposed to the air for a long time.

3) If the compressor motor burns out, the acidic harmful substances and burnt fragments will be brought into the system together. Therefore, the oil filter and lubricating oil must be replaced many times. It is recommended to replace the lubricating oil again after the system has been running for 72 hours until the quality of the lubricating oil in the system returns to normal.

4) Lubricating oil foreign matter contamination will cause oil circuit blockage, so the external oil circuit system must be equipped with an oil filter, and a pressure differential switch must be installed before and after the filter. When the pressure differential reaches the set value (1.5bar), the oil filter must be replaced.

5) Lubricating oil acidification will directly affect the life of the motor. It is recommended to replace the lubricating oil when the PH value is ≤6. (Please also replace the system filter dryer to ensure the system is dry)

6) It is important to replace the system with new oil, especially after the motor burns out, the acid residue remains in the system. The system status can be checked by changing the oil. Check the acidity of the lubricating oil and replace the lubricating oil again after the system runs for 72 hours until the acidity of the lubricating oil reaches the standard value.

7) If the system motor burns out, in addition to replacing the compressor, the lubricant oil must also be replaced, and the lubricant oil status must be tracked regularly. If it exceeds the standard range, please replace it in time. At the same time, please pay attention to the cleanliness and dryness of the system

7) If the system motor burns out, in addition to replacing the compressor, the lubricant oil must also be replaced, and the lubricant oil status must be tracked regularly. If it exceeds the standard range, please replace it in time. At the same time, please pay attention to the cleanliness and dryness of the system

5. System Application

★Note: For parallel application and high-temperature heat pump application, please communicate with Hanbell for a reasonable system configuration plan.

5.1 Pipeline Design

5.1.1 Configuration of Suction and Exhaust Pipelines

1) Structure and Material of Suction and Exhaust Pipelines

Due to the small vibration during normal operation of the compressor, the suction and exhaust pipelines generally do not require flexible connection components, but the pipeline must have sufficient flexible length and ensure that the suction and exhaust pipelines will not cause stress to the compressor. It is recommended to use copper pipes as suction and exhaust pipes, which can play a good role in pipeline vibration reduction when the compressor is running.

2) Size of Suction and Exhaust Pipelines

It is recommended to design the size of the suction and exhaust pipelines according to Hanbell's recommended values. (See 10.2.2 for details)

3) Piping of Parallel System

In order to improve the operating efficiency of the system, special attention should be paid to reducing airflow resistance when configuring the pipelines, and the suction pipes should also take into account the issue of oil return. The following is the suction and exhaust pipe configuration method recommended by Hanbell for parallel systems.

At the same time, special attention should be paid to the fact that the area of the main pipe should not be less than the sum of the areas of each branch pipe to ensure that the pressure drop of the pipeline is controlled within a reasonable range.

❄**Piping on the exhaust side**

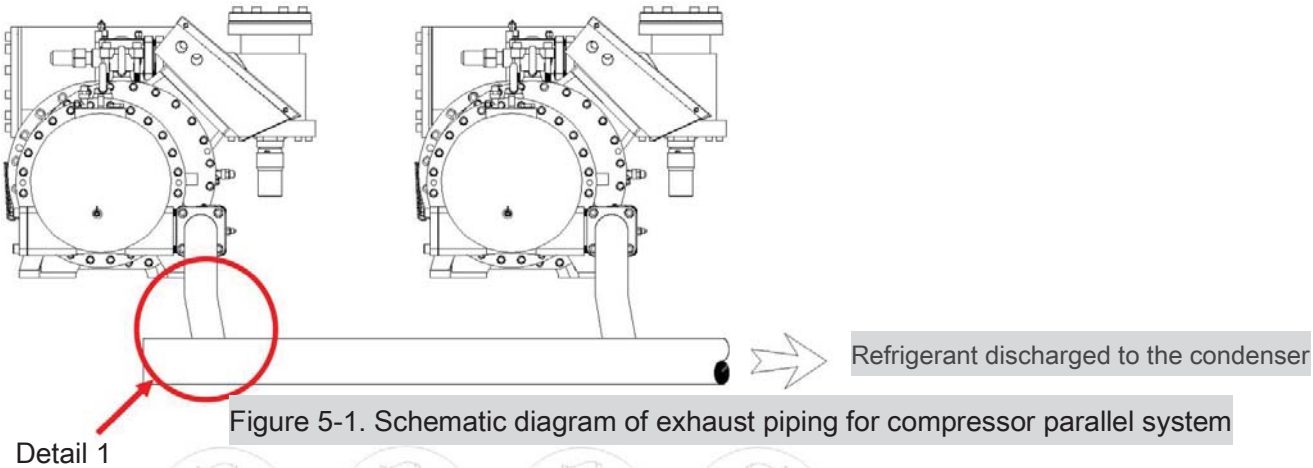
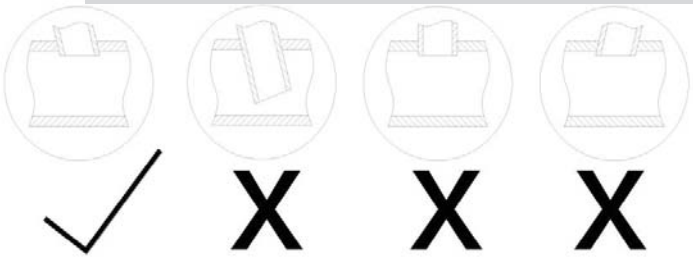


Figure 5-1. Schematic diagram of exhaust piping for compressor parallel system



Detailed figure 1

❄Piping on the suction side

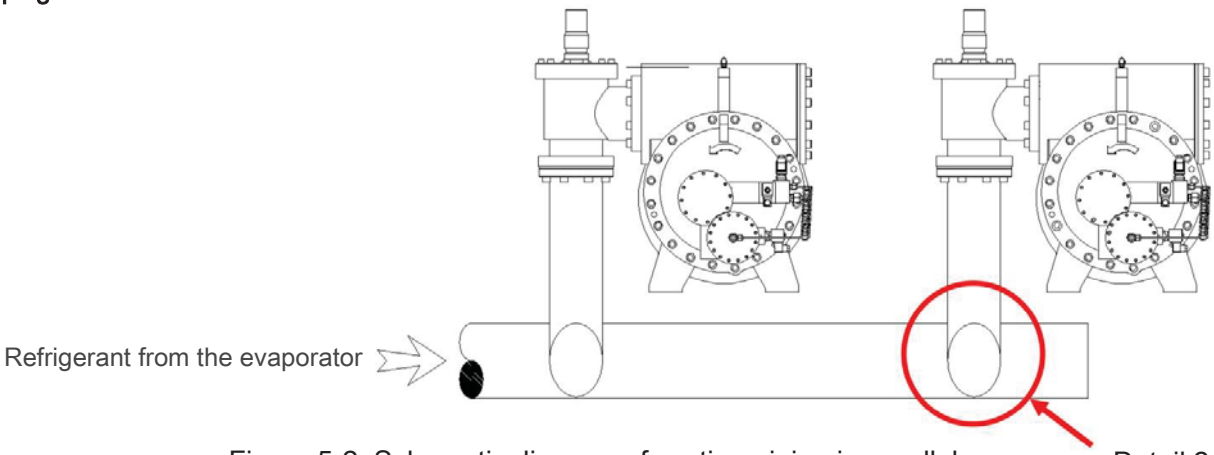
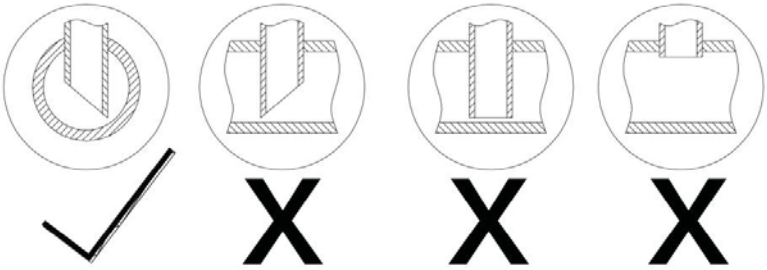


Figure 5-2. Schematic diagram of suction piping in parallel



Detailed figure 2

4) Intake filter

This type of compressor has a built-in intake filter, but it is only used to protect the compressor and cannot be used as an intake filter that needs to be cleaned regularly.

Therefore, please be sure to install an easily removable intake filter (25μm) at the intake end and clean it regularly.

When the system is used for the first time, frequent cleaning may be required. If the pressure drop is greater than 0.5bar, the filter element should be replaced or cleaned until the system is clean. When removing the filter, if the filter screen is found to be damaged, it must be replaced in time and the damaged impurities in the pipeline must be cleaned. Ensure that the filter is in the correct direction during installation, and it is recommended to add shut-off valves at the inlet and outlet for easy maintenance. Hanbell's recommended intake filter design can be found at

As shown in Figure 5-3 below

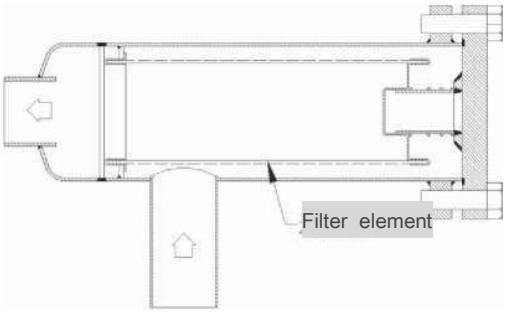


Figure 5-3. Suction filter

★ Note: External suction filter is used in low temperature refrigeration system

5.1.2 Economizer pipeline configuration

1) Economizer pipeline size

This type of compressor has a standard economizer stop valve. It is recommended to design the size of the economizer inlet pipeline according to Hanbell's recommended value. (See 10.2.2 for details)

2) Economizer check valve

When the operating conditions are unstable or when the economizer circuit is closed, part of the oil and refrigerant will flow back to the economizer pipeline. To prevent this phenomenon, this type of compressor has a standard economizer check valve.

3) Economizer intake filter

This type of compressor has a built-in economizer filter. It is mainly used to intercept impurities that may exist in the economizer and its corresponding piping during initial operation to prevent them from causing serious damage to the compressor. This filter is not suitable for regular cleaning and replacement of the filter element. If the system really has this requirement, an external filter is installed on the economizer pipeline.

5.1.3 Assembly of pressure maintenance valve

The oil supply pressure difference (high pressure and medium pressure difference) of the compressor should be able to reach 2.5 bar within 30 seconds after startup to ensure that the lubricating oil can enter the compressor in time.

If the compressor cannot establish the pressure difference in time, it will lead to insufficient oil supply. This will cause the compressor to shut down or even damage the compressor.

Therefore, LT series compressors are equipped with pressure maintenance valves to assist in the rapid establishment of high and medium pressure differences. The pressure maintenance valve should be installed at the oil outlet, and its balance pipe should be connected to the compressor medium pressure measurement point. The installation of the pressure maintenance valve for a single system is shown in Figure 5-4, and the installation of the pressure maintenance valve for a parallel system is shown in Figure 5-5. For details of the control logic, see "LT-S Control Requirements V4.0".

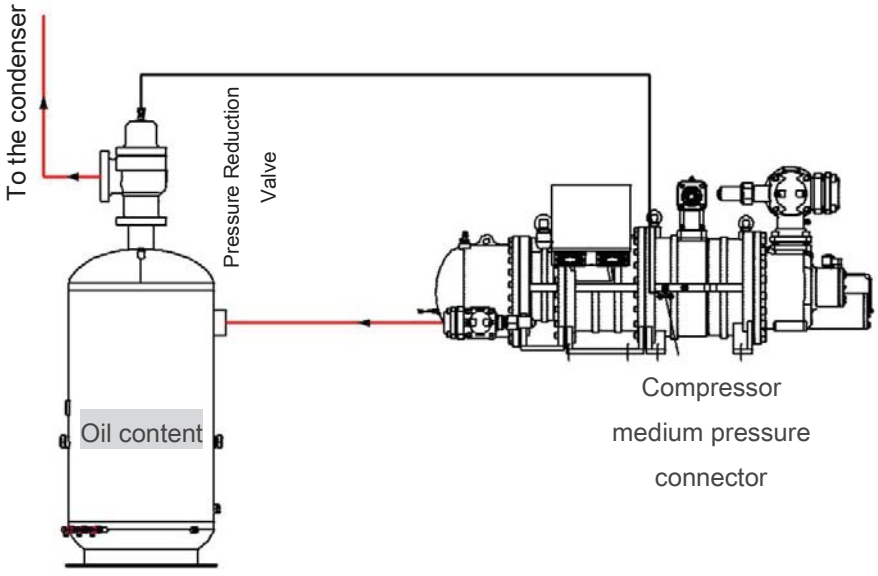


Figure 5-4. Schematic diagram of pressure maintenance valve installation in a single system5-4

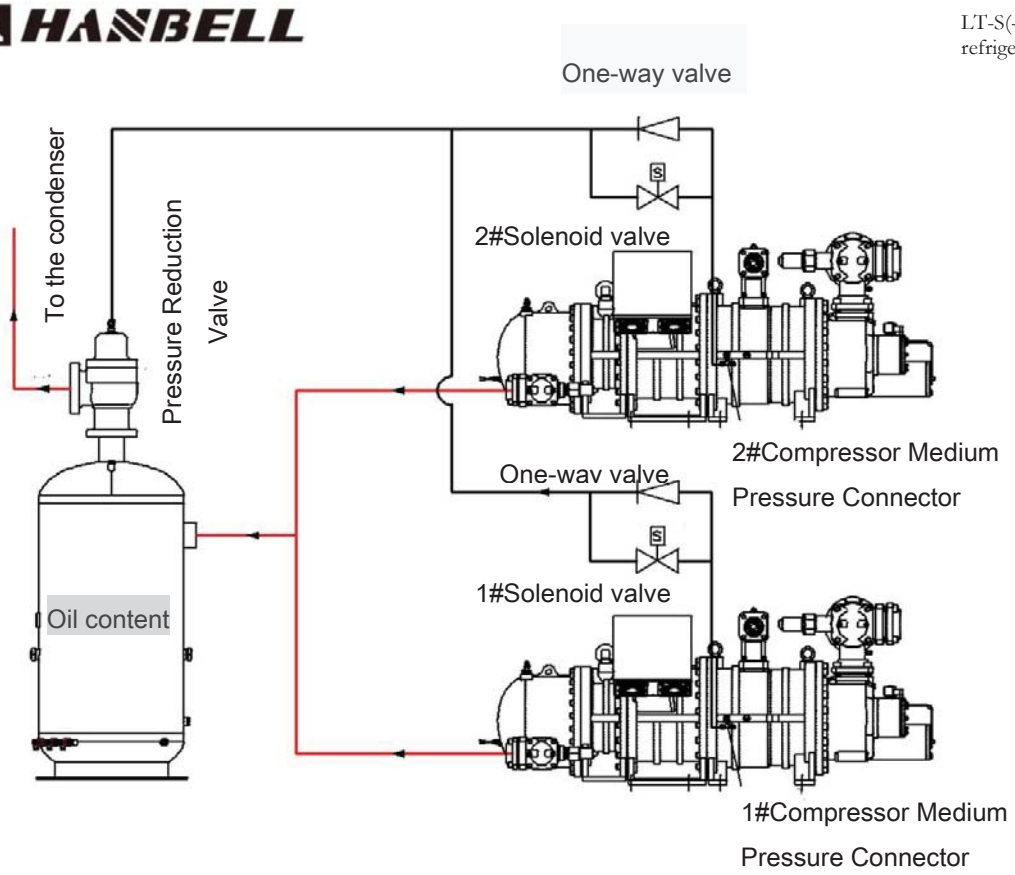


Figure 5-5. Schematic diagram of parallel system pressure maintenance valve installation

Configuration table of single and parallel pressure maintaining valves

Model	Single machine configuration	Parallel Configuration		
		2 in parallel	3 in parallel	4 in parallel
LT-20/10	2”	3”	4”	5”
LT-30/12	2”	3”	4”	5”
LT-45/20	2.5”	4”	5”	6”
LT-55/25	2.5”	4”	5”	6”
LT-65/32	2.5”	4”	5”	6”
LT-83/41	2.5”	4”	5”	6”

Table 5-1. Configuration table of single and parallel pressure maintaining valves

★Note: The size of the standard pressure maintaining valve of the LT series compressor is the same as the exhaust shut-off valve by default.

★Note: In addition to the standard configuration, HANBELL can also provide other specifications of pressure maintaining valves for selection. (See 10.2.4 for details)

★Note: All LT series compressors must be equipped with a pressure maintaining valve。

5.1.4 Liquid pipe filter dryer

Even a slightly higher water content can cause serious damage to the refrigeration system and compressor. Therefore, it is necessary to install a liquid pipe filter dryer on the system liquid pipe to keep the water content of the system at a sufficiently low value.

5.1.5 Dryness and humidity indicator sight glass

Hanbell strongly recommends installing a sight glass with dryness and humidity indicator on the liquid pipe to observe the water content of the system. When the water content is too high, the dry filter on the liquid pipe should be replaced.

★Note: Hanbell can provide a dryness and humidity indicator sight glass for selection.

5.2 Oil system

5.2.1 Oil supply method

This type of compressor uses differential pressure oil supply. The lubricating oil continuously enters the compressor from the oil separator with the help of the pressure difference between the oil separator and the injection point. The lubricating oil is sprayed into the bearing and compression chamber, discharged from the compressor with the exhaust gas, and returned to the oil separator, realizing the circulation of the oil circuit.

5.2.2 Lubrication and capacity adjustment system

The high and low pressure bearings of this type of compressor are supplied with oil through two oil inlets, as shown in the figure below. The low pressure bearing oil supply connector not only ensures the lubrication of the low pressure bearing, but also supplies oil to the capacity adjustment mechanism of the compressor.。

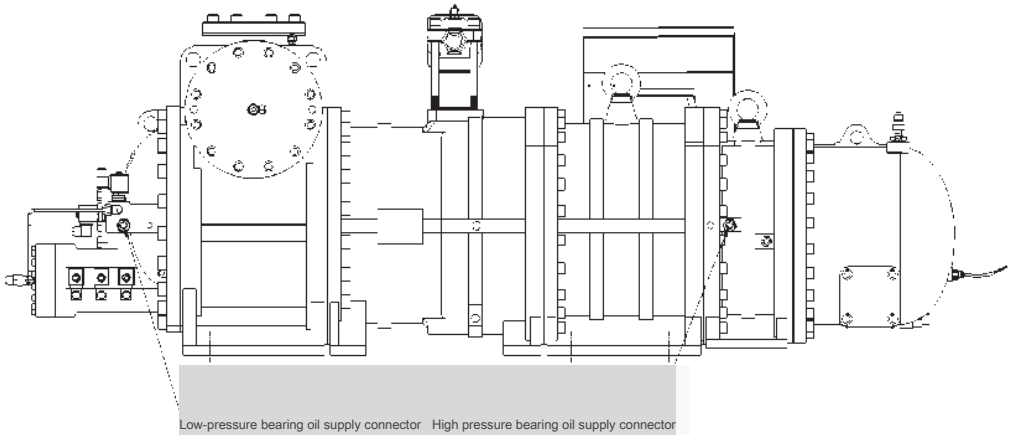


Figure 5-5. High and low pressure bearing oil supply connectors

5.2.3 Compression chamber oil injection cooling system

Under certain operating conditions, the compressor needs to be cooled by liquid spray in the compression chamber to reduce the exhaust temperature and ensure the normal operation of the compressor. This type of compressor is equipped with a total of 1 compression chamber liquid spray interface (as shown in Figure 5-6 below)。

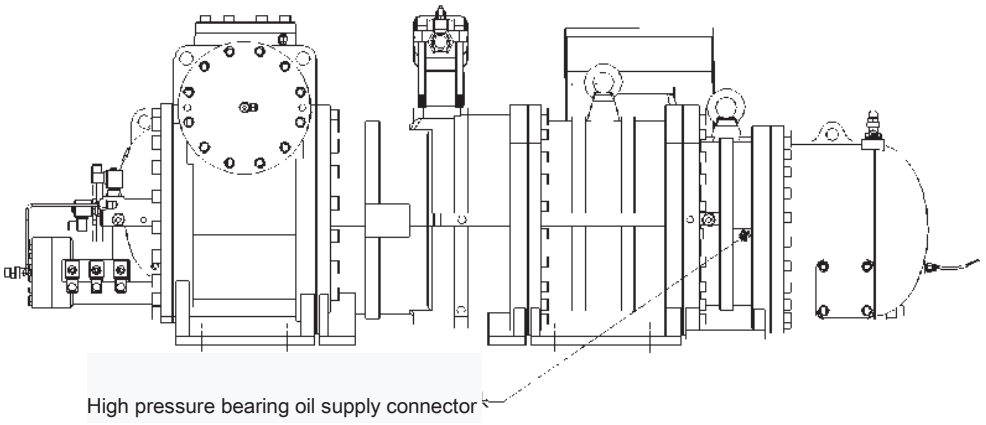


Figure 5-6. High pressure stage compression chamber cooling joint

1) High-pressure compression chamber cooling

After being compressed by the low-pressure stage, the gas temperature is already high. Although there is an economizer to provide medium-pressure air supply, which is mixed with the low-pressure exhaust gas, a certain amount of intermediate cooling is achieved. However, since it is also responsible for cooling the motor, it ultimately maintains a high superheat state. When this highly superheated refrigerant is sucked into the high-pressure stage for compression, liquid spray cooling of the compression chamber is essential. Therefore, Hanbell requires that liquid spray cooling of the high-pressure stage compression chamber must be applied.

★Note: For liquid spray cooling of the compression chamber, Hanbell recommends oil spray cooling。

Design reference for basic oil system

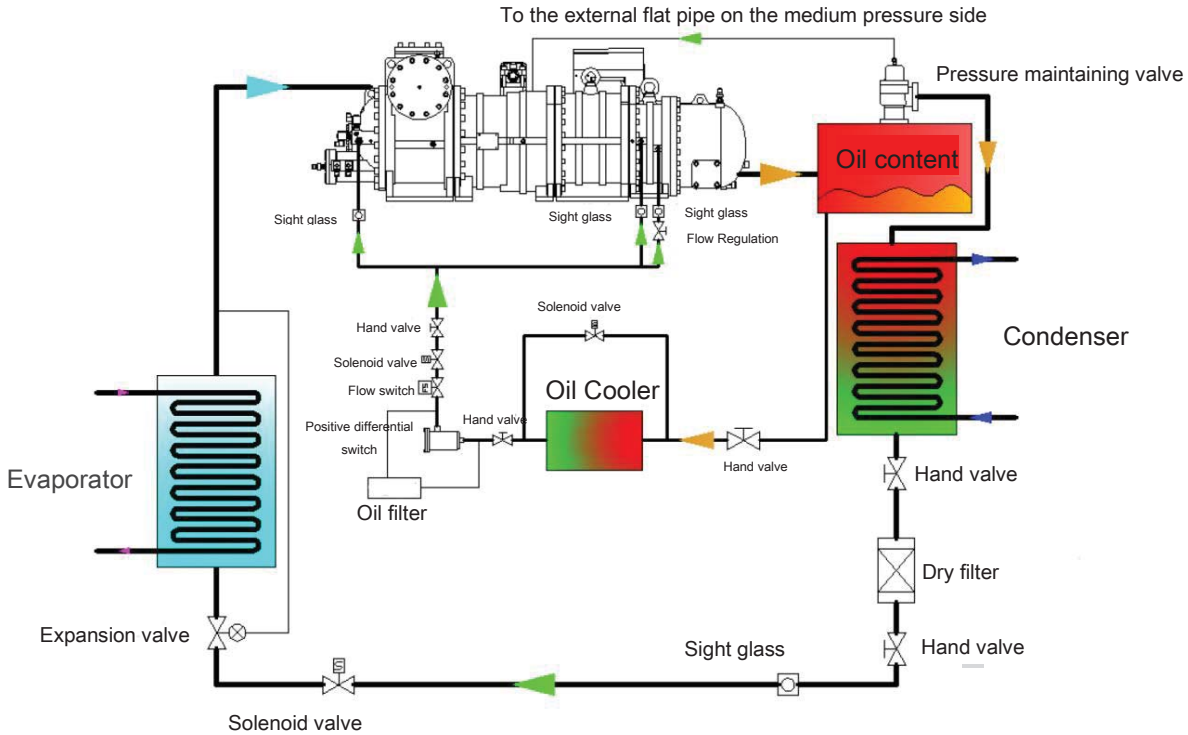


Figure 5-7. Basic oil system

5.2.4 Safety assurance of oil circuit

The normal operation of the oil system plays a vital role in the reliable operation of the compressor. In order to ensure the normal operation of the compressor capacity adjustment mechanism, the reliable lubrication of the bearings and the timely removal of compression heat, special attention should be paid to the following matters.

1) Oil temperature

Hanbell has strict requirements on the oil inlet temperature of the lubricating oil when the compressor is running.

When the oil temperature is too low:

❖ It may cause the viscosity of the lubricating oil to be too high, resulting in problems such as too low oil supply and poor capacity adjustment.

❖It may cause too much liquid refrigerant to dissolve in the lubricating oil, resulting in serious oil throwing and oil shortage in the system. It will also affect the effect of the lubricating oil and cause serious failures such as bearing damage.

When the oil temperature is too high:

❖ It will cause the viscosity of the lubricating oil to be too low and the lubrication effect to be too poor, resulting in premature failure of the bearing.

❖ It will cause the cooling effect to be too poor, resulting in excessively high compressor exhaust temperature, triggering shutdown protection, and in severe cases, causing compressor jamming and other failures.

❖ Excessive oil temperature will accelerate the deterioration of the lubricating oil and greatly shorten the service life of the lubricating oil. If it is not replaced in time, it may cause serious damage to the compressor.

☐☐Notes

1) The oil inlet temperature during compressor operation shall not be higher than 60℃ and not lower than 20℃.

2) When the compressor is stopped, the oil heater should also be turned on to ensure that the lubricating oil temperature is higher than 20℃.

3) When the compressor is stopped for a long time, the oil heater can be turned off. However, due to the long-term shutdown, the refrigerant may dissolve in the low-temperature lubricating oil in large quantities, causing the lubricating oil to be diluted by the refrigerant and the viscosity to be too low. Therefore, it is required to heat the oil temperature to above 20℃ before starting the machine.

★ Note: Hanbell can provide oil heaters for selection. (See 10.4.4 for details)

2) Oil filter

The cleanliness of the lubricating oil is also very important for screw compressors. When welding slag, debris and other debris enter the compressor through the oil circuit, it is easy to cause serious faults such as bearing loss, rotor bite and even jamming of the compressor. Therefore, Hanbell requires that an oil filter must be installed in the oil circuit, and the location should generally be selected after the oil cooler to ensure that no new impurities will enter the lubricating oil after the oil filter.

At the same time, we recommend installing a differential pressure switch before and after the oil filter to detect the pressure drop before and after the oil filter. When the pressure drop is greater than 1.5 bar, the compressor should be stopped and the oil filter element should be cleaned or replaced to ensure sufficient lubricating oil supply pressure and cleanliness.

★ Note: The configuration of the oil filter and its differential pressure switch can be seen in Figure 5-7

3) Guarantee of oil pressure difference

4) Oil level protection

The differential pressure switch alone cannot ensure the oil supply of the compressor, so Hanbell recommends configuring an oil level switch to ensure that there is enough lubricating oil in the oil tank to achieve oil circulation.

5) Oil flow protection

In order to ensure the oil supply of the compressor and improve the reliability of the system, an oil flow switch should also be configured.

★ Note: 1) The configuration of the oil flow switch can be seen in Figure 5-7

2) Hanbell can provide oil flow switches for selection. (See 10.3.1 for details)

5.2.5 Oil cooling system

This type of compressor is usually used under high pressure ratio conditions. At this time, the compressor generates a lot of heat, part of which will be carried away by the lubricating oil. If no additional cooling measures are taken for the lubricating oil, it is easy to cause the lubricating oil temperature to be too high, which cannot meet the conditions for the normal operation of the compressor.

Therefore, it is more common to use an external oil cooler. It can ensure that the oil temperature is always maintained within a reasonable range, so that the compressor can operate normally within a wide range of operating conditions.

⚠Notes:

1) It is recommended to install the oil cooler as close to the compressor as possible

2) When designing the oil cooling pipeline, pay attention to avoid the formation of air cavities in the oil cooler during the compressor shutdown, or the lubricating oil in the oil cooler entering the oil separator or compressor. Therefore, the installation position of the oil cooler should generally be lower than the compressor and oil separator.

3) The oil cooler must be equipped with an oil return temperature control device. To achieve oil temperature control between 40℃~60℃. 4) It is recommended to design an oil cooling bypass oil circuit and cooperate with the oil return temperature control device to better achieve oil return temperature control. Please refer to Figures 5-8&5-9&5-10。

Below are three common oil cooling system designs recommended by HANBELL.

1) Air-cooled oil cooling。
Air-cooled oil-cooled

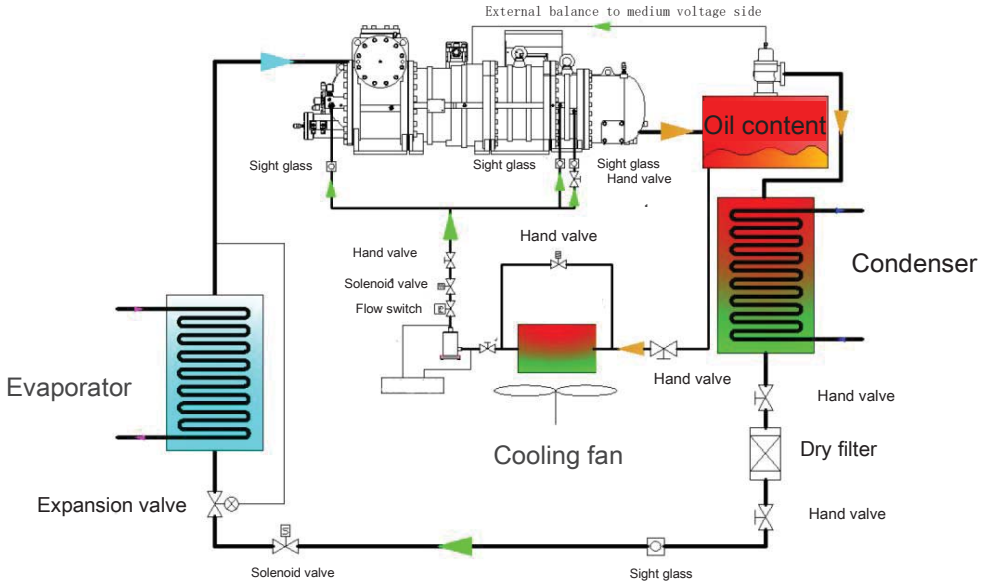


Figure 5-8. Air-cooled oil-cooled

Energy loss

★Note: Heating capacity is required during heating operation, so air cooling or oil cooling is not recommended to avoid system overheating.

2) Water-cooled oil-cooled

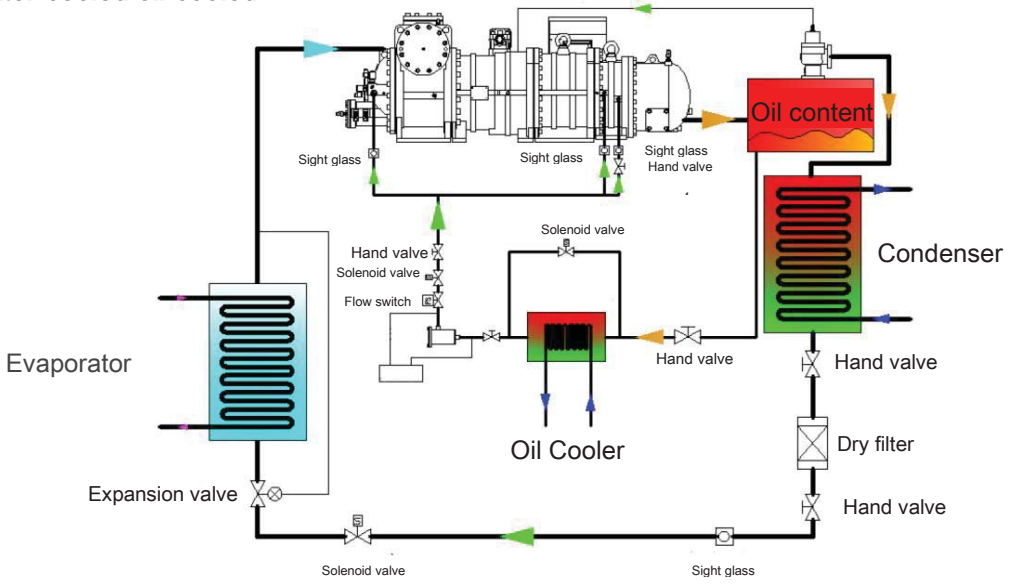


Figure 5-9. Water-cooled oil cooling

★ Note: When the water temperature is appropriate, it is recommended to take water from the condenser water inlet to recover the oil cooling load to the hot water side

3) Refrigerant oil cooling

至中压侧外部平衡管To medium pressure (external balance tube) To the external balance pipe on the medium pressure side

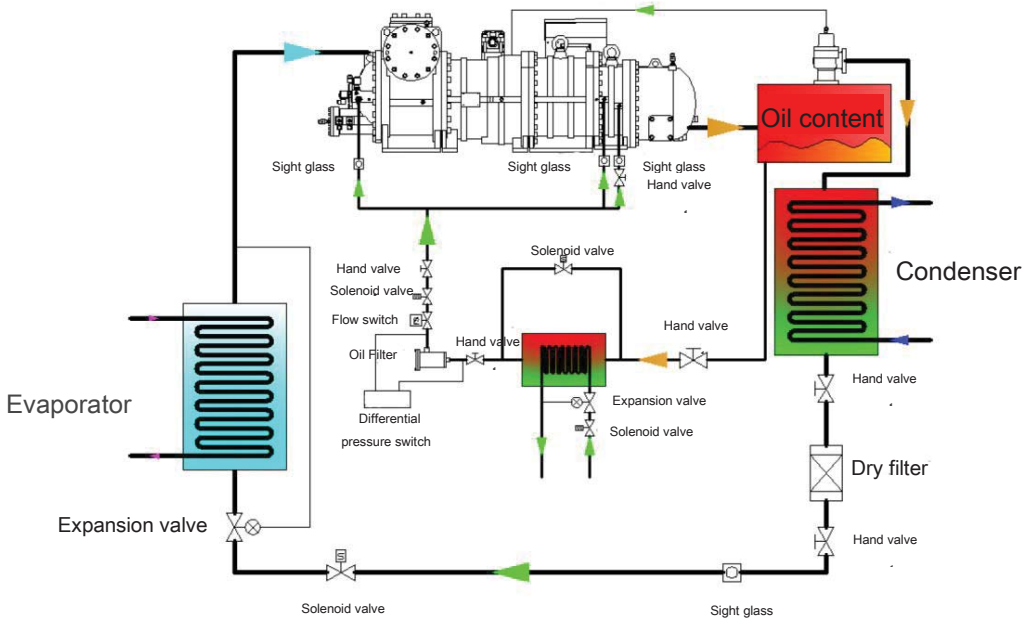


Figure 5-10. Refrigerant oil cooling

★ Note: The oil cooler takes liquid from the liquid pipe and returns it to the compressor medium pressure air supply port

5.3 Motor liquid spray cooling

The motor cooling of this type of compressor mainly relies on gaseous refrigerant cooling. The refrigerant gas discharged from the low-pressure stage flows through the motor together with the economizer air supply to achieve motor cooling

However, when the compressor is operating under some harsh working conditions, it is not enough to rely solely on gaseous refrigerant cooling. Therefore

HANBELL has specially designed a motor auxiliary cooling interface, from which liquid refrigerant can be sprayed into the medium-pressure cavity when necessary. After the liquid refrigerant enters the medium-pressure cavity, it will diffuse with the air flow to achieve uniform cooling of the motor,

while ensuring low energy loss and expanding the operating range of the compressor

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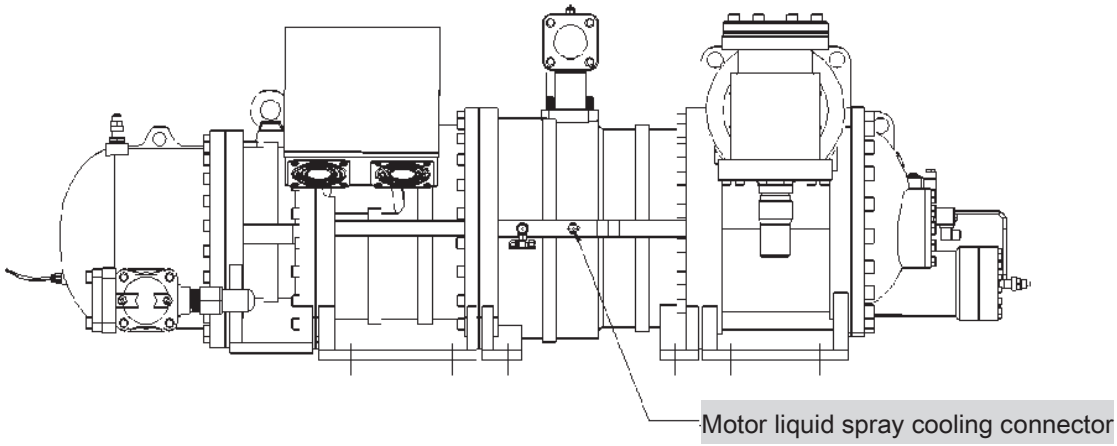

Figure 5-11. Motor liquid spray cooling connector

★Note: 1) Please refer to 2.4 for the operating range of motor liquid spray cooling

2) This type of compressor is equipped with a PT100 motor temperature sensor as standard, which can be used with the motor liquid spray solenoid valve for precise cooling control, thereby improving the operating efficiency of the compressor.

5.4 Economizer system

Using an economizer to further supercool the refrigerant before the system expansion valve will improve the cooling capacity and efficiency of the system, especially under high pressure ratio conditions, the effect of the economizer is particularly obvious.

For a single-machine two-stage compressor, the application of an economizer is even more necessary. Because of its own two-stage compression design, it can give full play to the effect of the economizer. The increase in its cooling capacity and compressor efficiency will be significantly higher than the increase when the economizer is used in a single-stage compressor. The air supply of the economizer can cool the exhaust gas of the low-pressure stage, which reduces the exhaust temperature of the high-pressure stage of the compressor, improves the performance and reliability of the compressor, and expands the operating range of the compressor.

The following are two typical economizer application systems.

5.4.1 Subcooling economizer system

In this operation mode, a heat exchanger (subcooler) is used to achieve subcooling of liquid refrigerant. The subcooling effect is achieved by injecting a portion of the expanded refrigerant from the condenser into the subcooler, and the throttled refrigerant will evaporate and absorb heat in the subcooler. This part of the superheated vapor enters the compressor through the economizer interface and mixes with the partially compressed gas from the evaporator.

In this operation mode, the subcooled liquid is at condensing pressure, so there are no special requirements for the connecting pipes between it and the evaporator, and only insulation treatment is required. This system is suitable for general applications.

Typical LT subcooling economizer system

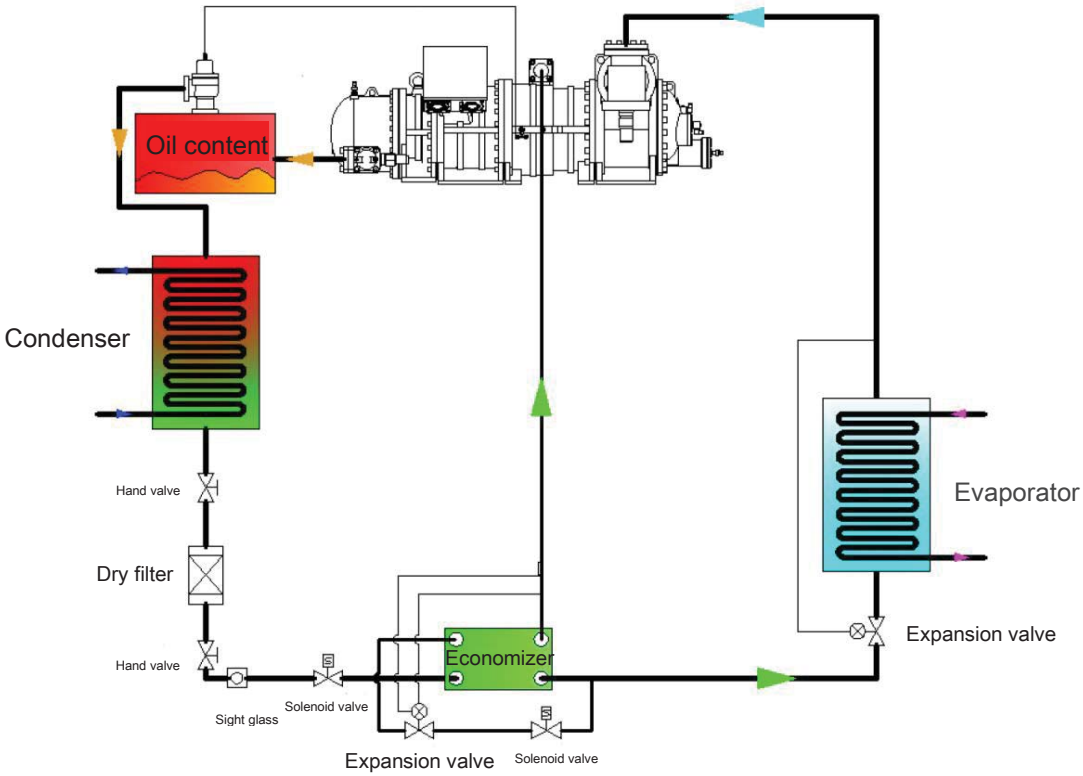

Figure 5-12. Subcooling economizer system

5.4.2 Flash economizer system

Here, liquid subcooling is achieved by reducing the evaporation pressure of the refrigerant in an intermediate pressure vessel (flash evaporator) with a pressure between the condensing and evaporating pressures. Due to the evaporation of part of the liquid refrigerant, a physical effect occurs that causes the refrigerant to cool to its boiling point. We use the method of adjusting the amount of steam entering the compressor through the economizer hole to stabilize the pressure inside the flash evaporator. Due to its direct heat exchange, this operating mode has more economical thermodynamic performance.

Typical LT over-flash economizer system

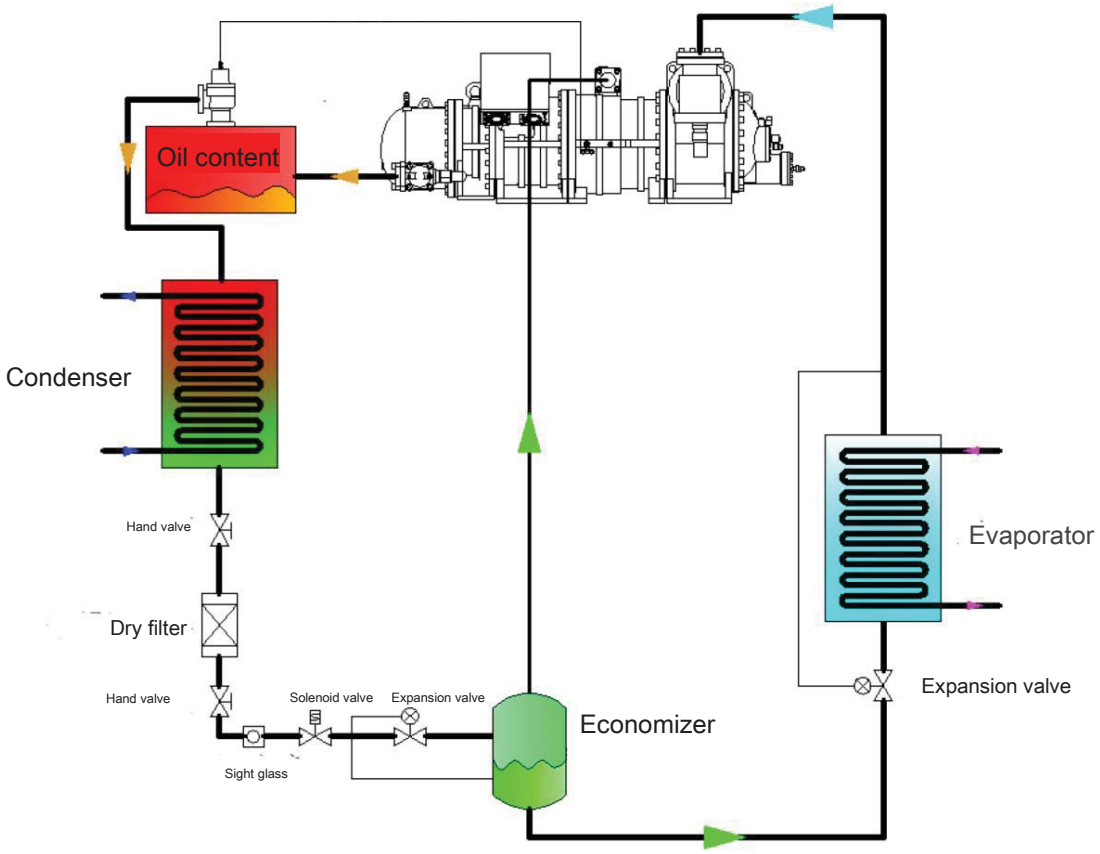

Figure 5-13. Flash economizer system

5.5 Recommendation system flow chart

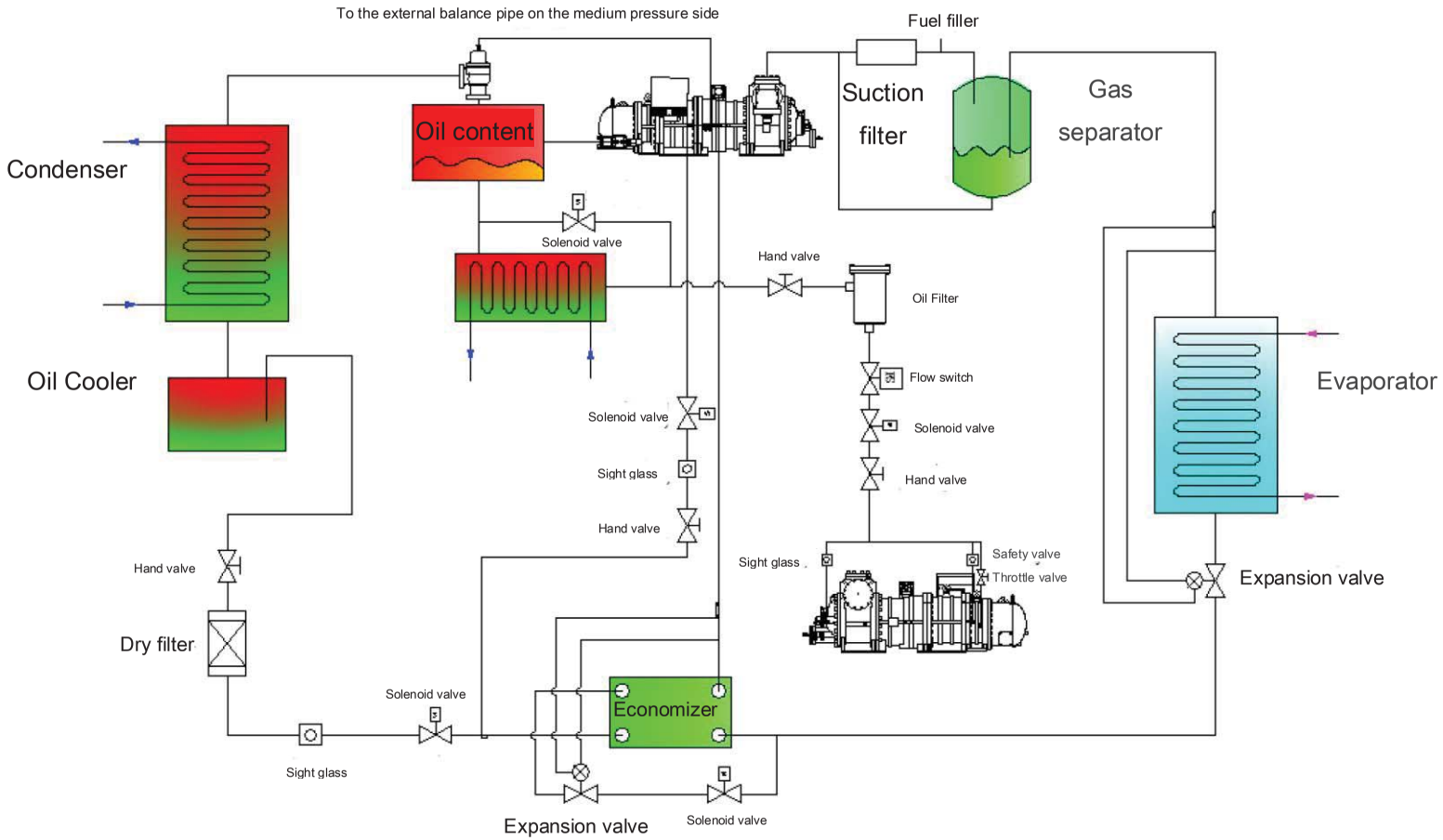

Figure 5-14. Flow chart of recommended low temperature freezing system

5.6 Recommended unit layout

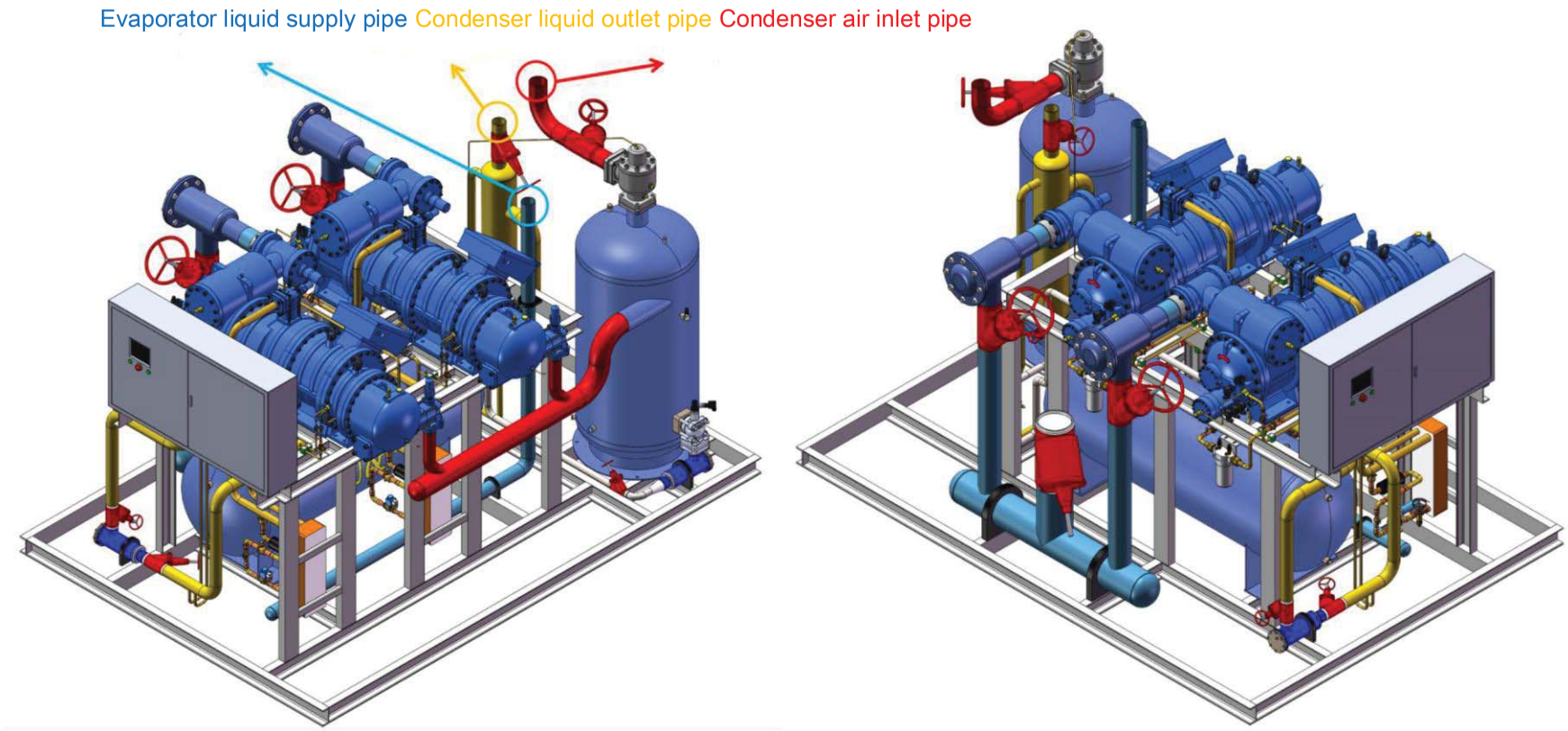

Figure 5-15. Layout diagram of the recommended unit for low temperature freezing

6. Electrical Design

6.1 Electrical parameters and design

❄ Motor design

The standard starting method of Hanbell's LT series screw compressor is Y-Δ starting.

6.1.1 Y-Δ starting

The Y-Δ connection starting method is Y-shaped connection at the beginning. At this time, the voltage on the winding is reduced to 1/3 of the input voltage. After the start is completed, it is reconnected to Δ connection. By starting in this way, we can reduce the starting current by reducing the starting voltage. This starting method is also called reduced voltage starting.

The Y-Δ connection method is shown in the figure below:

When the Y connection is in Y connection, MCM and MCS are energized to make the three points Z, X, and Y together to become the center point of the Y connection. After a few seconds (3 to 5 seconds are recommended), MCM and MCS are switched. About 0.25 seconds later, MCM and MCD are energized and switched to Δ connection.

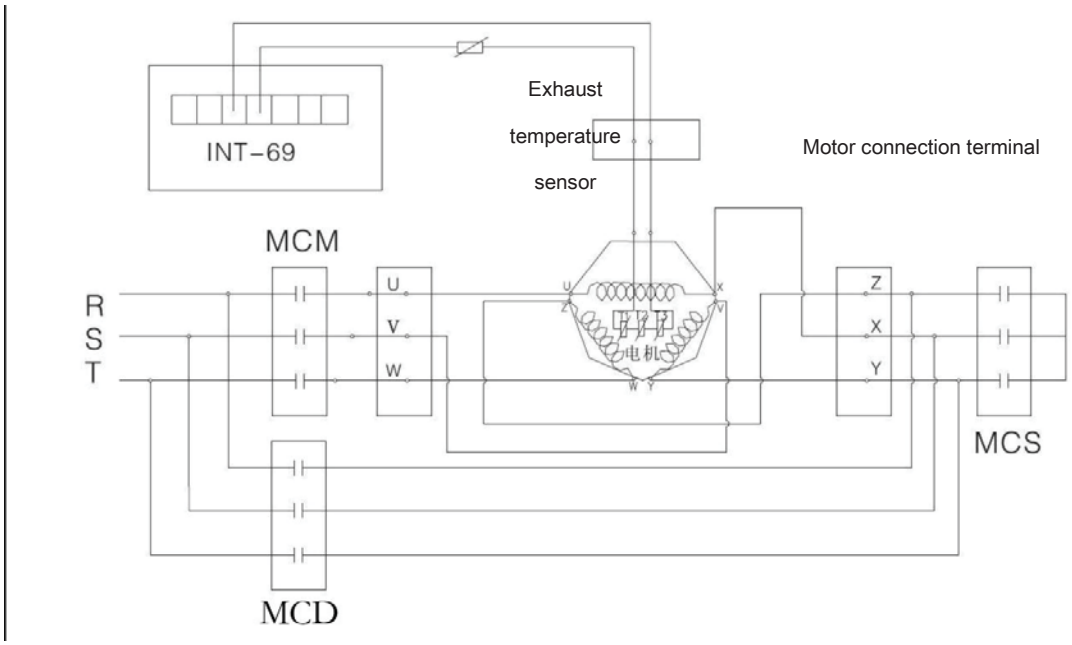

Figure 6-1. Y-Δ connection diagram

⚠ Notes: Motor connection terminal

After Y-start, MCM & MCS conversion is completed 0.25 seconds before MCM & MCD are powered for Δ operation. Within 0.25 seconds, a false short circuit may occur due to improper contactor operation, causing the compressor to trip. When this happens, it is recommended to use an adjustable Y-Δ time relay or delay to extend the MCM, MCD conversion - the MCM, MCD re-power time under the microcontroller or PLC program is approximately 0.25 to 0.5 seconds. Please refer to the Y-Δ conversion time diagram for specific information. Since the motor is not powered during the Y-Δ conversion, it is recommended that the Y-Δ conversion time should not be too long to prevent secondary starting due to deceleration.

However, if the Y-Δ conversion time is too short, it may cause the false short circuit phenomenon mentioned above.

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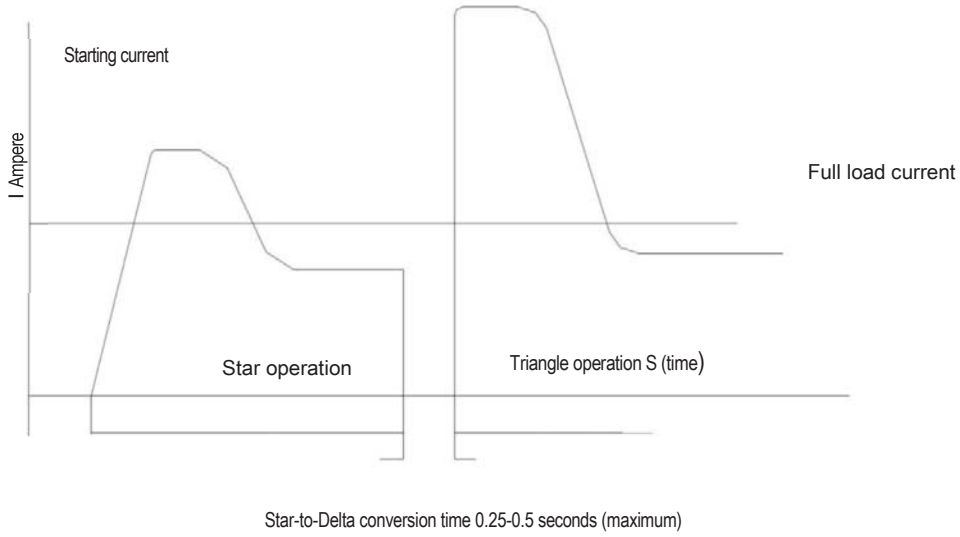

Figure 6-2. Y- Δ conversion time diagram-

❄**Y- Δ starting characteristics**

1) The starting current of the Y-shaped connection is 1/3 of the stall current.

2) The starting torque of the Y-shaped connection is 1/3 of the stall torque.

3) The pole rotation acceleration of heavy-load starting is reduced, so the compressor needs to be started with light load.

✦In addition to Y- Δ starting, if there is a need for soft starting or reactor voltage reduction starting, please contact Hanbell for further information.

6.1.2 Power supply requirements

❄Power supply limitations

❖ Voltage limitations

❖ Long-term operation: within ±5% of the rated voltage.

❖ Instantaneous operation: within ±10% of the rated voltage.

❖ Frequency: within ±2% of the rated frequency.

⚠Note:

In places where the voltage is unstable, set an additional high and low voltage protector. Setting the rated voltage within ±5% can ensure the safe long-term operation of the compressor.

❄ Unbalanced voltage

Unbalanced voltage usually occurs due to changes in the loading process. Unbalanced voltage occurs when one or more phases in a load are different from the others. This is due to differences in impedance or type and value between each loaded phase. Unbalanced voltage can cause serious problems,Y-AStarting characteristics

1) The starting current of the Y-connection is 1/3 of the stall current.

2) The starting torque of the Y-connection is 1/3 of the stall torque.

3) The pole rotation acceleration of heavy-load starting is reduced, so the compressor needs to be started

with light load.

In addition to the Y-△ starting, if there is a need for soft starting or reactor voltage reduction starting, please contact Hanbell for further information.

❖ NEMA stipulates voltage imbalance as follows:

$$\text{Voltage unbalance rate} = \frac{\text{The difference between the average voltage and the maximum voltage in the 3-phase voltage}}{\text{Average voltage}} \times 100\%$$

❖ NEMA states that a multi-phase motor can be successfully started to run at rated load when the voltage imbalance at the motor terminals does not exceed 1%. However, starting the motor with an imbalance of more than 5% is not allowed, otherwise it will cause damage to the motor.

Unbalanced voltage at the motor terminals will cause unbalanced current between phases. For a fully loaded motor, the current imbalance will vary in the range of 6 to 10 times the voltage imbalance percentage, which will cause the motor current to be too large and cause it to overheat, thus shortening the life of the compressor and even burning the motor. Moreover, if the unbalanced voltage is large, it will reduce the torque and fail to meet the operating requirements, so the motor cannot obtain the required speed.

。6.1.3 MCC&LRA

Model	Starting current LRA	Maximum operating current
LT-S-20/10	420	130
LT-S-30/12	620	165
LT-S-45/20	810	225
LT-S-55/25	875	245
LT-S-65/32	1430	310
LT-S-83/41	1430	380

Model	Starting current LRA	Maximum operating current
LT-S-20/10-L	880	145
LT-S-45/20-L	1675	275
LT-S-55/25-L	1675	335
LT-S-65/32-L	2625	395
LT-S-83/41-L	2625	500

Table 6-1. MCC&LRA

1) The above data is based on a 380V, 50Hz power supply.

2) Please check the LRA&MCC of the compressor from the table above according to the actual model, which has nothing to do with the type of refrigerant or working conditions

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6.1.4 Wiring cover

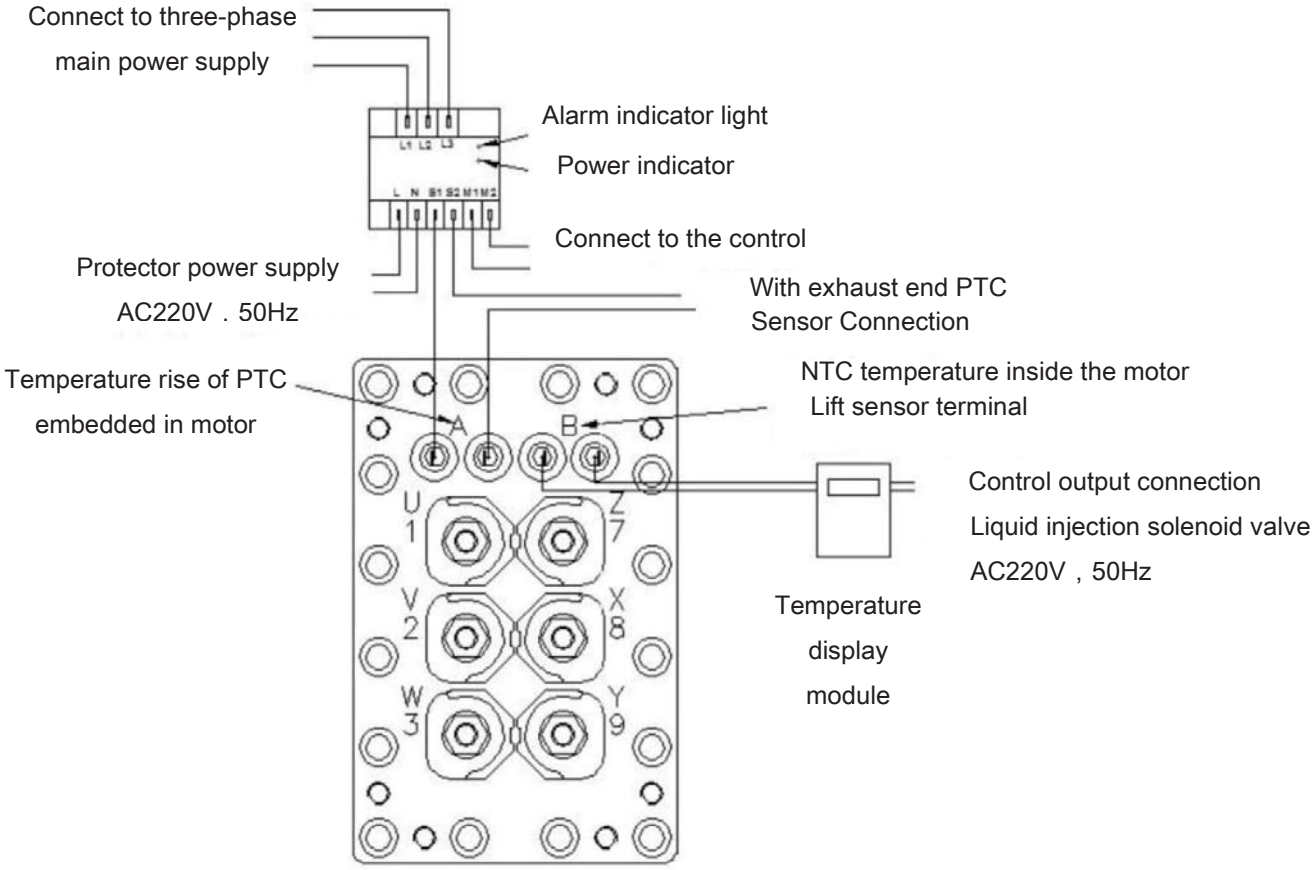


Figure 6-3. Wiring diagram of the wiring cover

Table 6-2. Specifications of the wiring cover terminal nuts

Model	Specification	Torque setting value (N.m)
LT-S-20/10	M12 screw	35
LT-S-30/12	M12 screw	35
LT-S-45/20	M12 screw	35
LT-S-55/25	M12 screw	35
LT-S-65/32	M12 screw	35
LT-S-83/41	M12 screw	35
LT-S-20/10-L	M12 screw	35
LT-S-45/20-L	M16 screw	50
LT-S-55/25-L	M16 screw	50
LT-S-65/32-L	M16 screw	50
LT-S-83/41-L	M16 screw	50

Junction Box

Hanbell has equipped the LT compressor with a terminal box that meets the IP54 standard. Please refer to the following figure for the relevant dimensions.

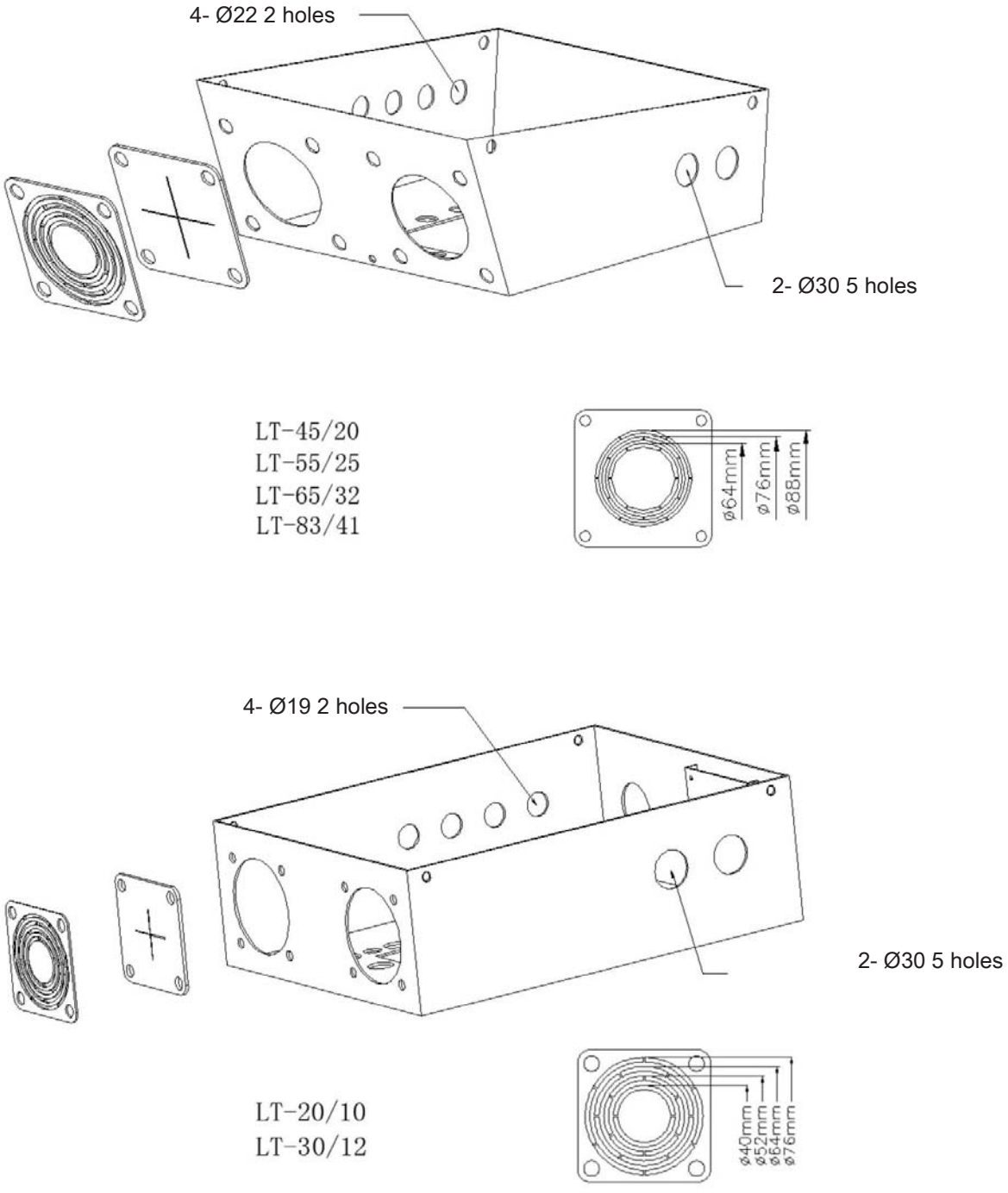


Figure 6-4. Junction box dimensions

7. Installation of compressor、

7.1 Unpacking the compressor

After receiving the compressor, please check whether the cargo box is intact and whether the compressor has been abnormally damaged. And check the attached accessories and related documents to ensure that they are consistent with the order requirements.

⚠Note: When the compressor leaves the factory, it is filled with 0.5~1bar nitrogen, so before removing any of its parts, please make sure to release the internal pressure first.

7.2 Lifting the compressor

If you want to lift the compressor, please use a steel cable for lifting operations and install the hook in the position shown in Figure 7-1. When lifting, be sure to keep the compressor in a horizontal state. Avoid collision with the compressor during the entire lifting operation, otherwise it is easy to cause damage to the compressor and its accessories.

⚠Note:

1) Please make sure that the selected steel cable has sufficient load-bearing capacity.

2) Before lifting, please carefully check the condition of the steel cable and hook to ensure that there is no abnormal condition such as deformation or cracking to avoid safety accidents.

3) Before lifting, please confirm that there is enough lifting space

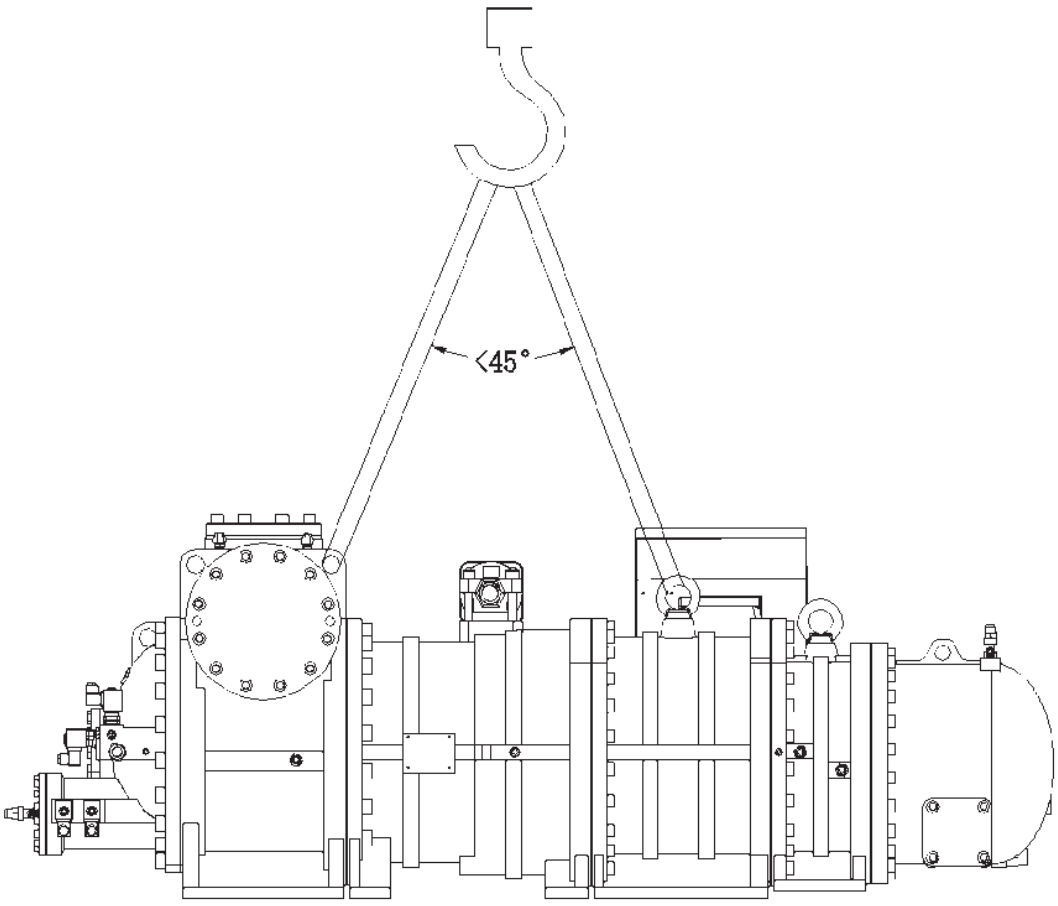


Figure 7-1. Lifting of the compressor

7.3 Installation of the compressor

When installing the compressor, make sure that the unit is away from heat sources to avoid heat radiation. The compressor should be installed as close to the power source as possible to facilitate wiring, and the environment should be well ventilated and dry. Ensure that the foundation is strong enough to avoid additional noise and vibration during the operation of the compressor, and reserve enough space for future maintenance of the compressor.

The compressor should be installed horizontally. At the same time, Hanbell recommends installing vibration damping pads to avoid vibration transmission between the compressor and the unit pipeline during operation.

The selection of the compressor anchor mounting holes is shown in the positions 1 to 4 in Figures 7-2 & 7-3 below.

1)LT-65/32&LT-83/41

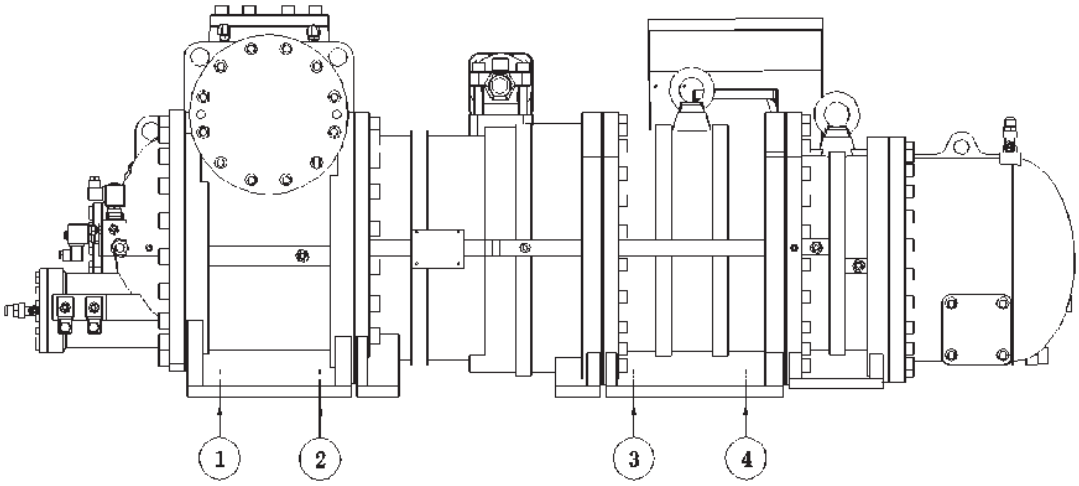


Figure 7-2. Footing of LT-83/41 & LT-65/32

2)LT-45/20&LT-55/25

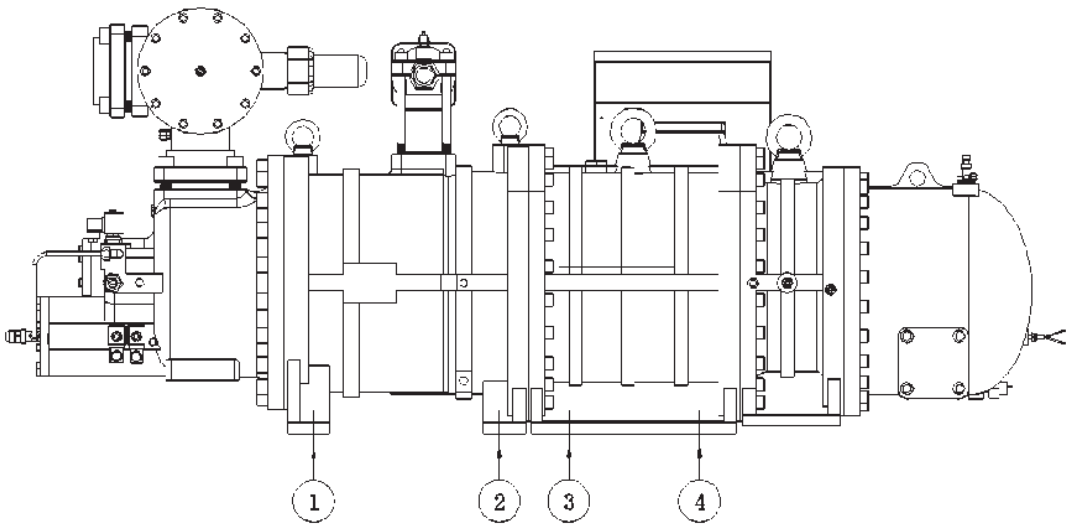


Figure 7-3. Footing of LT-45/20 & LT-55/25

3)LT-20/10&LT-30/12

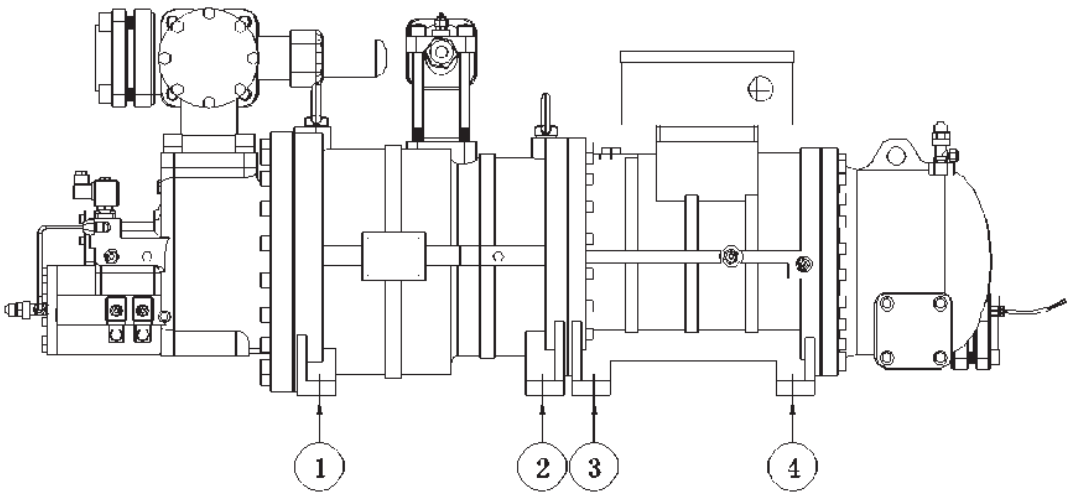


Figure 7-4. LT-20/10 & LT-30/12 feet

8. Operation and Maintenance

8.1 Compressor commissioning inspection

8.1.1 Start-up inspection items

Inspection items	Key points for testing	Corresponding confirmation method
1.External inspection of compressor and parts	1. Lubricating oil level in external oil distributor; 2. Lubricating oil temperature; 3. Inlet and outlet shut-off valves fully open; 4. Motor hydraulic spray angle valve fully open; 5. Hydraulic cylinder angle valve fully open; 6. External oil circuit valve fully open;	1. The high oil level window is full; 2. Before the test run, the oil temperature must be heated to about 40℃/heating time is about 8Hrs; 3. Open the dustproof nut of the shut-off valve for inspection; 4. Open the dustproof nut of the motor hydraulic spray angle valve for inspection. 5. Open the dustproof nut of the hydraulic cylinder angle valve for inspection. 6. Open the dustproof nut of the external oil circuit valve for inspection。
2.Electrical system	1. Main power supply voltage 2. Control circuit voltage 3. Motor phase-to-phase and ground insulation resistance 4. Power supply and wire connection 5. Ground wire installation 6. Switch, sensor and controller settings	1. The voltage fluctuation range of the main power supply is controlled within the rated voltage of 380V±5%, and the instantaneous voltage drop at startup is less than 10%; 2. The standard voltage value of the control circuit is 220V±10%. If you have other requirements, please contact Hanbell Company; 3. The insulation value must be higher than 50MΩ; 4. The power supply is connected to the junction box and should have good insulation. The power cord should be away from heat sources and angular metal objects to avoid damage to the insulation. It should be equipped with a junction box and junction box bolts; 5. Confirm the installation; 6. Refer to "Electrical Control Content".
3. Pipeline system	1. Check whether the pipe is fixed firmly 2. Check whether there is any leakage in the pipe	1. Visual or manual inspection; 2. Check with a leak detector or soapy water, especially at welds and joints。
4. Protective equipment	1. Coil temperature protection 2. Exhaust temperature protection 3. Oil level switch 4. Motor temperature sensor confirmation	1. No action (closed circuit) 2. No action (closed circuit) 3. Full oil level (closed circuit) 4. Display temperature is basically the same as ambient temperature (refer to 3.4.4)

Table 8-1. Start-up checklist

8.1.2 Operation inspection items

1) Start the compressor (about 0.5-1 second) to monitor the suction and exhaust pressures to determine whether the compressor is turning normally. (Normal compressor turning judgment method: suction pressure drops immediately, while exhaust pressure rises).

2) After starting, check whether the lubricating oil in the liquid mirror of the external oil circuit is full. If there is a problem, please check the system high and low pressure difference (oil supply pressure difference), whether the filter is blocked (oil pressure difference alarm), whether the external oil return solenoid valve is open, and check whether the oil circuit outlet is blocked.

3) When the compressor is started, the lubricating oil in the oil separator will produce foam for a short time, but when the compressor works under rated conditions, the lubricating oil foam will disappear. Otherwise, it means that the system is not refueled enough or the compressor exhaust is liquid.

4) The operating conditions of the compressor should be adjusted as follows: The exhaust temperature of R404A should be higher than the condensing temperature by more than 15K, and the exhaust temperature of R22 should be higher than the condensing temperature by more than 25K;

5) The entire equipment, especially the pipeline, must undergo abnormal vibration testing. If there is abnormal vibration or noise during the operation of the compressor, please contact HANBELL.

6) When the compressor is in long-term operation, the following items need to be checked daily: the operating data of the machine (such as: three-phase voltage, compressor line current, etc.), check the oil temperature and oil level of the lubricating oil, all sensor parts of the compressor, check the connection and tightness of the wires, and check the oil circuit sight glass.

7) When the condensing unit is operated on site, special attention should be paid to its auxiliary equipment and the maintenance cycle of the unit after the initial start-up of the unit.

8) In order to maintain the normal viscosity of the lubricating oil at a lower ambient temperature and ensure smooth bearing lubrication, it is recommended to keep the oil heater on the external oil separator turned on after the compressor is shut down to prepare for the next start-up of the compressor.

9) When the compressor is running, the liquid supply valve must not be closed to allow the compressor to run empty.。

8.2 Troubleshooting Table

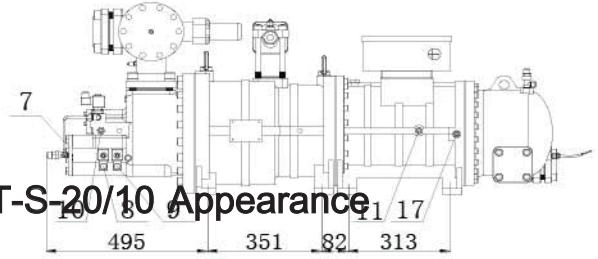
Fault conditions	Possible causes
Compressor motor coil temperature protection tripped	1. The motor load is too large, the cooling is insufficient or the motor liquid injection solenoid valve fails. 2. The coil protection switch is faulty. 3. The electrical system is bad or faulty. 4. The motor coil is bad and the temperature rise is too high.. Motor cooling expansion valve failure.
Motor insulation is poor	1. The compressor motor wire connector is damp and condensed. 2. The compressor motor is defective. 3. The compressor motor terminal is defective. 4. The electromagnetic contactor insulation is poor. 5. The system is acidified and the insulation is corroded. 6. The coil is operated at high temperature for a long time, and the insulation is deteriorated. 7. Frequent starting, the coil is deteriorated。 8. The water content of the refrigerant is too high。
The motor cannot start or switch	1. The air intake control solenoid valve fails, resulting in full load starting. 2. The voltage is too low or the voltage is wrong. 3. The starting voltage drop is too large, and the electromagnetic contactor cannot be attracted. 4. Motor failure. 5. Phase loss, reverse phase, and phase loss operation. 6. The motor protection switch is activated. 7. The motor coil wiring is wrong. 8. The Y-△ start timer is bad 9. The overcurrent setting is too small or the circuit breaker is improperly selected. 10. The electromagnetic contactor is defective.
Unusual vibration or noise	1.Bearing damage. 2. Compressor fluid compression. 3. Rotor overheating and friction with each other or the casing. 4. Oil loss and poor lubrication. 5. Loose internal parts. 6. Machine resonance caused by poor piping and no elastic expansion。 7. Foreign matter enters the compression chamber。
The rotor reverse time is too long	1. The unit control logic is not designed for shutdown action.
Exhaust temperature is too high	1. The superheat of the inhaled refrigerant is too high (insufficient refrigerant, abnormal expansion valve). 2. The high pressure is too high (poor cooling, air intrusion into the system, too high cooling water temperature, insufficient cooling water flow, poor condenser heat exchange effect). 3. The compression ratio is too large and there is no auxiliary cooling. 4. Bearing damage, rotor friction。 . Oil loss or oil level too low。

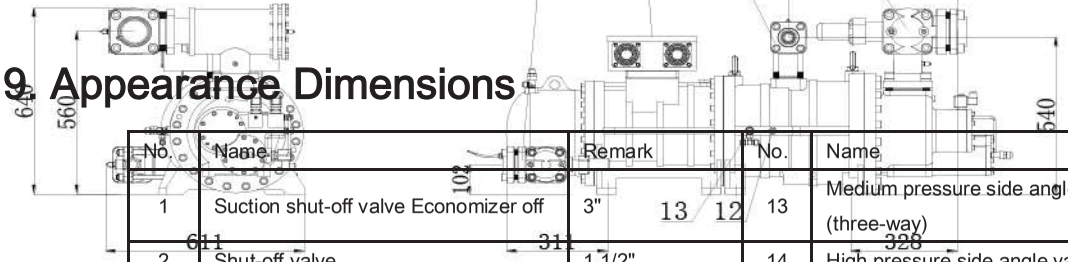
System low pressure alarm	1. Insufficient refrigerant. 2. Severe frost on the evaporator affects heat exchange. 3. The expansion valve is too small, the temperature sensor is loose, and there is no insulation. 4. The air intake filter is blocked by ice or dirt. 5. The evaporator is too small. Low voltage protection setting problem。
System high pressure alarm	1. Too much refrigerant. 2. The condenser is dirty or mixed with air, resulting in poor heat exchange. 3. The exhaust temperature is too high. 4. The expansion valve is dirty or iced. 5. The condenser is too small. High voltage protection setting problem。
Oil flow alarm	1. Oil flow switch failure 2. The condensing pressure cannot be established when the machine is turned on, and the oil supply pressure difference is insufficient. 3. The oil circuit is blocked 4. The oil circuit solenoid valve fails
Exhaust temperature is too low	The compressor suction contains liquid. The return oil temperature is too low. The system liquid pipe expansion valve is too open. The economizer expansion valve is too open.
Oil separation	Exhaust temperature is too low; Oil separator filter is inoperative; Oil temperature in the oil separator is too low (the oil heater is not turned on before startup); Suction gas contains liquid; Economizer expansion valve is opened too much

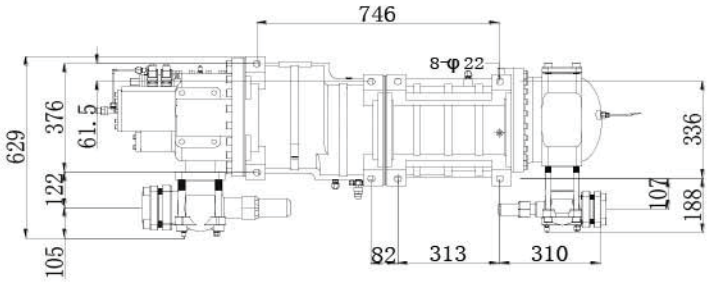
Table 8-2. Troubleshooting table

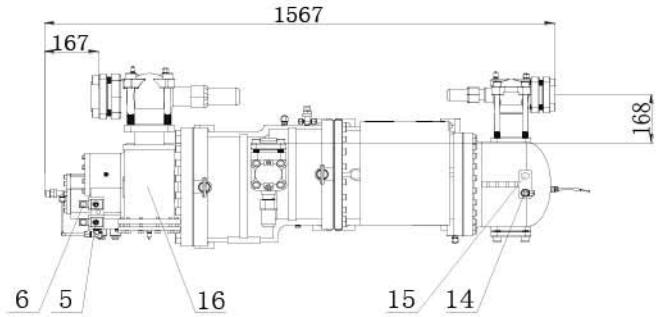
9. Appearance Dimensions

9.1 LT-S-20/10 Appearance

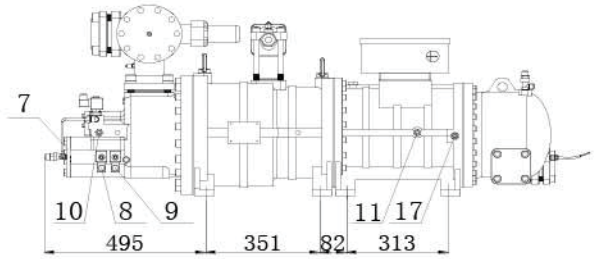


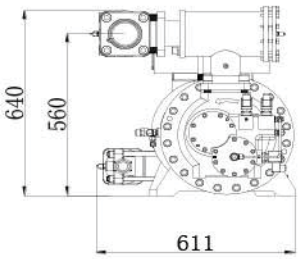


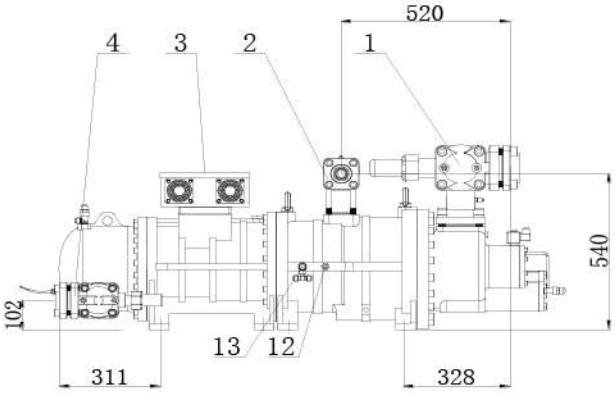




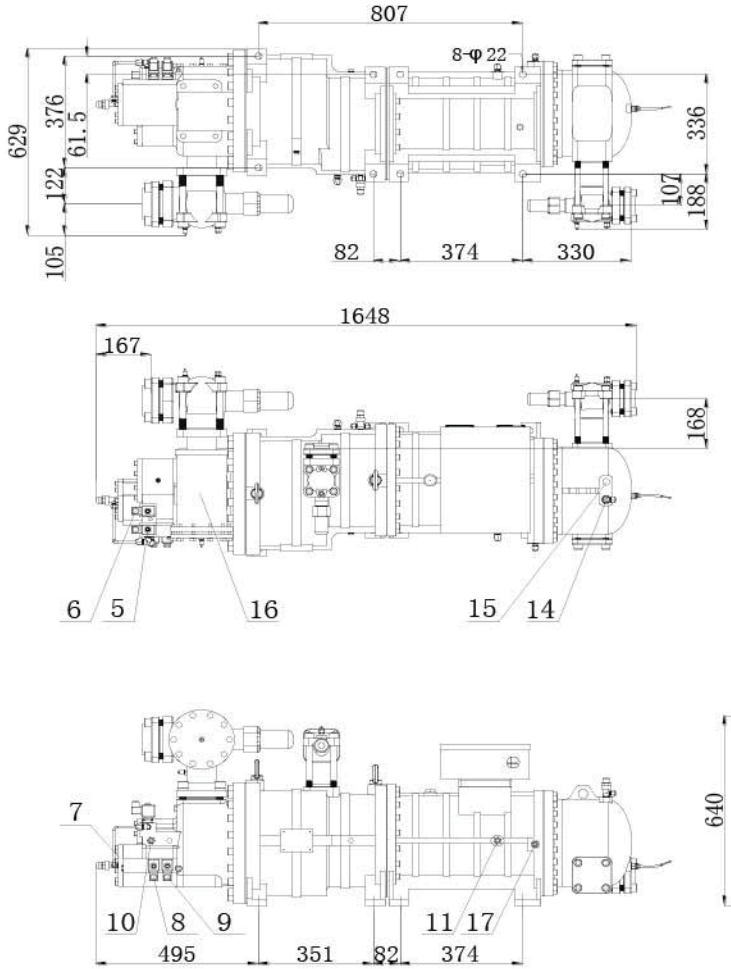
No.	Name	Remark	No.	Name	Remark
1	Suction shut-off valve Economizer off	3"	13	Medium pressure side angle valve (three-way)	1/4"Flare
2	Shut-off valve	1 1/2"	14	High pressure side angle valve	1/4"Flare
3	Junction Box		15	Safety valve interface	1/2"
4	Exhaust shut-off valve	2"	16	Suction filter	
5	Capacity regulating solenoid valve	Uninstall SV1	17	High (oil pressure or level refrigeration compression) chamber injection port	1/4"Flare
6	Capacity regulating solenoid valve	100% SV5			
7	Capacity regulating hydraulic cylinder end cover				
8	Capacity regulating solenoid valve	50% SV3			
9	Capacity regulating solenoid valve	10% SV2			
10	Low pressure bearing oil inlet connector	3/8"Flare			
11	High pressure bearing oil inlet connector	3/8"Flare			
12	Motor liquid coolant injection port	3/8"Flare, motor auxiliary cooling			







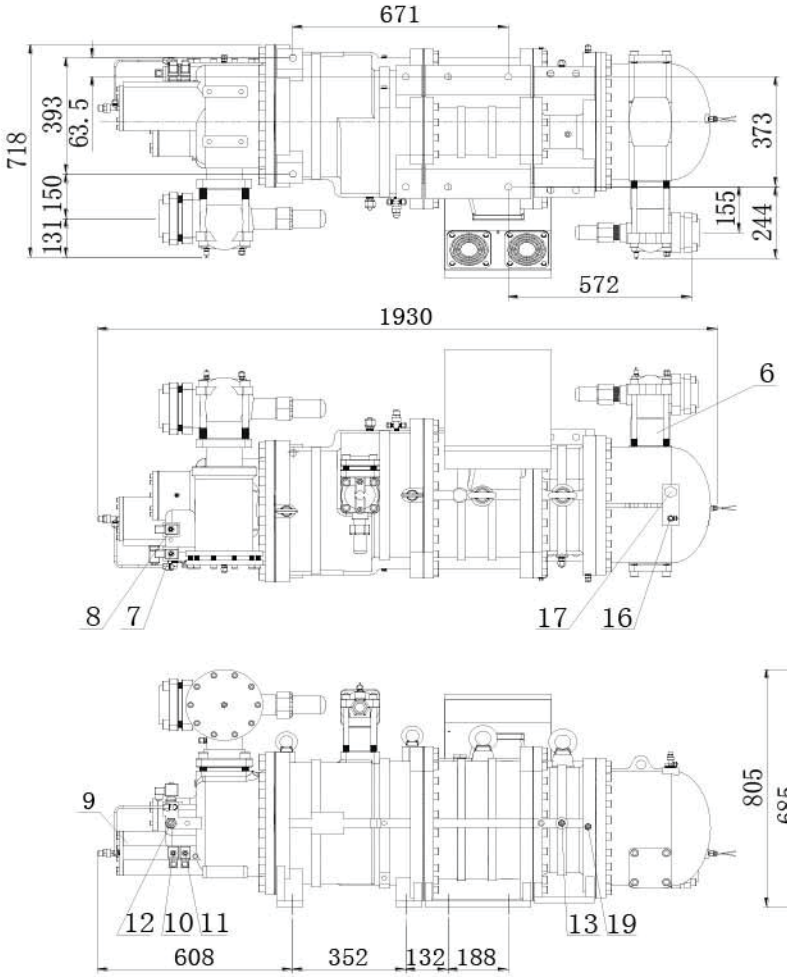
9.2 LT-S-30/12 Appearance



No.	Name	Remark	No.	Name	Remark
1	Suction shut-off valve Economizer off	3"	13	Medium pressure side angle valve (three-way)	1/4"Flare
2	Shut-off valve	1 1/2"	14	High pressure side angle valve	1/4"Flare
3	Junction Box		15	Safety valve interface	1/2"
4	Exhaust shut-off valve	2"	16	Suction filter	
5	Capacity regulating solenoid valve	Uninstall SV1	17	High (oil pressure or level refrigeration compression) chamber injection port	1/4"Flare
6	Capacity regulating solenoid valve	100% SV5			
7	Capacity regulating hydraulic cylinder end cover				
8	Capacity regulating solenoid valve	50% SV3			
9	Capacity regulating solenoid valve	10% SV2			
10	Low pressure bearing oil inlet connector	3/8"Flare			
11	High pressure bearing oil inlet connector	3/8"Flare			
12	Motor liquid coolant injection port	3/8"Flare, motor auxiliary cooling			

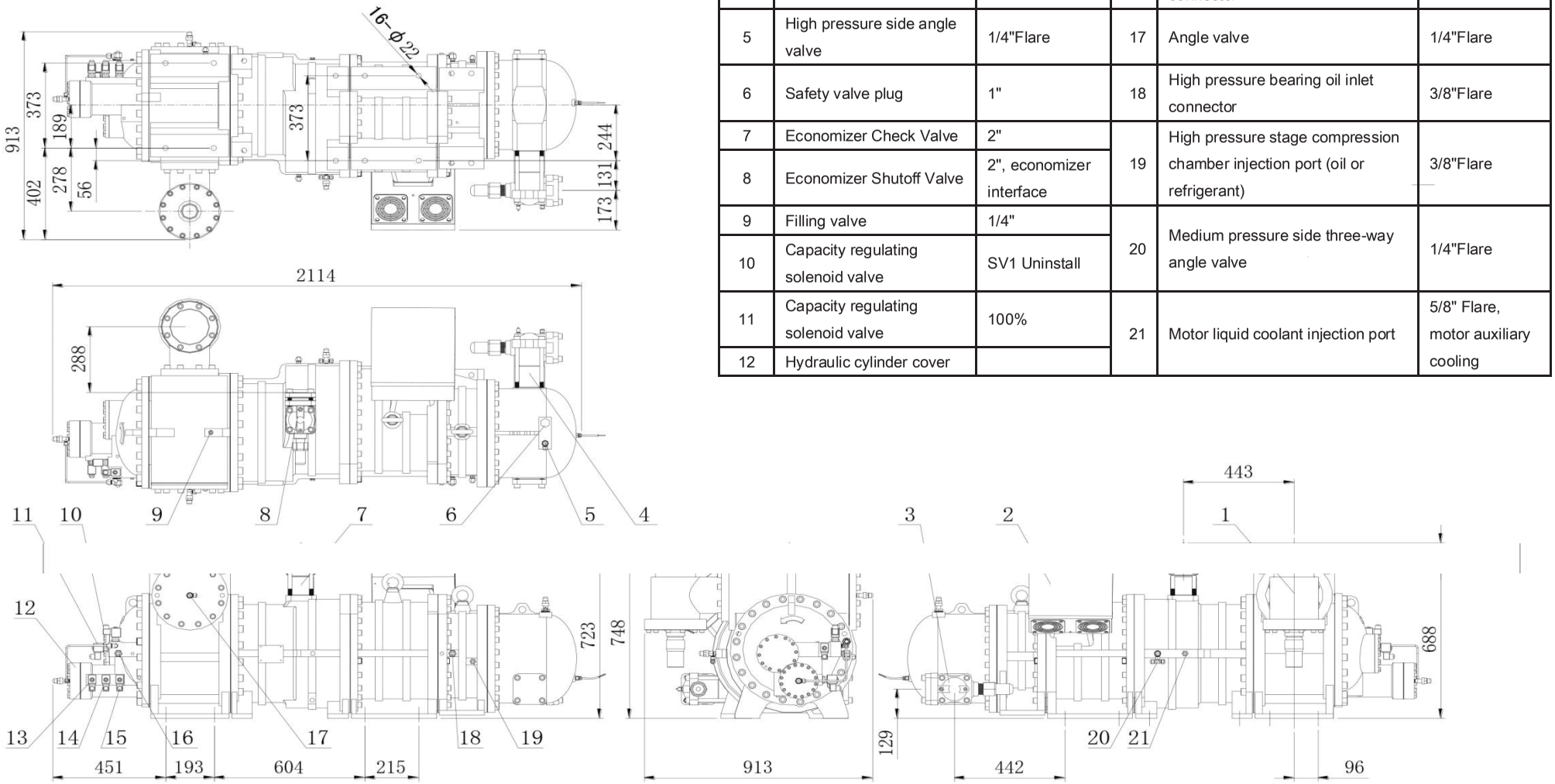
9.3 LT-S-45/20&LT-S-55/25 Appearance

No.	name	Remark	No.	name	Remark
1	Suction shut-off valve Economizer off	4"	13	High pressure bearing oil inlet connector	3/8"Flare
2	Shut-off valve	2"	14	Motor liquid coolant injection	5/8" Flare, motor auxiliary cooling
3	Junction Box		15	Medium pressure side angle valve (three-way)	1/4"Flare
4	Exhaust shut-off valve	2 1/2"	16	High pressure side angle valve	1/4"Flare
5	Economizer suction check valve	2"	17	Safety valve interface	1"
6	Exhaust Horizontal Check Valve	2-1/2"	18	Suction filter	
7	Capacity regulating solenoid valve	Uninstall SV1	19	High pressure compression chamber injection port (oil or refrigerant)	3/8"Flare
8	Capacity regulating solenoid valve	100%			
9	Capacity regulating hydraulic cylinder end cover		20	Intake side pressure measurement point (before intake filter)	1/4"Flare
10	Capacity regulating solenoid valve	50%			
11	Capacity regulating solenoid valve	10%	21	Intake side pressure measurement point (after intake filter)	1/4"Flare
12	Low pressure bearing oil inlet connector	5/8"Flare			



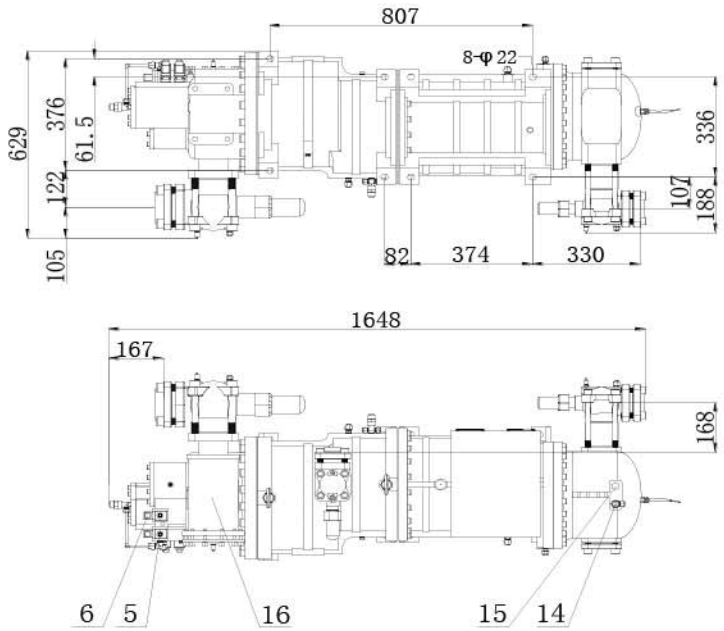
9.4 LT-S-65/32&LT-S-83/41 Appearance

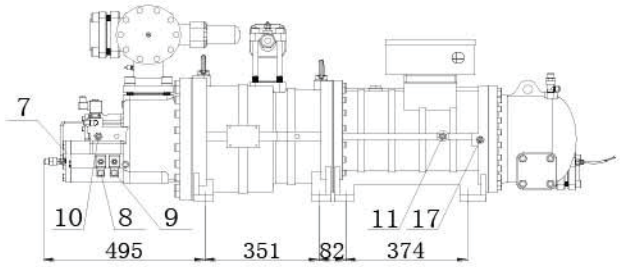
No.	name	Remark	No.	name	Remark
1	Suction inlet shut-off valve	5"	13	Capacity regulating solenoid valve	75%
2	Junction Box		14	Capacity regulating solenoid valve	50%
3	Exhaust shut-off valve	2-1/2"	15	Capacity regulating solenoid valve	10%
4	Exhaust check valve	2-1/2"	16	Low pressure bearing oil inlet connector	5/8"Flare
5	High pressure side angle valve	1/4"Flare	17	Angle valve	1/4"Flare
6	Safety valve plug	1"	18	High pressure bearing oil inlet connector	3/8"Flare
7	Economizer Check Valve	2"	19	High pressure stage compression chamber injection port (oil or refrigerant)	3/8"Flare
8	Economizer Shutoff Valve	2", economizer interface			
9	Filling valve	1/4"	20	Medium pressure side three-way angle valve	1/4"Flare
10	Capacity regulating solenoid valve	SV1 Uninstall			
11	Capacity regulating solenoid valve	100%	21	Motor liquid coolant injection port	5/8" Flare, motor auxiliary cooling
12	Hydraulic cylinder cover				

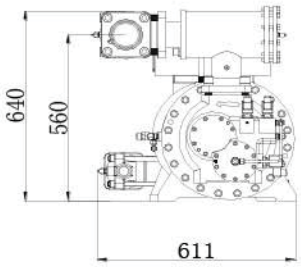


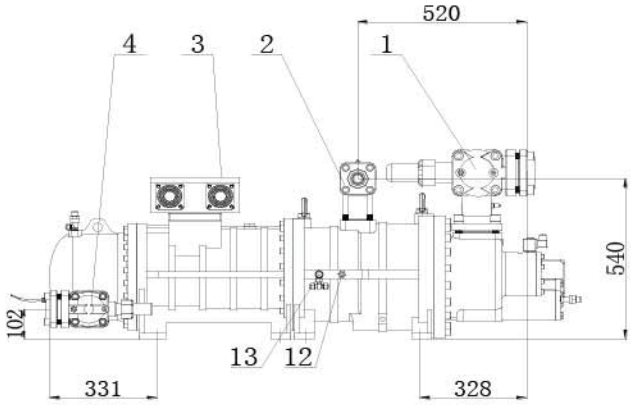
9.5 LT-S-20/10-L Appearance

No.	name	Remark	No.	name	Remark
1	Suction shut-off valve	3"	13	Medium pressure side angle valve (three-way)	1/4"Flare
2	Economizer Shutoff Valve	1 1/2"	14	High pressure side angle valve	1/4"Flare
3	Junction Box		15	Safety valve interface	1/2"
4	Exhaust shut-off valve	2"	16	Suction filter	
5	Capacity regulating solenoid valve	Uninstall SV1	17	High pressure compression chamber injection port (oil or refrigerant)	1/4"Flare
6	Capacity regulating solenoid valve	100% SV5			
7	Capacity adjustment hydraulic cylinder end cover	50% SV3			
8	Solenoid valve				
9	Capacity regulating solenoid valve	10% SV2			
10	Low pressure bearing oil inlet connector	3/8"Flare			
11	High pressure bearing oil inlet connector	3/8"Flare			
12	Motor liquid coolant injection port	3/8" Flare, motor auxiliary cooling			



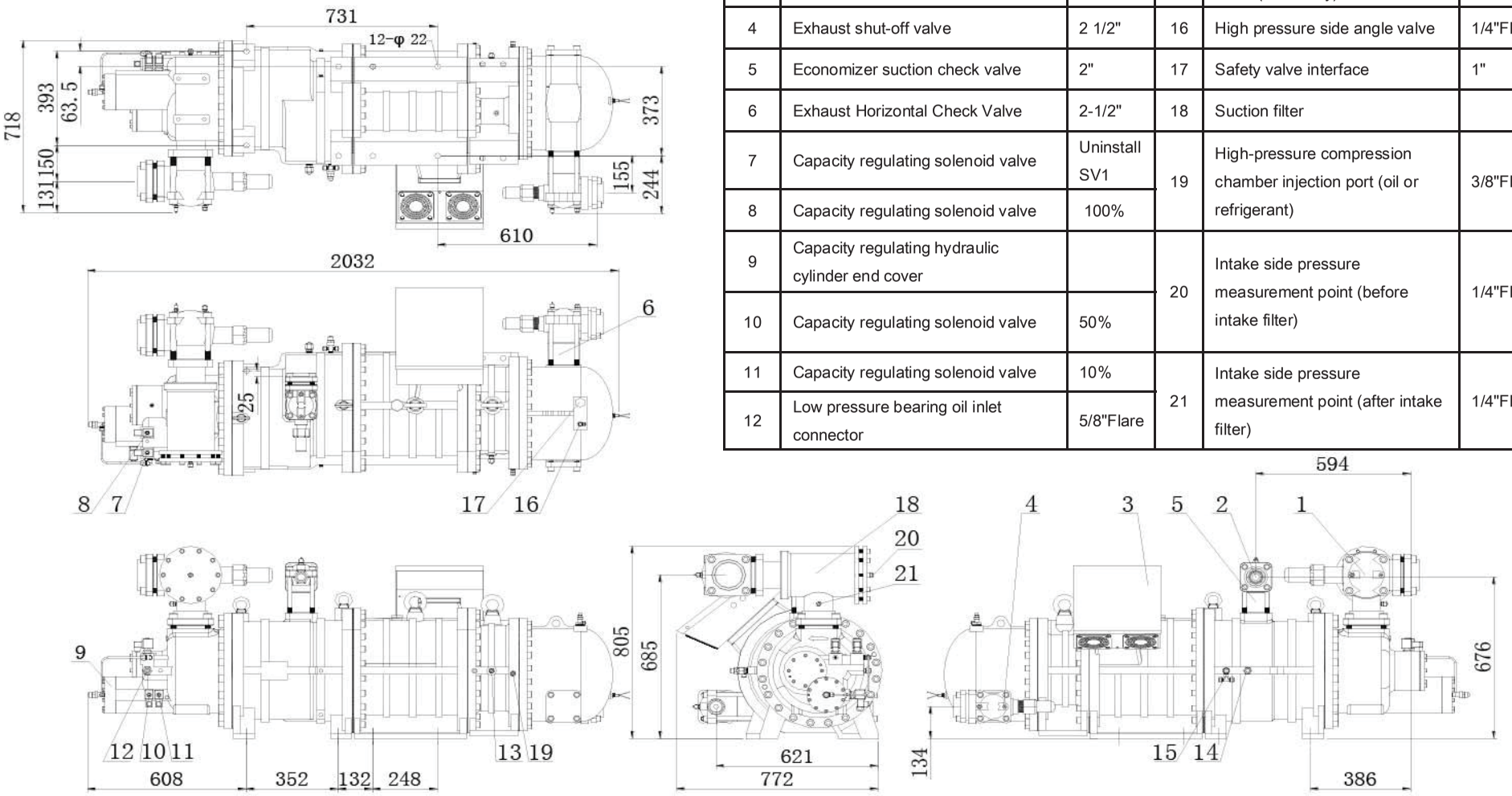






9.6 LT-S-45/20 & LT-S-55/25-L Appearance

No.	name	Remark	No.	name	Remark
1	Suction shut-off valve	4"	13	High pressure bearing oil inlet connector	3/8"Flare
2	Economizer Shutoff Valve	2"	14	Motor liquid coolant injection port	5/8"Flare, motor auxiliary cooling
3	Junction Box		15	Medium pressure side angle valve (three-way)	1/4"Flare
4	Exhaust shut-off valve	2 1/2"	16	High pressure side angle valve	1/4"Flare
5	Economizer suction check valve	2"	17	Safety valve interface	1"
6	Exhaust Horizontal Check Valve	2-1/2"	18	Suction filter	
7	Capacity regulating solenoid valve	Uninstall SV1	19	High-pressure compression chamber injection port (oil or refrigerant)	3/8"Flare
8	Capacity regulating solenoid valve	100%			
9	Capacity regulating hydraulic cylinder end cover		20	Intake side pressure measurement point (before intake filter)	1/4"Flare
10	Capacity regulating solenoid valve	50%			
11	Capacity regulating solenoid valve	10%	21	Intake side pressure measurement point (after intake filter)	1/4"Flare
12	Low pressure bearing oil inlet connector	5/8"Flare			



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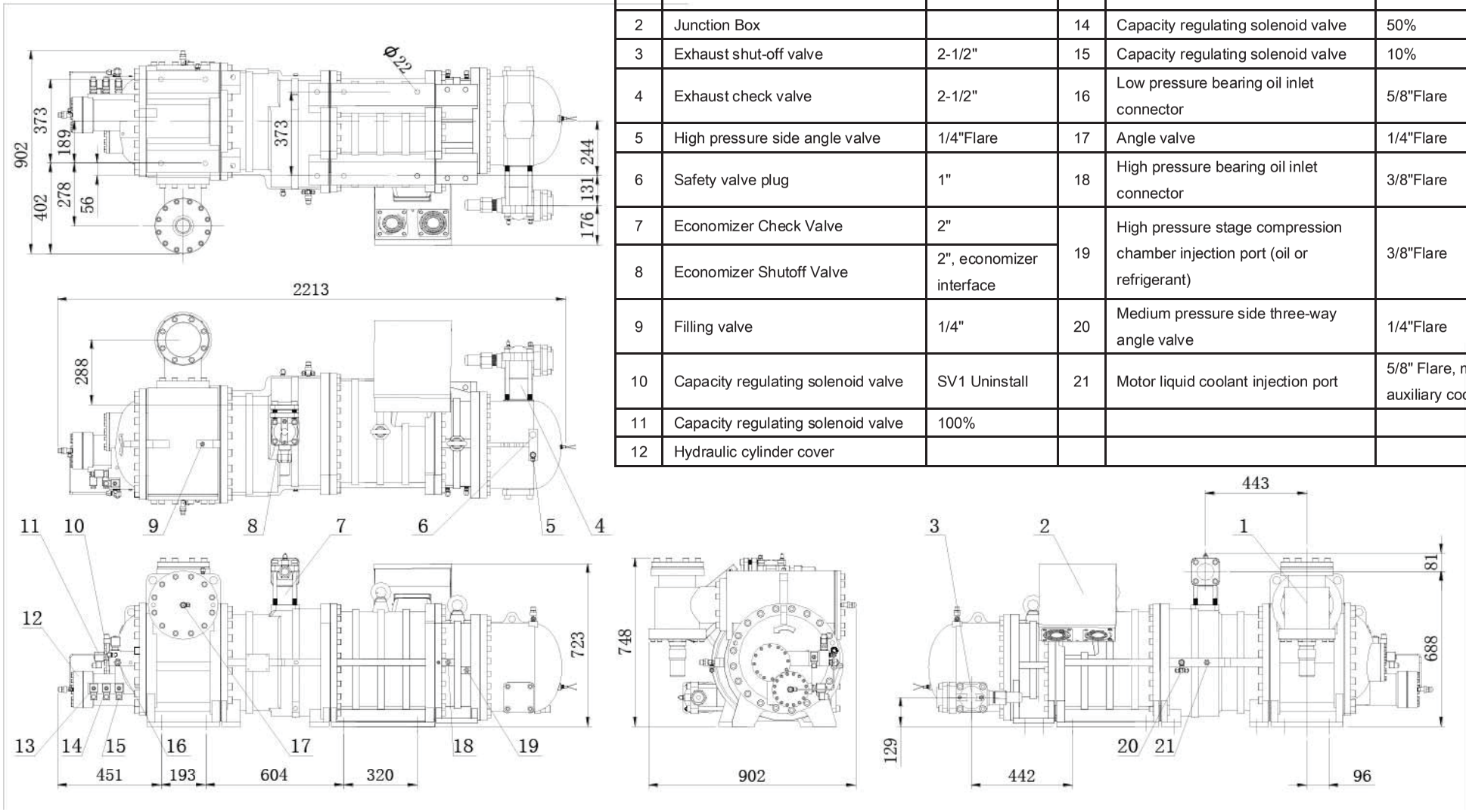
9.7 LT-S-65/32 & LT-S-83/41-L Appearance



No.	name	Remark	No.	name	Remark
1	Suction inlet shut-off valve	5"	13	Capacity regulating solenoid valve	75%
2	Junction Box		14	Capacity regulating solenoid valve	50%
3	Exhaust shut-off valve	2-1/2"	15	Capacity regulating solenoid valve	10%
4	Exhaust check valve	2-1/2"	16	Low pressure bearing oil inlet connector	5/8"Flare
5	High pressure side angle valve	1/4"Flare	17	Angle valve	1/4"Flare
6	Safety valve plug	1"	18	High pressure bearing oil inlet connector	3/8"Flare
7	Economizer Check Valve	2"	19	High pressure stage compression chamber injection port (oil or refrigerant)	3/8"Flare
8	Economizer Shutoff Valve	2", economizer interface			
9	Filling valve	1/4"	20	Medium pressure side three-way angle valve	1/4"Flare
10	Capacity regulating solenoid valve	SV1 Uninstall	21	Motor liquid coolant injection port	5/8" Flare, motor auxiliary cooling
11	Capacity regulating solenoid valve	100%			
12	Hydraulic cylinder cover				

10. Accessories

In order to provide customers with a comprehensive solution, HANBELL has designed standard accessories and optional accessories according to different application requirements to ensure that the compressor can operate safely and stably.

10.1 Compressor Accessories List

LT-S (-L) Series Compressor Parts List			●	Standard
			△	Optional
Number	Name	Quantity	Parallel Application	Standalone application
1.	Exhaust shut-off valve	1 piece	●	
2.	Exhaust check valve	1 piece	●	
3.	Suction shut-off valve	1 piece	●	
4.	Economizer Shutoff Valve	1 piece	●	
5.	Economizer Check Valve	1 piece	●	
6.	Pressure maintaining valve and piping components	1 set	●	
7.	Air intake, exhaust, and economizer air supply	1 set	●	
8.	Intake filter (suction)	1 piece	●	
9.	Intake filter (medium pressure)	1 piece	●	
10.	Vibration damping pads	8 piece	●	
11.	External oil filter	1 piece	●	
12.	Oil flow switch	1 piece	●	
13.	External oil filter pressure differential monitoring switch	1 piece	● ●	
14.	Intelligent integrated protection module	1 piece	●	
15.	Exhaust temperature sensor	1 piece	●	
16.	Motor coil temperature sensor	1 set	●	
17.	Oil circuit solenoid valve	1 piece	●	
18.	Oil level switch	On	△	
19.	Hanzhong special oil	On	△	
20.	300W oil heater	On	△	
21	Oil path mirror	1 piece	△	
22	Bypass valve kit	1 set	△	—

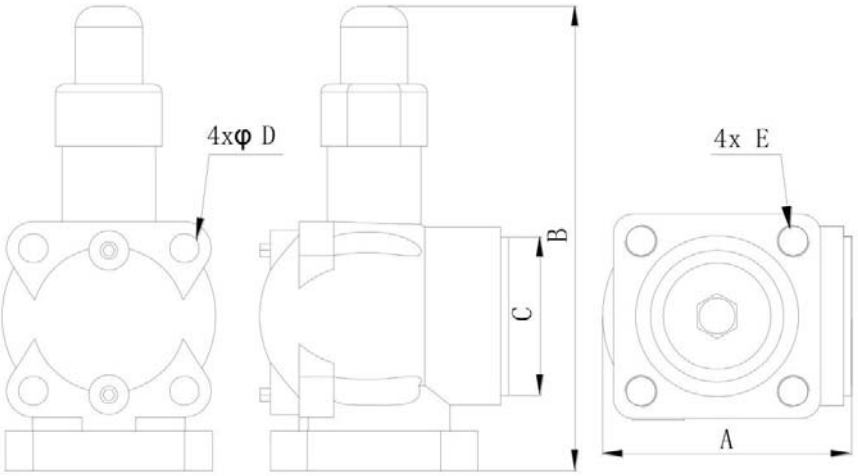
★ Note: The filter element in the above 1 piece needs to be replaced regularly according to the cleanliness of the system;

One pressure maintaining valve is standardly configured for single machine and parallel application. For the configuration of single machine and parallel application, please refer to Table 5.1 Pressure maintaining valve single machine and parallel configuration table; For parallel application, it is recommended to select bypass valve kit。

10.2 Gas circuit accessories

10.2.1 Shut-off valve

In order to facilitate the repair and maintenance of the compressor, it is recommended to install suction, exhaust and economizer shut-off valves for the compressor. The following are the dimensions, specifications and performance parameters of the HANBELL shut-off valve.。



10-1. Shut-off valve dimensions

Specification	Size				
	A	B	φC	φD	F
1-1/2”	115	263	75	18	M16X2
2”	131	284	90	18	M16X2
2-1/2”	147	289	110	18	M16X2
3”	177	351	120	22	M20X2.5
4”	209	407	145	22	M20X2.5

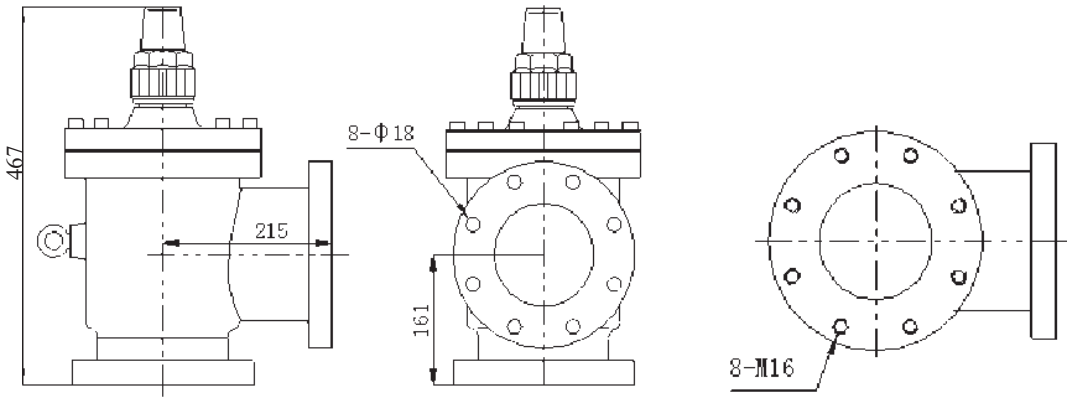


Figure 10-2. 5" suction shut-off valve

*** Shut-off valve configuration**

Model	Shutoff valve size		
	Inhale	Exhaust	Economizer
LT-20/10	3"	2"	1 1/2"
LT-30/12	3"	2"	1 1/2"
LT-45/20	4"	2 1/2"	2"
LT-55/25	4"	2 1/2"	2"
LT-65/32	5"	2 1/2"	2"
LT-83/41	5"	2 1/2"	2"

10.2.2 Casing

LT compressor casing standard configuration table

model	Standard exhaust flange		Standard suction flange		Standard Economizer Flange	
	Steel pipe	Copper	Steel pipe	Copper Tube	Steel pipe	Copper Tube
LT-20/10	2	2 1/8”	3	3 1/8”	1 1/2	1 5/8”
LT-30/12	2	2 1/8”	3	3 1/8”	1 1/2	1 5/8”
LT-45/20	2 1/2	2 5/8”	4	3 5/8”	2	2 1/8”
LT-55/25	2 1/2	2 5/8”	4	3 5/8”	2	2 1/8”
LT-65/32	2 1/2	2 5/8”	5	4 1/8”	2	2 1/8”
LT-83/41	2 1/2	2 5/8”	5	4 1/8”	2	2 1/8”

★ Note: The table above lists the standard casing sizes applicable to each model of Hanbell's LT series. Their size specifications are shown in the table below. If the casing specifications are not specified in the order, Hanbell will provide the casing according to the above standard specifications.

If non-standard casing is required, please confirm with the Hanbell sales representative when purchasing the compressor

。

LT casing size and diameter specifications

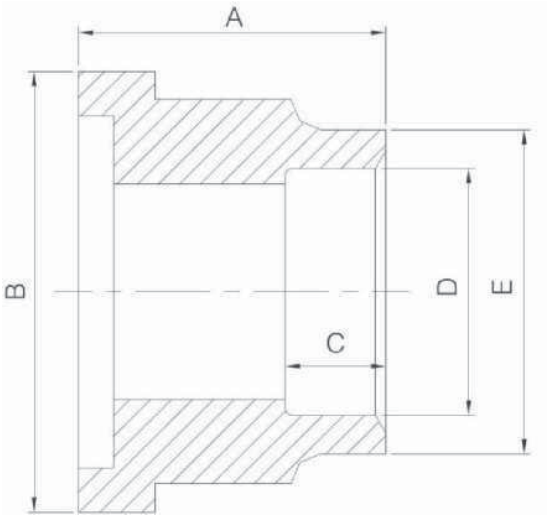


Figure 10-3. Casing10-3.

Model	Location	Selected pipe diameter and material		Casing size				
				A	B	C	D	E
LT-20/10 LT-30/12	Exhaust	Copper pipe	2 1/8"	50	90	30	55	65
		Steel pipe	2"				61.3	74
	Inhale	Copper pipe	3 1/8"	66	120	45	80.5	90
		Steel pipe	3"				90.2	103
	Economizer	Copper pipe	1 5/8"	52	75	35	42	52
		Steel pipe	1 1/2"				49.3	64
LT-45/20 LT-55/25	Exhaust	Copper pipe	2 5/8"	60	110	35	68	77
		Steel pipe	2 1/2"				77	90
	Inhale	Copper pipe	3 5/8"	76	145	50	93	103
		Steel pipe	4"				110	128
	Economizer	Copper pipe	2 1/8"	50	90	30	55	65
		Steel pipe	2"				61.3	74
LT-83/41 LT-65/32	Exhaust	Copper pipe	2 5/8"	60	110	35	68	77
		Steel pipe	2 1/2"				77	90
	Inhale	Copper pipe	4 1/8"	80	174	35	106	121
		Steel pipe	5"	75			135	154
	Economizer	Copper pipe	2 1/8"	50	90	30	55	65
		Steel pipe	2"				61.3	74

10.2.3 Check valve

The exhaust check valve configured by Hanbell for the LT series is horizontal. When the compressor stops, the teflon valve plate will automatically close the valve immediately under the drive of the internal spring to block the reverse flow of high-pressure airflow, thereby greatly reducing the reversal time of the compressor and protecting the compressor.

1) Economizer check valve (horizontal type)

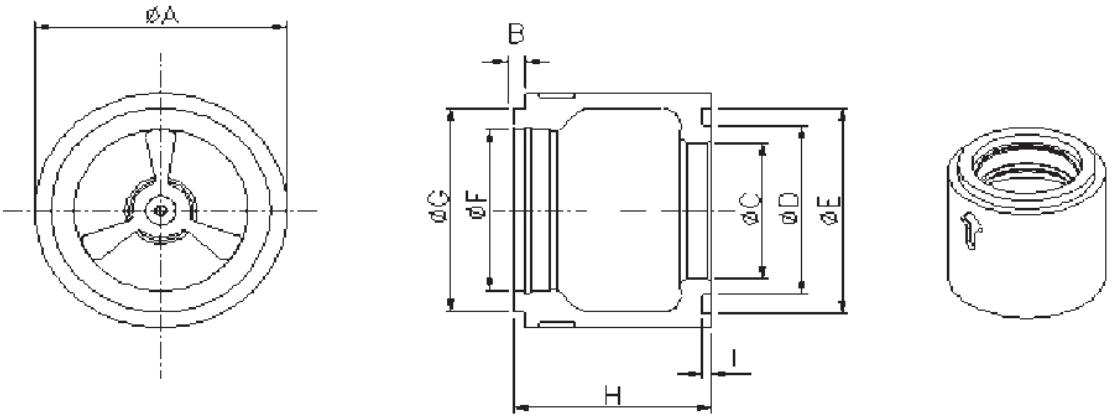


Figure 10-4. Economizer Check Valve

Specification	Dimensions in mm								
	A	B	C	D	E	F	G	H	I
2”	102	6	53	69	91	65	90	85	5
2 1/2″	122	6	69	89	111	85	110	97	5
3″	138	6	80	99	121	95	120	108	5
4″	163	6	96	124	146	120	145	123	5

2) Exhaust check valve (horizontal type)

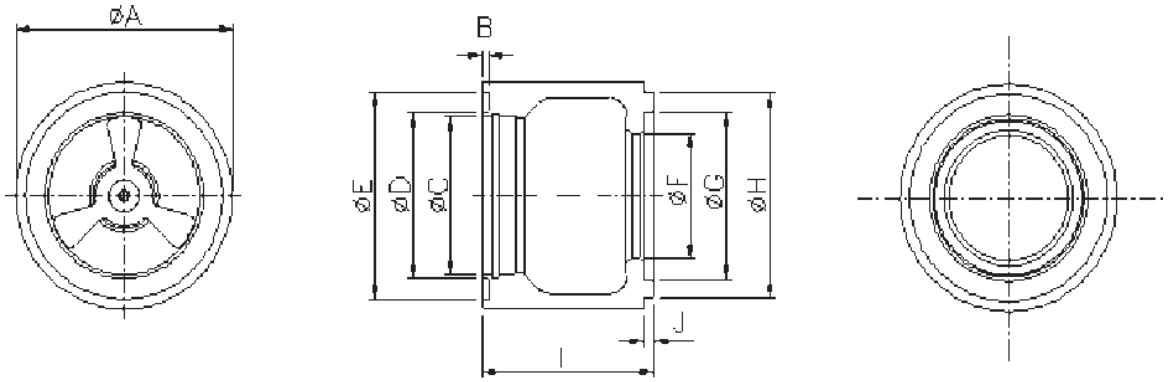


Figure 10-5. Exhaust check valve

Specification.	Dimensions in mm									
	A	B	C	D	E	F	G	H	I	J
1 1/2″	86	4	55	59	76	42	60	75	80.5	6
2”	102	4	65	69	91	53	70	90	85	6
2 1/2″	122	4	85	89	111	67	90	110	97	6
3″	138	4	95	99	121	80	100	120	108	6
4″	163	4	120	124	146	96	125	145	123	6
6”	238	5	190	195	216	146	190	215	160	6

★Note: The size of the check valve configured at each position of the compressor is the same as the corresponding shut-off valve size, see 10.2.1 for details。

10.2.4 Pressure maintenance valve

The pressure maintenance valve allows the compressor to quickly establish a sufficient high and low pressure difference within a short period of time after the compressor is turned on. When the compressor starts running, it ensures the internal oil supply pressure of the compressor. This ensures smooth capacity adjustment and loading of the compressor, which is particularly suitable for units such as air-cooled heat pumps that may have insufficient oil supply pressure difference due to seasonal reasons. The pressure maintenance valve also has the function of a check valve. When the compressor stops, it can quickly cut off the connection between the compressor and the exhaust pipe to prevent high-pressure gas from flowing back into the compressor, effectively avoiding long-term reversal of the compressor.

★Note: When the pressure maintenance valve is used with the LT series compressor, the assembly method in the system is shown in 5.1.3 and Figure 5-4

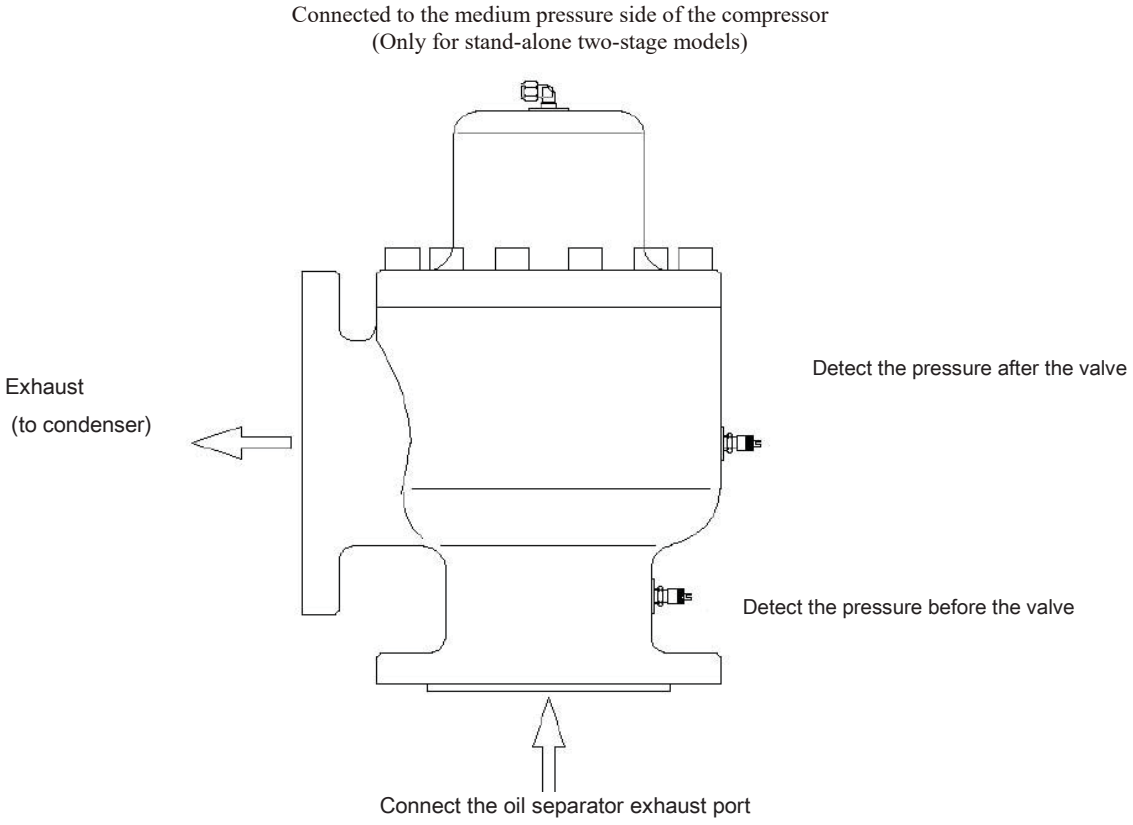
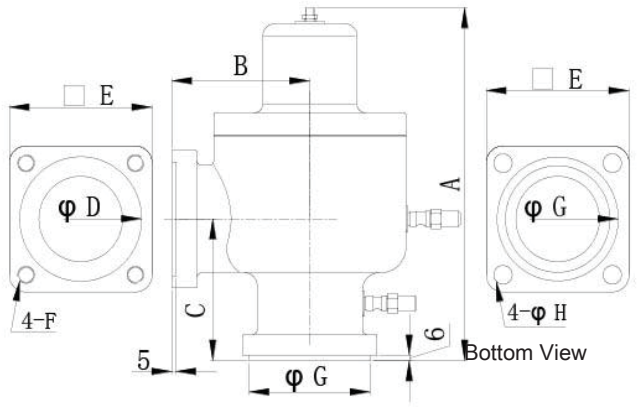


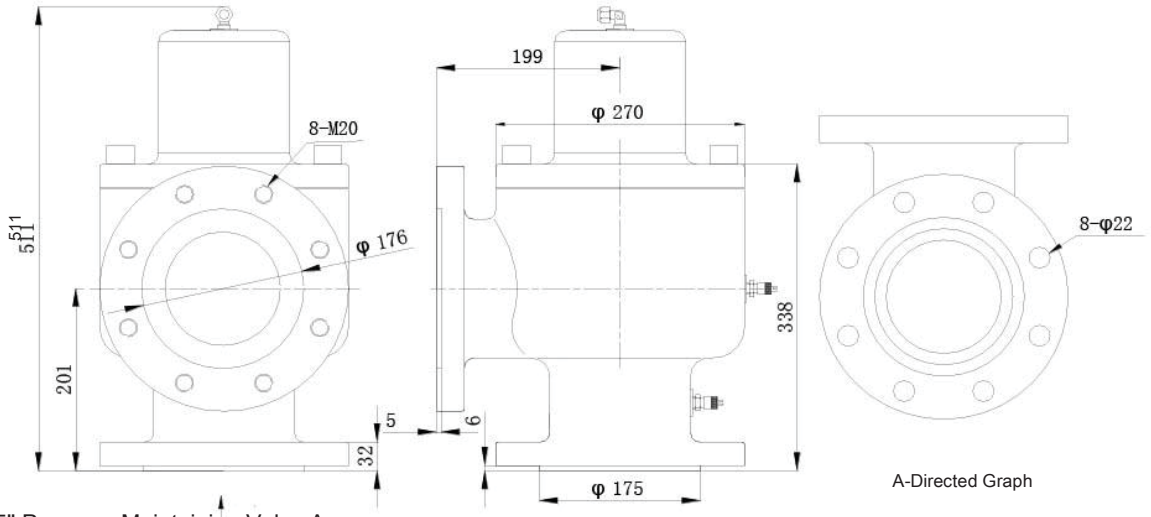
Figure 10-6. Pressure maintaining valve10-6.

Specification / Technical parametes	Opening pressure	Operating temperature range	Pressure loss
1.5"	3.6±0.3Bar	<120℃	<0.1Bar
2"			
2.5"			
3"			
4"			
5"			
6"			

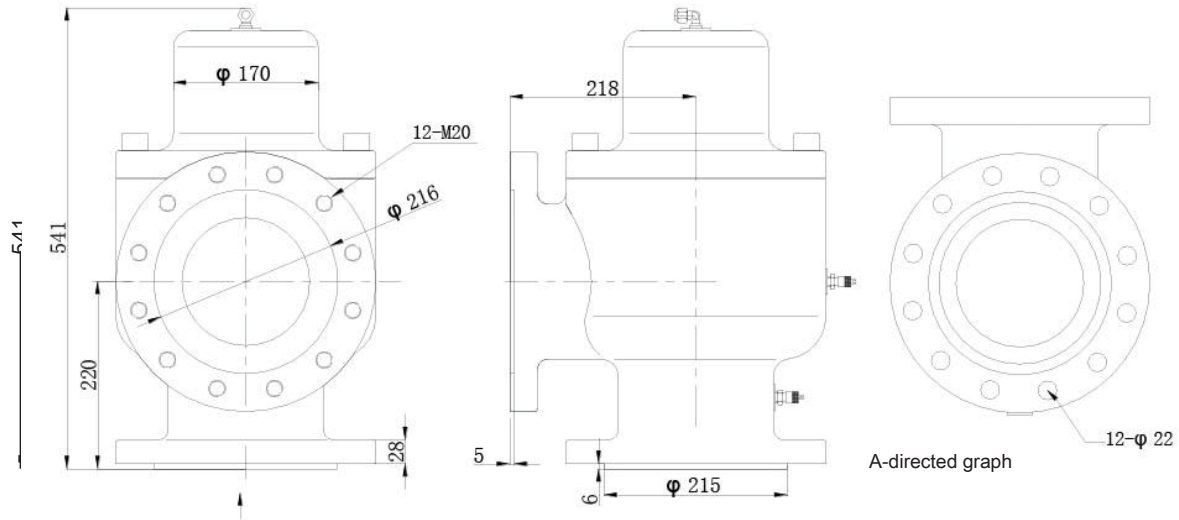


Specifica	A	B	C	D	E	F	G	H
1.5inche	235	93	119	76	109	M16	75	18
2	247	105	126	91	122	M16	90	18
2.5 寸	300	110	136	111	134	M16	110	18
3 寸	364	122	156	121	153	M20	120	22
4 寸	413	165	166	146	171	M20	145	22

1.51.5"~4" Pressure Maintaining Valve Appearance



5" Pressure Maintaining Valve Appearance



6" Pressure Maintaining Valve Appearance

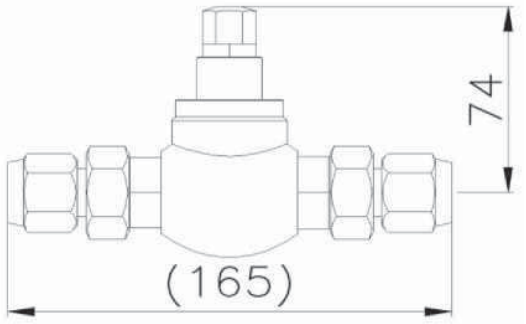
10.3 Oil circuit accessories

10.3.1 Oil flow switch

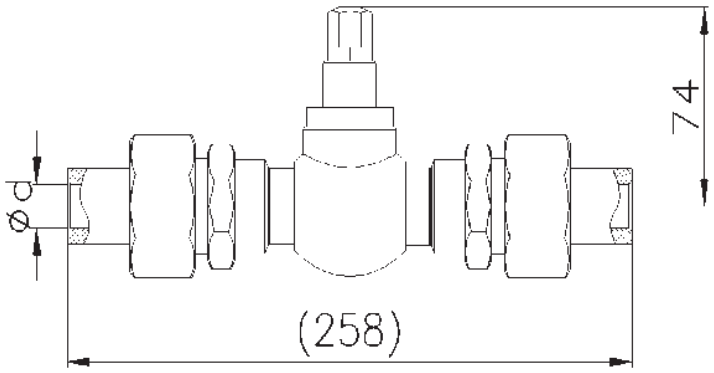
An oil flow switch should be installed in a compressor system with an external oil separator to prevent the compressor from losing oil. The specifications and installation of the oil flow switch are shown in the figure below:

Specification table：

Category	Interface	Pipe size		Applicable models
		Screw thread	Welding	
Type 138	Screw thread/weld	5/8"	16	LT-20/10~ 30/12
Type 125	Welding joint	/	22.5	LT-45/20~83/41



Screw thread form



Welding form

Figure 10-7. Appearance of oil flow switch

Functional Description：

- ❖ Maximum working pressure 200bar
- ❖ Maximum working temperature 100℃
- ❖ Protection level IP65
- ❖ Maximum working current 1A
- ❖ Maximum working voltage 230VAC

External oil filter

The external oil filter provided by Hanbell is a washable type with a filter screen precision of 300 mesh. The structure and size specifications are as follows

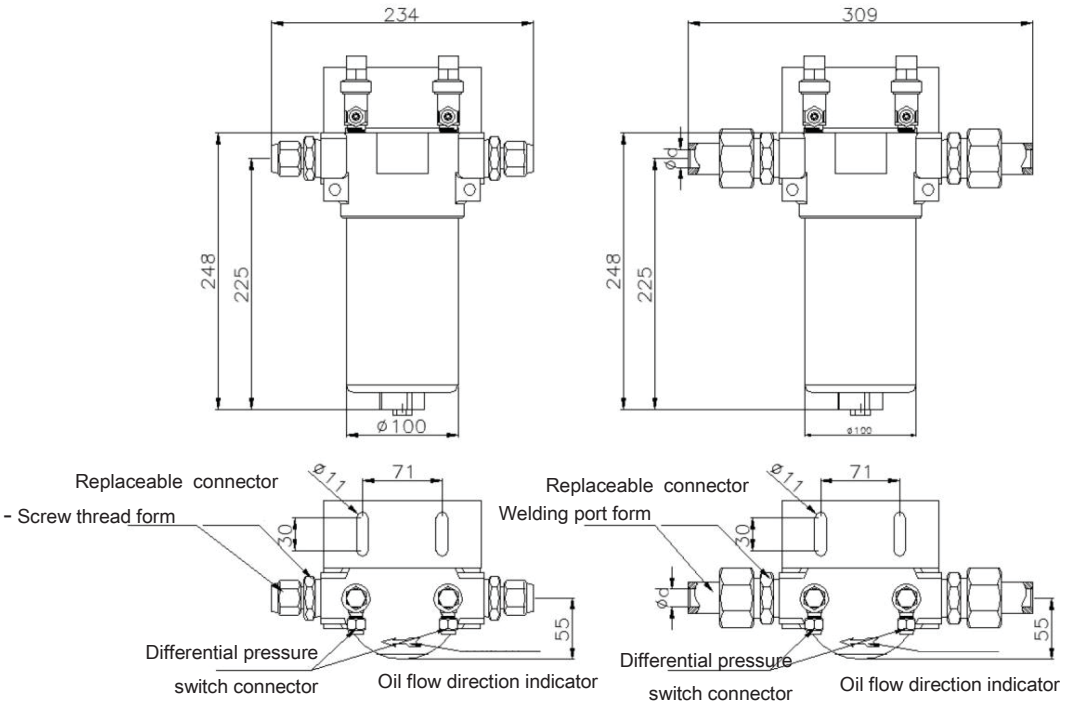


Figure 10-8. Appearance of external oil filter

Interface	Pipe size		Applicable models
	Screw thread	Welding joint	
Screw thread/weld	5/8"	16	LT-20/10~ 30/12
Welding joint	/	22.5	LT-45/20~83/41

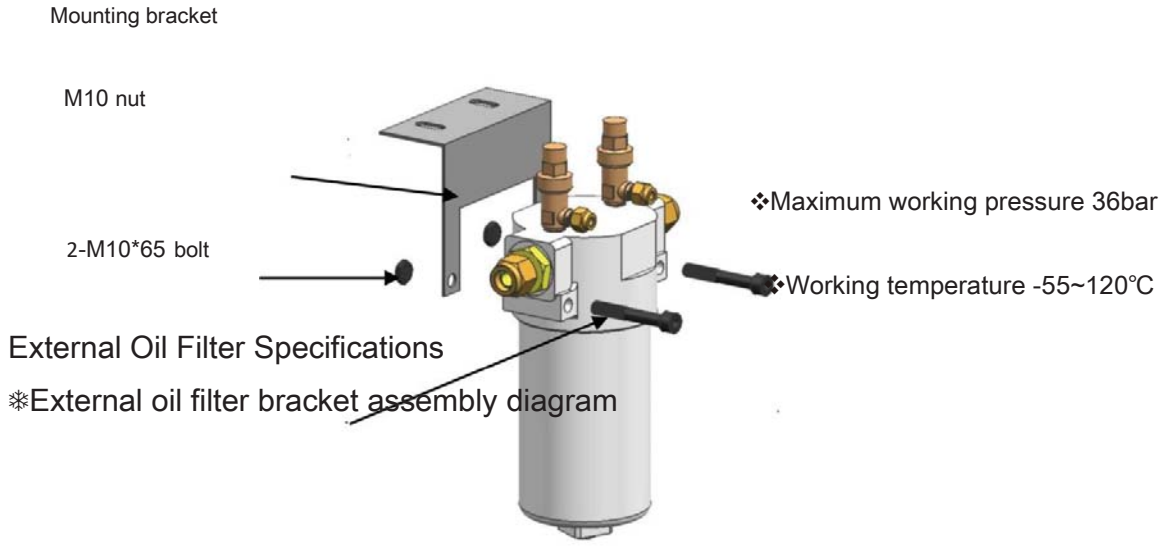
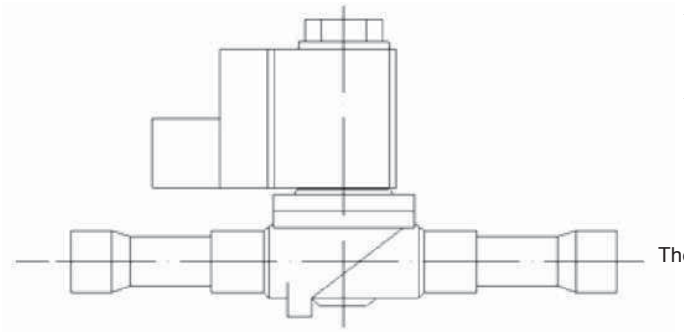


Figure 10-9. External oil filter bracket assembly diagram

10.3. 2 Oil circuit solenoid valve

✧Oil pressure differential switch



❖ Maximum operating temperature 105℃

❖ Power supply 220V/ 50HZ

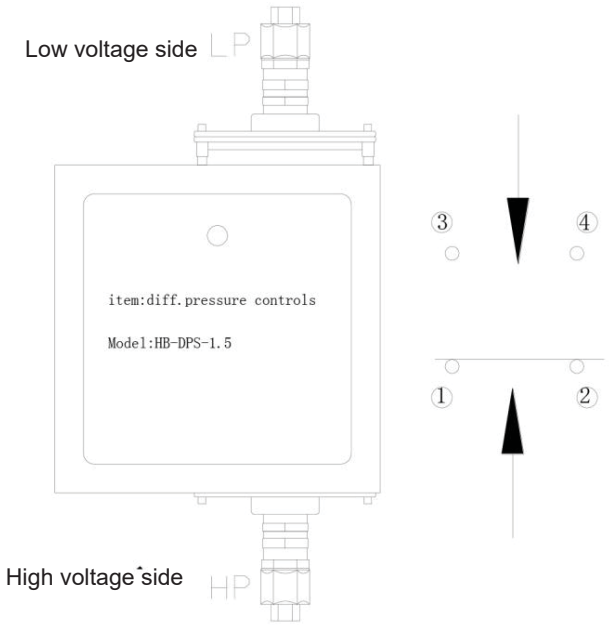
There is a direction arrow "⟶" at the bottom

10.3.3 Oil circuit solenoid valve

❄**Function**: Detect the pressure drop before and after the oil filter. If the pressure drop exceeds the set value, the oil pressure differential switch trips to prevent damage to the oil supply system due to excessive foreign matter and impurities adsorbed on the surface of the oil filter.

❄**Specification**: The oil pressure differential switch provided by Hanbell has a standard trip value of 1.5 bar. Reset is manual reset.

❄**Instructions for use**: For a single machine non-external oil circuit system, the high-pressure connector (HP) of the pressure differential switch is connected to the high-pressure interface of the compressor (high-pressure side angle valve or system exhaust oil side angle valve), and the low-pressure connector (LP) is connected to the flange angle valve of the compressor oil filter. When the return oil resistance is greater than the set value (1.5 bar), the pressure differential switch is activated (OFF) to cut off the compressor control circuit and remind the user to clean the built-in oil filter of the compressor. For a parallel system (or a single machine with an external oil circuit), please install the pressure differential switch on the external oil filter.



In normal conditions, the differential pressure controller switches 1-2 on. When the differential pressure increases above the set value, switches 3-4 on. When the differential pressure decreases below the set value, pressing the manual reset button switches 1-2 on.

Figure 10-10. Appearance of differential pressure switch

10.4 Electrical accessories

10.4.1 INT69 HBY Diagnose protection module

The protection module INT69 HBY Diagnose is an advanced product in the protection module series, used for compressor protection microcontrollers. The flexible response function of the additional input in the phase sequence monitoring improves practicality and prolongs the life of the refrigeration system. INT69 HBY Diagnose automatically saves working and error data in a memory. The data can be read on a personal computer through a specific transmission line and used for diagnostic analysis.

Function description:

❖ PTC thermistors are connected in series to the signal input terminal of the protection module.

❖ If the resistance of any thermistor rises above its trip value, the protection module trips and disconnects.

When the PTC resistance drops below the reset resistance, the module automatically resets after 5 minutes of reset time. If the PTC resistance rises above the reset resistance for the second time within 24 hours of the first trip, the reset time is 60 minutes. If the PTC resistance rises above the reset resistance for the third time within 24 hours, the module will lock and cannot be reset automatically.

❖ The motor phase monitoring function is activated 1s after the motor starts and continues to monitor for 5s. Abnormal motor phase or motor phase loss will cause the protection module to disconnect and lock.

❖ In order to avoid tripping due to reverse rotation after the compressor stops, the phase monitoring function is only maintained for 20 seconds after the motor stops.

❖ LED (light emitting diode) (red/green/orange) displays its working information.

❖ The motor protection module cannot be used in variable frequency drives.

❖ PTC short circuit will cause lockout, and short-term cycles will cause reset delay.

❖ After the temperature drops or the error is eliminated, the reset delay resets the module; after reset, the compressor restarts.

☐Installation, maintenance and operation must be carried out by electronic professionals. The provisions of the current European and relevant national standards for electronic equipment connection and refrigeration equipment must be observed. Sensor connections and connecting wires outside the terminal box must have at least a basic insulation.

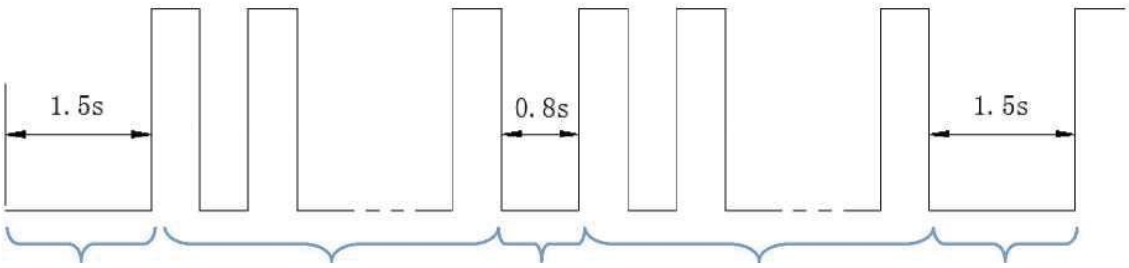
Technical Parameters:

project	Technical Parameters	project	Technical Parameters
Supply voltage	AC 50/60HZ 115/240V±10% 3VA	System PTC short	Typically <30Ω
Motor voltage	3 AC 50/60Hz 200/690V ±10%	Over frequency	Not supported
— Sensor Type — R25, All — Maximum Connection Length	Optional 1-2 AMS sensors, 1-9 PTCs in series, in accordance with DIN 44081 and DIN 44082 <1.8KΩ 30M	— Motor static trip 1 time/24h 2 times/24h 3 times/24h — Switching frequency — Phase error— Phase loss Cancel lock or reset	5min±1min 60min±12min Locked 5min±1min Locked Locked Power off reset
Ambient temperature	-30…70℃	Maximum switching frequency	Switch on and off 3 times within 30S
Phase monitoring — Phase sequence — Phase loss—Inactivation	Activates 1 second after the motor starts and monitors for 5 seconds Activates 1 second after the motor starts and monitors until it stops About 20 seconds after the motor stops	Delayed reset relay —Power supply —Mechanical life	AC 240V 2.5A C300 at least AC/DC 24V 20mA 1 million switching cycles

Signal light flashing:

Signal light display is convenient and quick for maintenance; the light signal consists of periodic red and orange flashes; the current flashing state depends on the number of pulse flashes.

The signal is as follows：



Pause 1 time Red Pause 2 times Orange Pause 1 time

Second-rate

(1-5 pulses) (1-5 pulses)

Traffic Light Overview	Green Light	Compressor Operation
	Green light	Compressor operation
	Flashing	If a fault occurs, the relay trips and the compressor stops;

Flashing sequence 1 (red light)	Second flash sequence (orange light)	describe
1	1	Motor temperature: Static trip, winding temperature is too high
	3	Motor temperature: Reset delay after static trip
	4	Motor temperature: The temperature sensing element detects an open circuit or a short circuit
2	1	Motor voltage: wrong phase sequence
	2	Motor voltage: wrong phase/three-phase asymmetry
3	1	Power supply voltage: The power supply to the module is too low
The green light is always on but the unit cannot be started: Use the resistance range of the multimeter to measure the continuity between M1 and M2. If M1-M2 is not conductive, replace the protector.		

Appearance and wiring：

Figure 10-11. INT69 HBY Diagnose Appearance

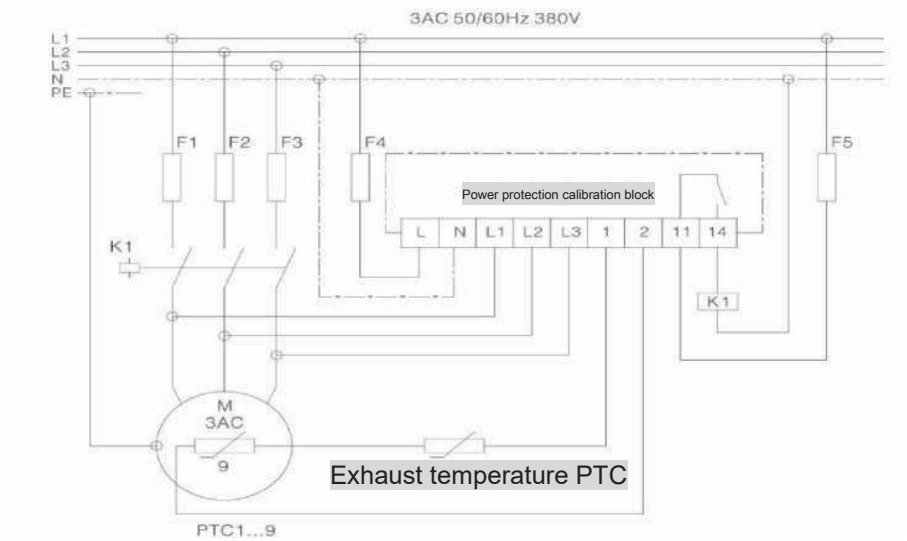


Figure 10-11. INT69 HBY Diagnose Appearance

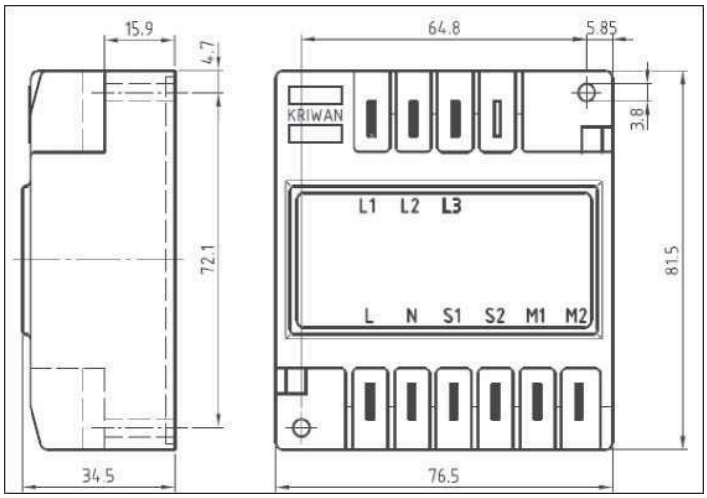
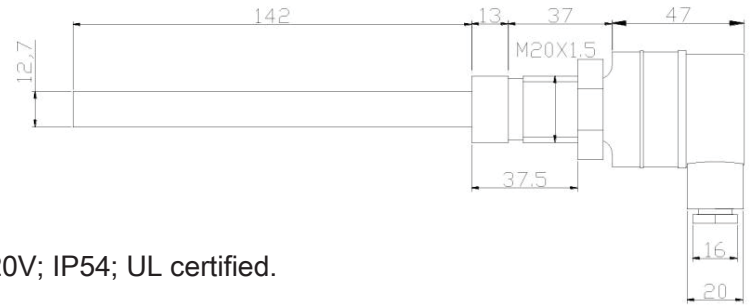


Figure 10-12. INT69 HBY&PTC connection diagram10-12.

□Note: The above figure only shows the connection method of the protection module, not the compressor starting method.

10. 4. 1 300W oil heater

Each Hanbell compressor is equipped with a UL-certified 300W oil heater as a standard accessory. Before restarting the compressor after a long shutdown, please keep the oil heater turned on for more than 8 hours to ensure that the internal temperature of the compressor is higher than the system temperature and ambient temperature, to avoid the liquid refrigerant in the compressor oil tank causing liquid compression when the compressor is turned on next time or poor lubrication due to low viscosity of the lubricating oil.



Specifications: 300W; 220V; IP54; UL certified.

10.4.2 Oil level switch

Photoelectric liquid level switch

●Application description:

Photoelectric liquid level switch is used to monitor the lubricating oil level of the compressor. It contains an infrared light-emitting diode and a light receiver. The light emitted by the light-emitting diode is directed into the prism on the top of the sensor. When the liquid does not submerge the prism, the light is directly reflected from the prism back to the receiver; when the liquid submerges the prism, the light is refracted into the liquid and the receiver cannot receive the light. By sensing this change, the receiver can drive the internal electrical switch, thereby activating an external alarm or control circuit.

●Function description:

Serial	Function	Effect
1	Oil level protection	Can detect the compressor oil level in real time to prevent the compressor from being seriously damaged due to oil loss
2	Action delay function	To prevent the compressor from tripping when the oil level fluctuates, this product recommends that the user set a delay of 60-90 seconds to cut off the compressor power supply. When the oil level continues to be higher than the detected oil level for
3	Signal Indication	INT276LN: The oil level is higher than the detection level. The oil level is lower than the detection level. When there is an internal fault, the input voltage is too low or the installation is abnormal.

●Wiring method and instructions:

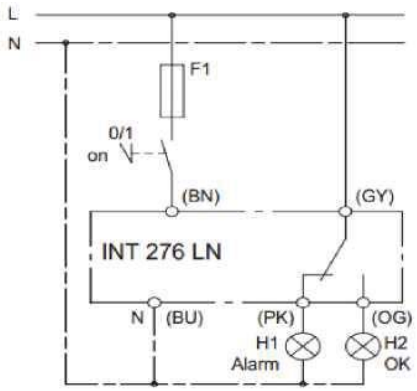
1) When L1, L2, and L3 are connected to the power supply, the voltage value should be within the allowable range specified by the product, otherwise the product cannot work normally.

2) The blue line and the brown line are connected to the L1 and N power lines (220V) respectively as the power supply for the light liquid switch;

3) The gray line is connected to L1;

4) The orange line is connected to the unit protection circuit, and the start and stop of the compressor motor are indirectly controlled by the opening and closing of the control relay; 5) The pink line is connected to the unit alarm circuit

配 Accessories 件

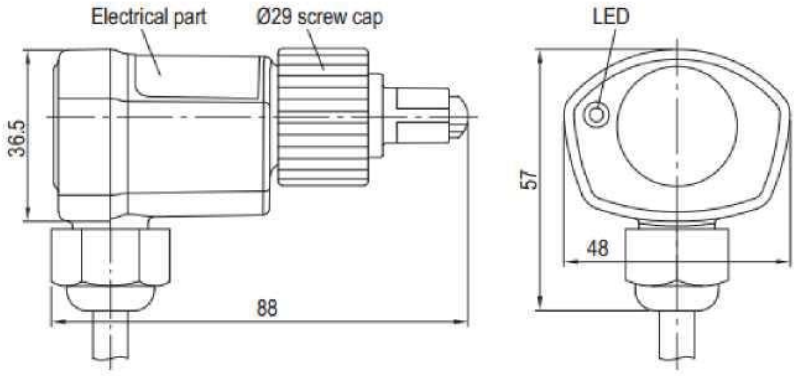


INT276LN

- Technical Parameters:

Numbe	Project	Parameter	Number	Project	Parameter
1	Power supply voltage	AC50/60Hz 230V±10%	4	Power on delay	3s±1s
2	Ambient temperature range	-30℃...+60℃	5	Action delay time	5s±2s
3	Maximum tolerance temperature of prism	+120℃	6	Relay level	AC 240V 2.5A

- Dimensions and installation



INT276LN

Note: 1. Ensure that the optical connector thread and lens are clean;

2. Insert the module to the bottom along the end of the mechanical component to ensure that the electrical terminal is vertically downward; 3. Tighten the external connection nut by hand.

•Compressor delay control instructions

When setting the photoelectric liquid level switch time, in order to avoid frequent compressor tripping when the oil level fluctuates, this product can be set to cut off the compressor power supply after a delay of 60-90 seconds. Therefore, it is recommended to set the delayed shutdown time of the photoelectric liquid level switch control to 60-90 seconds.

That is, when the compressor is running, if the oil level detected by the optical liquid level switch is lower than the control oil level line for a period of time (5±2s), the liquid level switch sends a signal to supply oil to the compressor; when the oil level is higher than the control oil level line for a period of time (5±2s), the liquid level switch automatically resets. If the oil level detected by the optical liquid level switch is lower than the control oil level line for a period of time, the liquid level switch will automatically reset. ;

If the compressor oil level does not reach the control oil level line within 60-90 seconds after the signal is sent out, the compressor will cut off the motor power line for protective shutdown.

• Fault analysis and handling

Phenomenon	Problem Analysis	Workaround
Normal liquid level false alarm	1.The prism detection head is covered with dirt; 2.The prism surface is scratched and opaque。	1. Clean the dirt attached to the prism; 2. Replace the prism with a new one。
The signal light shows "Abnormal"	1. The 220V voltage is too low; 2. The medium temperature is too high, causing damage to the internal components of the module; 3. The module and the connector are not tightened; 4. The coil is damaged。	1. Connect the power supply of LN terminal, the voltage value should be within the specified range; 2. Make the temperature of the optical liquid switch within the allowable range; 3.Tighten the joint nut by hand; 4. Replace the coil.
Action delay failure or error	1Wiring error; 2.Coil damage。	1. Connect wires in the correct way; 2. Replace coil。
Note: If the optical level switch cannot be used normally, there are the following possibilities: 1. Chemical substances in the use environment damage the optical liquid coil wire, etc. ;		

10.5 Other accessories

10.5.1 Vibration-damping pads

In order to avoid additional vibration and noise caused by direct contact between the compressor and its mounting foot and mounting base, it is recommended to install a vibration damping pad under the compressor foot. The required torque for the vibration damping pad installation is: 20~30N.m.

□Note: For the compressor foot position, see 7.3

❄Dimensions and specifications of vibration damping pads：

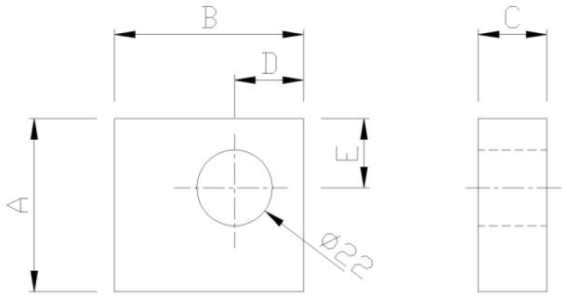


Figure 10-12. Compressor vibration damping pad

❄Specifications of Vibration Damping Pads:

Number	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)	Applicable models
1	50	55	20	20	20	LT-20/10~LT-30/12
2	80	100	20	25	25	LT-45/20~LT-83/41

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