



S18 Micro Vacuum Liquid Pump Series

User Guide


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About This Document

Purpose

This document is related to the S18 micro vacuum liquid pump products, which is used to guide relevant technical personnel to initially understand the characteristics of the product.

Intended Audience

This document is intended for technical personnel. You should have a good understanding of your product and have a clear concept of the relevant parameters, specifications, and other information of the applications of the micro pump.

Keyword

PWM speed control, related parameters, wiring instructions

Change History

The change history accumulates each update of this document. The latest version of the document contains all the previous updates.

| Issue | Date | Product Version | Issuer | Modification |
|-------|---------|-----------------|--------|---|
| 01 | 2024-01 | 1.0 | WXJ | First official release, initially determine the product model |
| 02 | 2024-06 | 1.0 | LYZ | Approved text |
| 03 | 2024-06 | 1.0 | WXJ | Modified model naming examples, added FS and FV parameter tables, modified pipeline connection instructions for compression fittings and hose connector |
| 04 | 2024-06 | 1.0 | LYZ | Modified connector description, remarks dimensions drawing replacement requirements |
| 05 | 2024-07 | 1.0 | LYZ | Review BL motor parameters |
| 06 | 2024-07 | 1.0 | LYZ | Verified BA motor parameters, Delete some DC motor models |
| 07 | 2024-07 | 1.0 | WXJ | Added S18LS-DC parameters |
| 08 | 2024-08 | 1.0 | LYZ | Modified the motor wiring color and added compression fittings pictures |
| 09 | 2024-08 | 1.0 | WXJ | New section: 5.3 Pipeline connection of back pressure safety valve |

| Issue | Date | Product Version | Issuer | Modification |
|--------------|-------------|----------------------------|---------------|--|
| 10 | 2024-09 | 1.0 | WXJ | Modified the pipe connection of the compression fittings |

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1 Characteristics



1.1 High Output Pressure

This product can output a maximum liquid pressure of 100kPa (10 meters water column), meeting the needs of a wide range of pressure ranges, and can be used for high-pressure applications such as spraying, atomization, and high-pressure cleaning.

1.2 Excellent Sealing and Pressure Resistance

The specially designed sealing structure and the use of high-strength engineering plastics give this product excellent sealing and anti-leakage performance. It has been tested to maintain good and reliable pressure resistance and sealing performance under a high liquid pressure of 1MPa.

1.3 Broad Chemical Compatibility and Corrosion Resistance

With a variety of corrosion-resistant engineering plastics, elastic components, and sealing component options, it can achieve a wide

range of chemical compatibility and can withstand various corrosive media such as organic solvents, strong acids, and strong alkalis.

1.4 Stable&Reliable Self-priming and Fluid Transmission

It has stable and reliable self-priming performance, can automatically suck in liquid in the dry pump state, and the fluid transmission is stable and reliable.

1.5 Output Liquid is Smooth and Low Pulsation

The optional double-diaphragm pump head makes the output liquid smoother and has low pulsation characteristics.

1.6 Multiple Pipe Connections

It has two connection options, hose connector and compression fitting, to meet a wider range of pipeline connection needs. The compression fitting can achieve more stable and reliable pipeline connection and sealing performance under high pressure conditions.

1.7 Gas-liquid Dual Purpose

It is dual-purpose for liquid and gas, and can be used as a liquid pump or a vacuum pump, and can also be used to transport gas-liquid mixed medium.

1.8 Multiple Motors

According to application requirements, motor configuration options with long life, high performance, low cost, and multiple input voltage specifications can be provided to meet different cost and reliability application requirements.

2

Special Functions

2.1 Speed Control Function

Brushless motors can change the flow rate by adjusting the motor speed of the pump (by adjusting the PWM duty cycle), and brushed motors can achieve speed adjustment by controlling the input voltage.

2.2 Start-stop Function

The brushless motor can control the start and stop of the pump through the start and stop control level signals, which is suitable for working conditions with frequent starts and stops.

2.3 Speed Feedback

The speed of the pump can be known through the speed feedback signal, which facilitates the realization of working condition monitoring and closed-loop control.

2.4 Protection Function

All brushless motor models are equipped with stall protection function, which can protect the motor from over-current burnout and short-circuit safety hazards under high-load stall conditions.

4 Technical Specifications

4.1 Key Specifications

| Model | Voltage (V DC) | As a Liquid Pump | | | | As a Vacuum Pump | | | |
|--|---|------------------|-------------------------|---------------------|----------------------|------------------|----------------------------|------------------------|----------------|
| | | Load current | Free Flow Rate (mL/min) | Max. Pressure (kPa) | Suction Height (mWg) | Load current | Average Flow Rate (mL/min) | Relative Vacuum (-kPa) | Pressure (kPa) |
| Material and configuration | ES——Diaphragm: EPDM ; Check valve: EPDM; Pump head:PPS | | | | | | | | |
| S18LS-BL | 5 | 0.38 | 240 | 50 | 3.0 | 0.19 | 290 | 35 | 55 |
| | 12 | 0.17 | 240 | 50 | 3.0 | 0.10 | 290 | 35 | 55 |
| S18LS-BA | 5 | 0.43 | 230 | 100 | 3.0 | 0.24 | 260 | 35 | 55 |
| | 12 | 0.18 | 230 | 100 | 3.0 | 0.11 | 260 | 35 | 55 |
| S18LS-DC | 5 | 0.31 | 220 | 100 | 3.0 | 0.16 | 230 | 35 | 55 |
| | 12 | 0.15 | 220 | 100 | 3.0 | 0.07 | 230 | 35 | 55 |
| Material and configuration | FS/FV——Diaphragm: FKM ; Check valve: FKM; Pump head:PPS or PVDF | | | | | | | | |
| S18LS-BL | | | | | | | | | |
| | | | | | | | | | |
| S18LS-BA | | | | | | | | | |
| | | | | | | | | | |
| Material and configuration | KS/KV——Diaphragm: PTFE; Check valve: FFKM; Pump head: PPS/PVDF | | | | | | | | |
| S18LS-BL | 5 | 0.45 | 160 | 50 | 3.0 | 0.23 | 200 | 35 | 55 |
| | 12 | 0.22 | 160 | 50 | 3.0 | 0.12 | 200 | 35 | 55 |
| S18LS-BA | 5 | 0.5 | 190 | 100 | 3.0 | 0.30 | 200 | 35 | 55 |
| | 12 | 0.2 | 190 | 100 | 3.0 | 0.11 | 200 | 35 | 55 |
| These parameters are preliminary product parameters before official release and may need to be revised and adjusted following subsequent product releases. | | | | | | | | | |

| Model | Voltage (V DC) | As a Liquid Pump | | | | As a Vacuum Pump | | | |
|--|---|------------------|-------------------------|---------------------|----------------------|------------------|----------------------------|------------------------|----------------|
| | | Load current | Free Flow Rate (mL/min) | Max. Pressure (kPa) | Suction Height (mHg) | Load current | Average Flow Rate (mL/min) | Relative Vacuum (-kPa) | Pressure (kPa) |
| Material and configuration | ES——Diaphragm: EPDM ; Check valve: EPDM; Pump head:PPS | | | | | | | | |
| S18MS-BL | 5 | 0.27 | 220 | 50 | 2.0 | 0.18 | 190 | 24 | 35 |
| | 12 | 0.13 | 220 | 50 | 2.0 | 0.08 | 190 | 24 | 35 |
| S18MS-BA | 5 | 0.33 | 200 | 100 | 2.0 | 0.24 | 180 | 24 | 35 |
| | 12 | 0.15 | 200 | 100 | 2.0 | 0.11 | 180 | 24 | 35 |
| S18MS-DC | 5 | | | | | | | | |
| | 12 | | | | | | | | |
| Material and configuration | FS/FV——Diaphragm: FKM ; Check valve: FKM; Pump head:PPS or PVDF | | | | | | | | |
| S18MS-BL | 5 | | | | | | | | |
| | 12 | | | | | | | | |
| S18MS-BA | 5 | | | | | | | | |
| | 12 | | | | | | | | |
| Material and configuration | KS/KV——Diaphragm: PTFE; Check valve: FFKM; Pump head: PPS/PVDF | | | | | | | | |
| S18MS-BL | 5 | 0.33 | 150 | 50 | 2.0 | 0.21 | 150 | 24 | 35 |
| | 12 | 0.15 | 150 | 50 | 2.0 | 0.10 | 150 | 24 | 35 |
| S18MS-BA | 5 | 0.38 | 160 | 100 | 2.0 | 0.27 | 150 | 24 | 35 |
| | 12 | 0.15 | 160 | 100 | 2.0 | 0.10 | 150 | 24 | 35 |
| These parameters are preliminary product parameters before official release and may need to be revised and adjusted following subsequent product releases. | | | | | | | | | |

Note: 1. The input voltage requires 5V and 12V

2. The parameters in the table are measured at the maximum speed of the motor;
3. Unless otherwise specified, the technical parameters are measured under the conditions of temperature 20°C and standard atmospheric pressure of 101kPa. .
4. The average flow rate in the table is the flow rate value measured with a soap film flow-meter.

4.2 Configuration Options

| Material option | Default | Optional Items | |
|------------------|---|----------------------------|------|
| Pump head | PPS | PVDF | |
| Diaphragm | EPDM | FKM | PTFE |
| One-way valve | EPDM | FKM | FFKM |
| motor | BLDC | BLDC(A type) | DC |
| Connector option | Default | Optional Items | |
| Connector type | Hose connector | Compression fitting | |
| | (For detailed connector introduction, see the following chapters) | | |
| Pump head option | Default | Optional Items | |
| Pump head type | Standard Pump head | Double diaphragm pump head | |
| | (For detailed function introduction, see the following chapters) | | |

4.3 Reliability Parameters

| Models | S18 | |
|-----------------------------|---|----------|
| Versions | Simplified | Standard |
| Fully Loaded Lifetime (hrs) | 1000* | 2000* |
| Unloaded Lifetime (hrs) | 2000* | 6000* |
| Motor Lifetime (hrs) | 2500* | 8000 |
| Lifetime test instructions: | Full-load life test conditions: The liquid inlet is connected to a hose and immersed under the tap water surface. The drainage pressure of the liquid outlet is limited to 100kPa through a regulating valve (with a BL motor, the pressure is limited to 50kPa, and with a BA motor/DC motor, the pressure is limited to 100kPa), allowing the pump to operate continuously for a long time to pump water. | |

| | |
|--|---|
| | No-load life (liquid) test conditions: The liquid inlet is connected to a hose and immersed under the tap water surface, keeping the discharge port open, so that the pump can work continuously for 24 hours without stopping to pump water. |
| | Motor life test conditions: Under the conditions of good ventilation and heat dissipation, the motor can run continuously for 24 hours without load. |
| | Environmental conditions for life test: In a clean, non-corrosive laboratory, the ambient temperature is 5~33°C fluctuates with the climate, and the relative humidity of the environment is 50%~85%, fluctuates with the climate; |
| | * Represents the design target parameters, the actual life is under testing. |
| | The source of the experimental data is from Hilin Technology Aging and life laboratory and supplier laboratory |

| Working Conditions | |
|---------------------------|---|
| Environment | The ambient temperature is 0°C~50°C. It is not suitable to be exposed to the sun outdoors. You should work in a clean and ventilated environment. |
| Medium | The medium temperature is 0°C~50°C, low viscosity, no solid particle liquid |
| Load | Both the liquid inlet and outlet can operate with full load (that is, the output pressure is below the rated maximum pressure), but the load imposed on the liquid suction port cannot exceed the maximum vacuum of the pump, and the load imposed on the liquid outlet cannot exceed the maximum output pressure |
| Corrosion | Depending on the material configuration of different parts such as the |

| | |
|--|---|
| | pump head, diaphragm, and one-way valve that are in contact with the medium, it has a wide range of tolerance to various types of strong acids, strong alkalis, and organic solvents. (See the following chapters for detailed connector information) |
|--|---|

4. 4 Materials and Chemical Compatibility

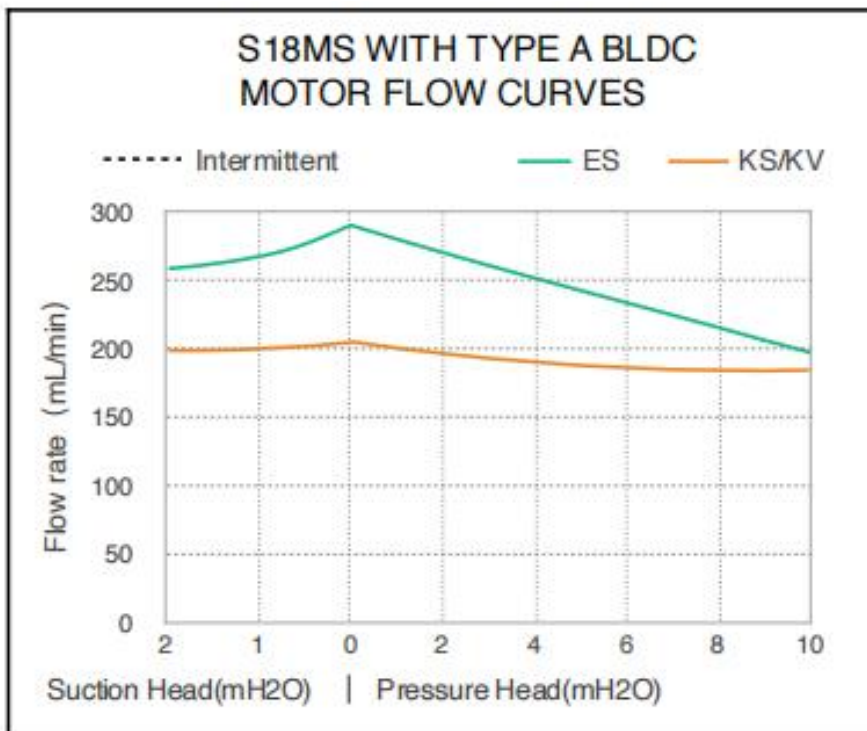
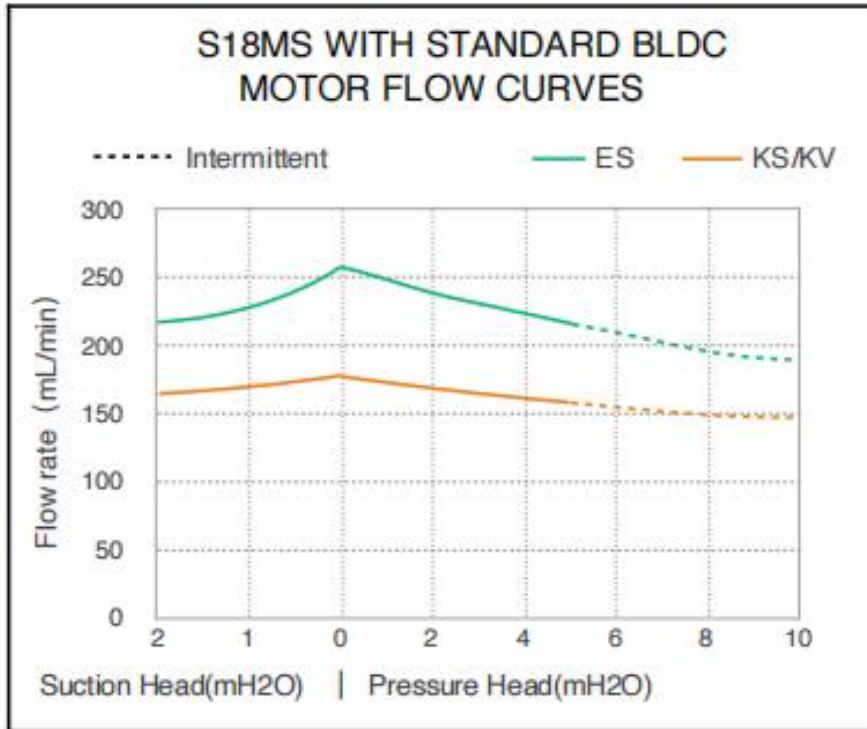
| Medium composition | Material Options | | | |
|-----------------------|------------------|-----|-----|-----|
| | ES | FS | KS | KV |
| hydrochloric acid | ○ | ○ | ○ | ●●● |
| Acetic acid | ●● | ● | ●●● | ●● |
| Sulfuric acid | ● | ●● | ●● | ●●● |
| Nitric acid | ○ | ○ | ○ | ●● |
| Sodium hydroxide | ●●● | ○ | ●●● | ●●● |
| Calcium hydroxide | ●●● | ●●● | ●●● | ●●● |
| Potassium hydroxide | ●●● | ○ | ●●● | ●●● |
| Sodium bicarbonate | ●●● | ●●● | ●●● | ●●● |
| Ammonia | ●●● | ○ | ●● | ●● |
| Benzene | ○ | ●● | ●●● | ●●● |
| Xylene | ○ | ●● | ●●● | ●●● |
| Methane | ○ | ●●● | ●●● | ●●● |
| Gasoline | ○ | ●●● | ●●● | ●●● |
| Methylene chloride | ○ | ● | ●●● | ● |
| Methanol | ●●● | ○ | ●●● | ●●● |
| Ethanol | ●●● | ○ | ●●● | ●●● |
| Ether | ○ | ○ | ●●● | ●● |
| Acetone | ●●● | ○ | ●●● | ● |

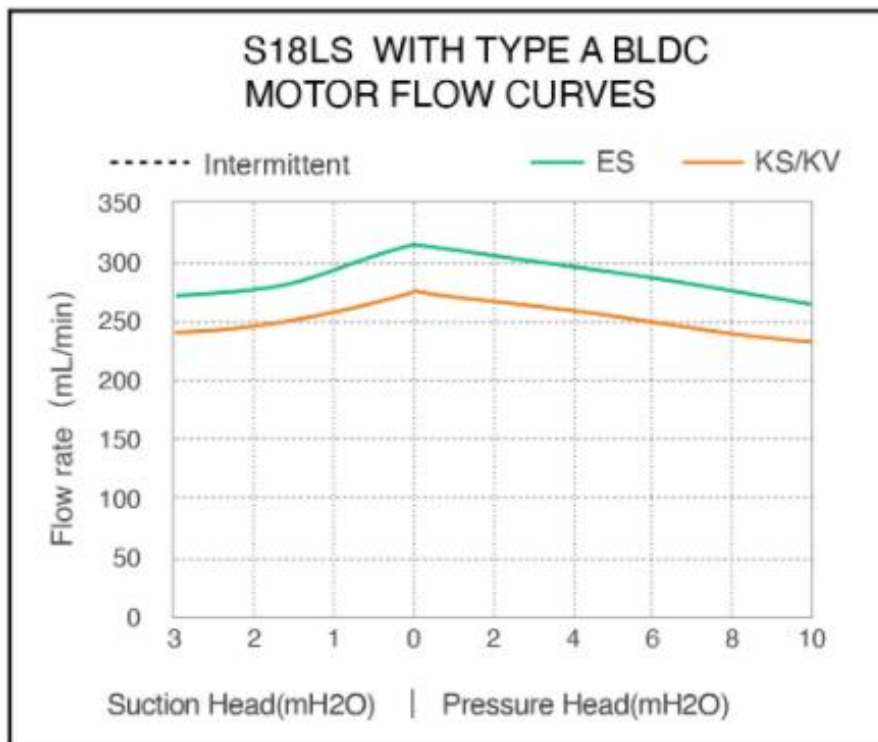
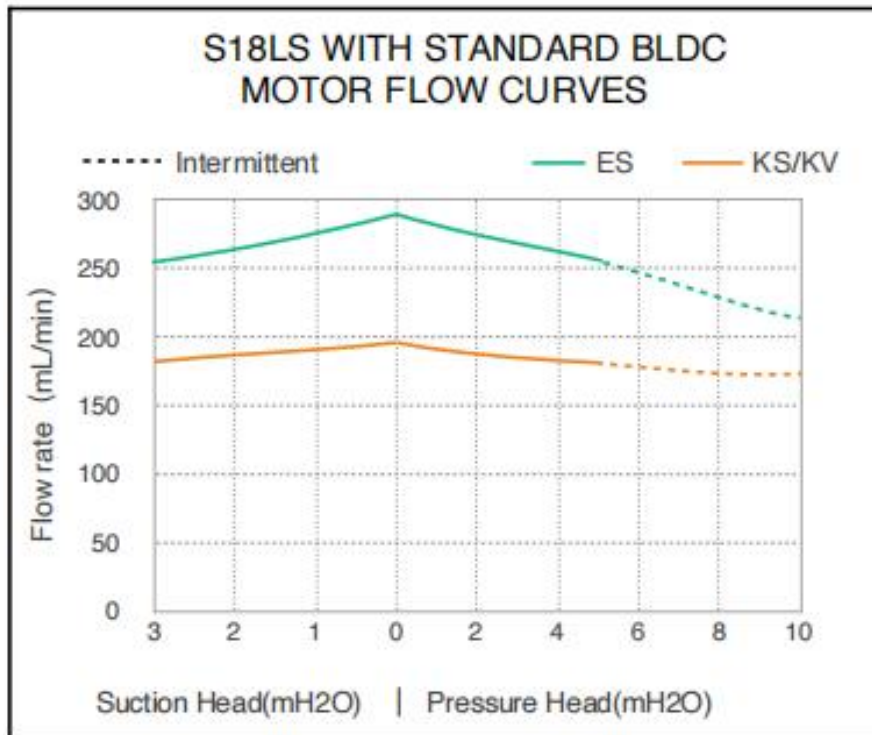
| Phenol | ○ | ● | ●●● | ●● |
|-------------|--|---|-----|----|
| Description | <p>ES: EPDM diaphragm EPDM valve EPDM seal PPS pump head</p> <p>FS: FKM diaphragm FKM valve FKM seal PPS pump head</p> <p>KS: PTFE diaphragm FFKM valve FFKM seal PPS pump head</p> <p>KV: PTFE diaphragm FFKM valve FFKM seal PVDF pump head</p> <p>●●● Fully tolerated: Definite data shows that it can be tolerated</p> <p>●● Well tolerated: Tolerable in most cases</p> <p>● Limited tolerance: Tolerable under certain concentration and other conditions</p> <p>○ Severe reaction: Do not use if severe reaction occurs</p> <p>The data in this table are only for quick reference and do not constitute a commitment or guarantee. Please refer to Chapter 7 for precautions when pumping flammable, toxic, and highly corrosive medium.</p> <p>For more information on chemical medium compatibility, please contact our sales manager.</p> | | | |

4.5 Pump Head and Air Nozzle Options

| Pump head options | characteristic |
|----------------------------|---|
| Regular single pump head | The regular single pump head simplifies the number of pump head parts and has better sealing performance and pressure resistance than the double diaphragm pump head; when there are special requirements for sealing or working under higher working pressure, compared with the double diaphragm pump head, Diaphragm pump head has better sealing reliability. |
| Double diaphragm pump head | A resonant diaphragm that works passively following the fluid pulsation is added inside the double-diaphragm pump head, which can reduce the liquid pulsation when pumping fluid, and has a higher output flow and a more linear flow control curve with rotational speed. When the flow needs to be controlled has better control characteristics. |
| Connector option | characteristic |
| Hose connector | Regular hose connection form, simple and low-cost, suitable for working pressure situations within 100kPa. Suitable for hoses with an inner diameter of 3-4mm and an outer diameter of 8mm. |
| Compression fittings | When the working pressure exceeds 100kPa, for stronger pipeline connection and sealing, it is recommended to use compression fittings. Suitable for hoses with an inner diameter of 3mm and an outer diameter of 8mm, and hard pipes with an inner diameter of 4mm and an outer diameter of 6mm. |
| | (See the following chapters for detailed function introduction) |

4.6 Pressure-Flow Curve



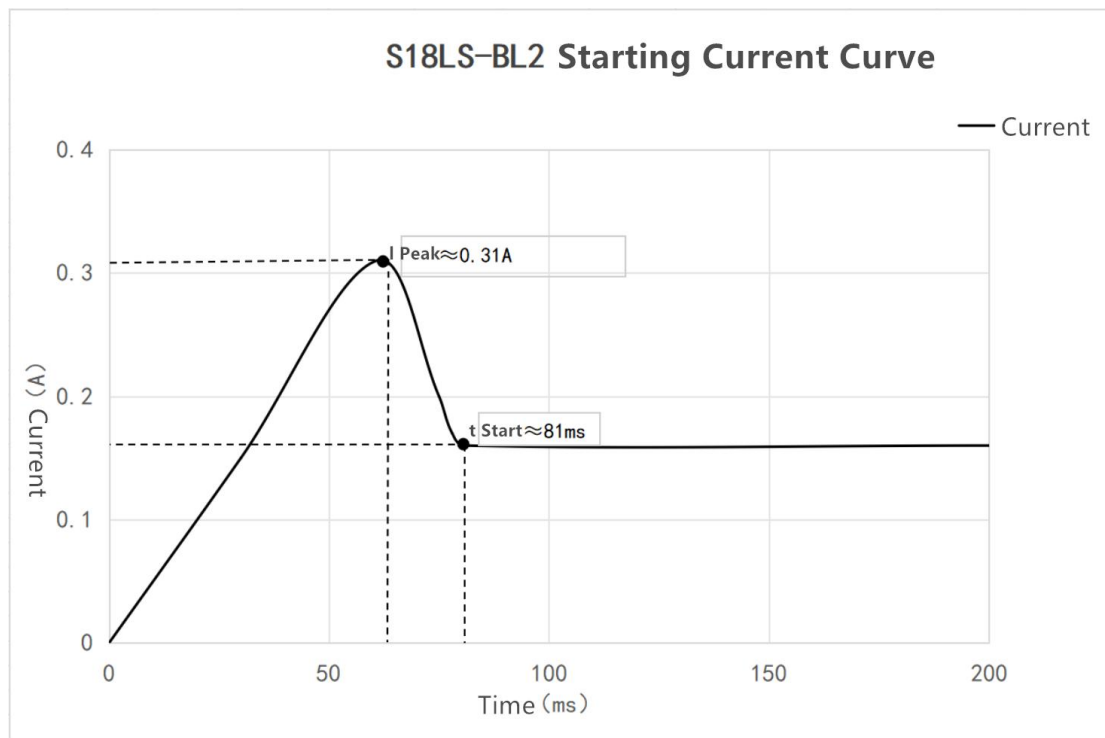
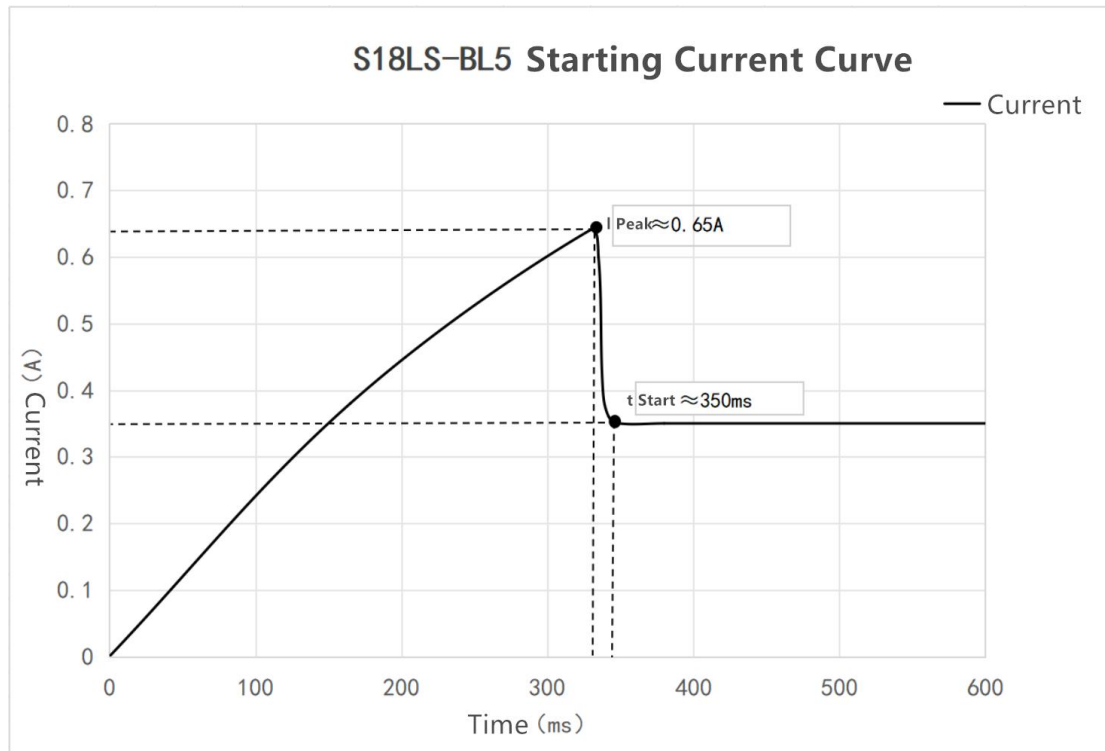


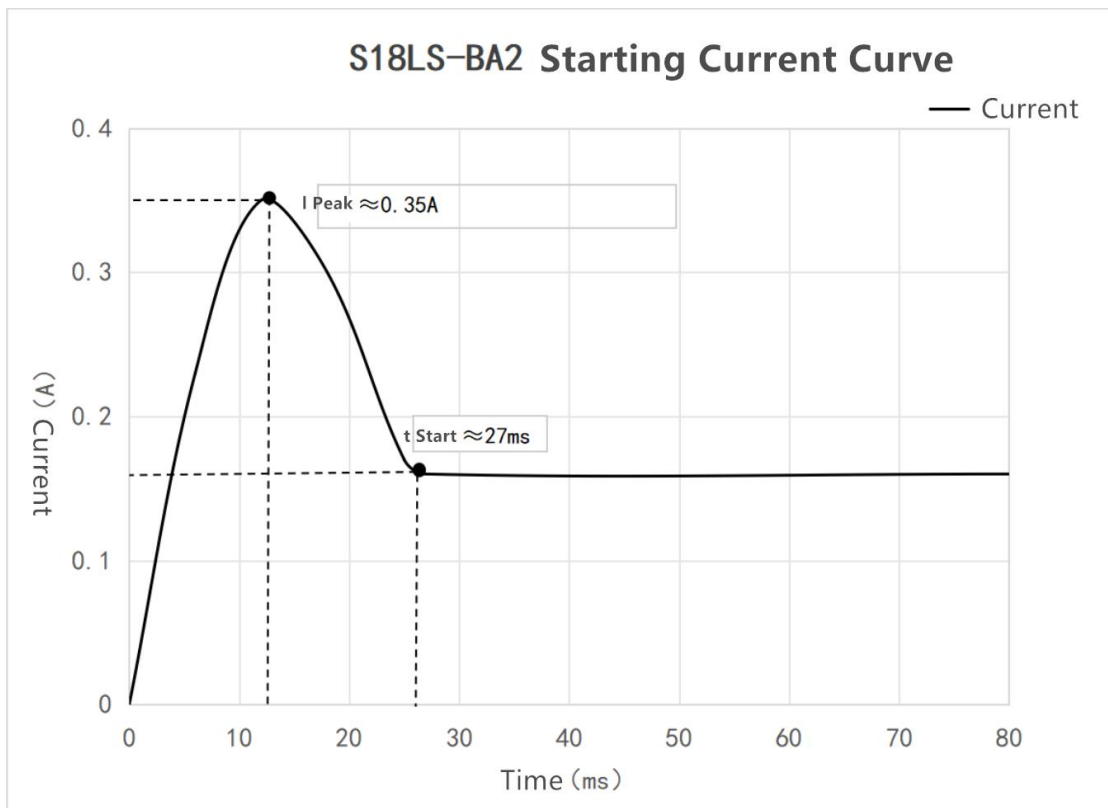
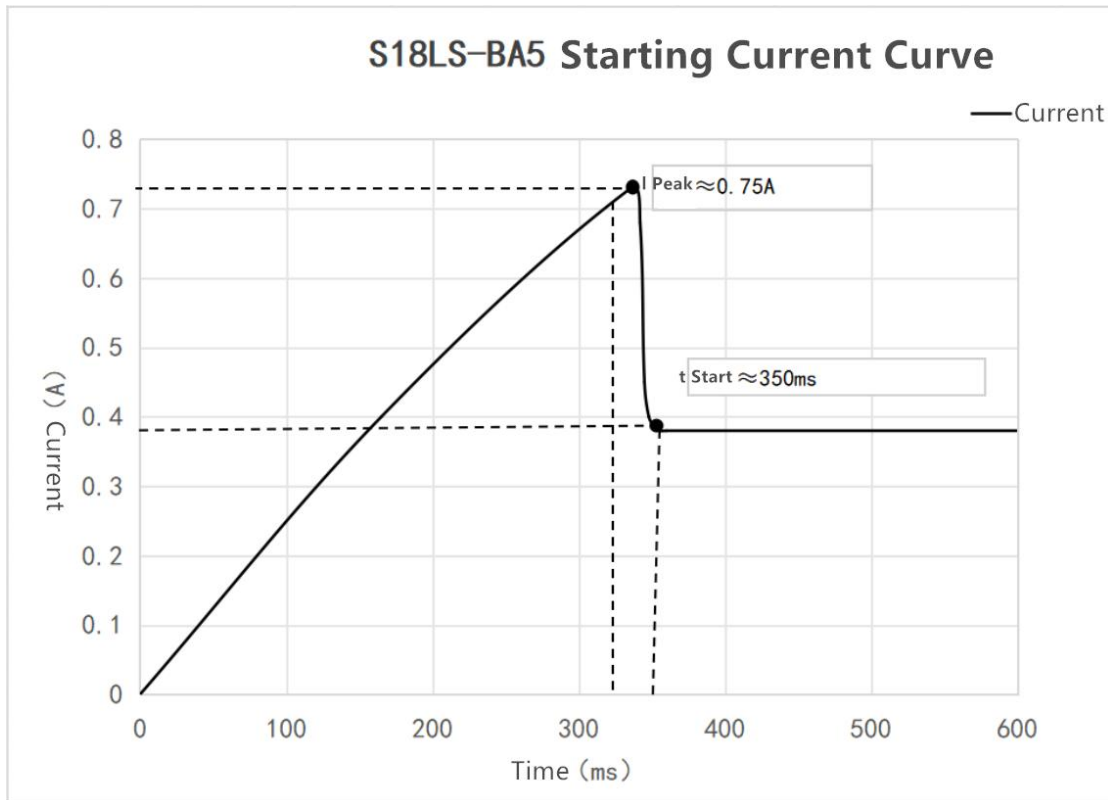
Note: 1. Due to individual differences between different micropumps and different test pipelines having different effects on the measured parameters, this curve is a statistical value;

2. The value of this curve is only a technical reference for users to confirm the working point, and does not serve as a basis for product acceptance.

4.7 Starting Current Curve

The starting current curve was measured under the condition that the inlet and outlet are directly connected to the atmosphere. There are individual differences among different micro pumps. This curve is a statistical value and is only provided as a technical reference for users to determine the power supply system. It is not an acceptance data.

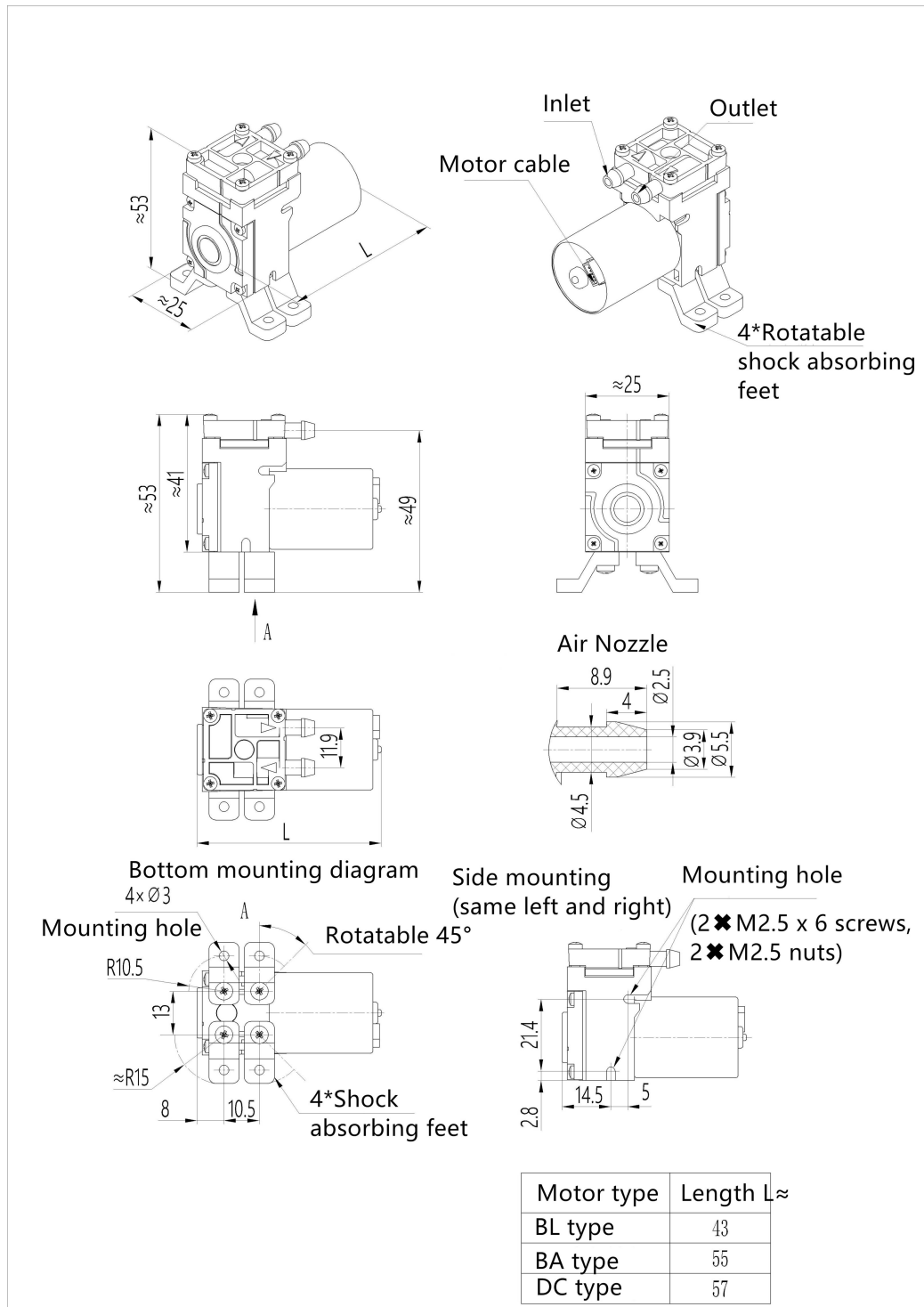




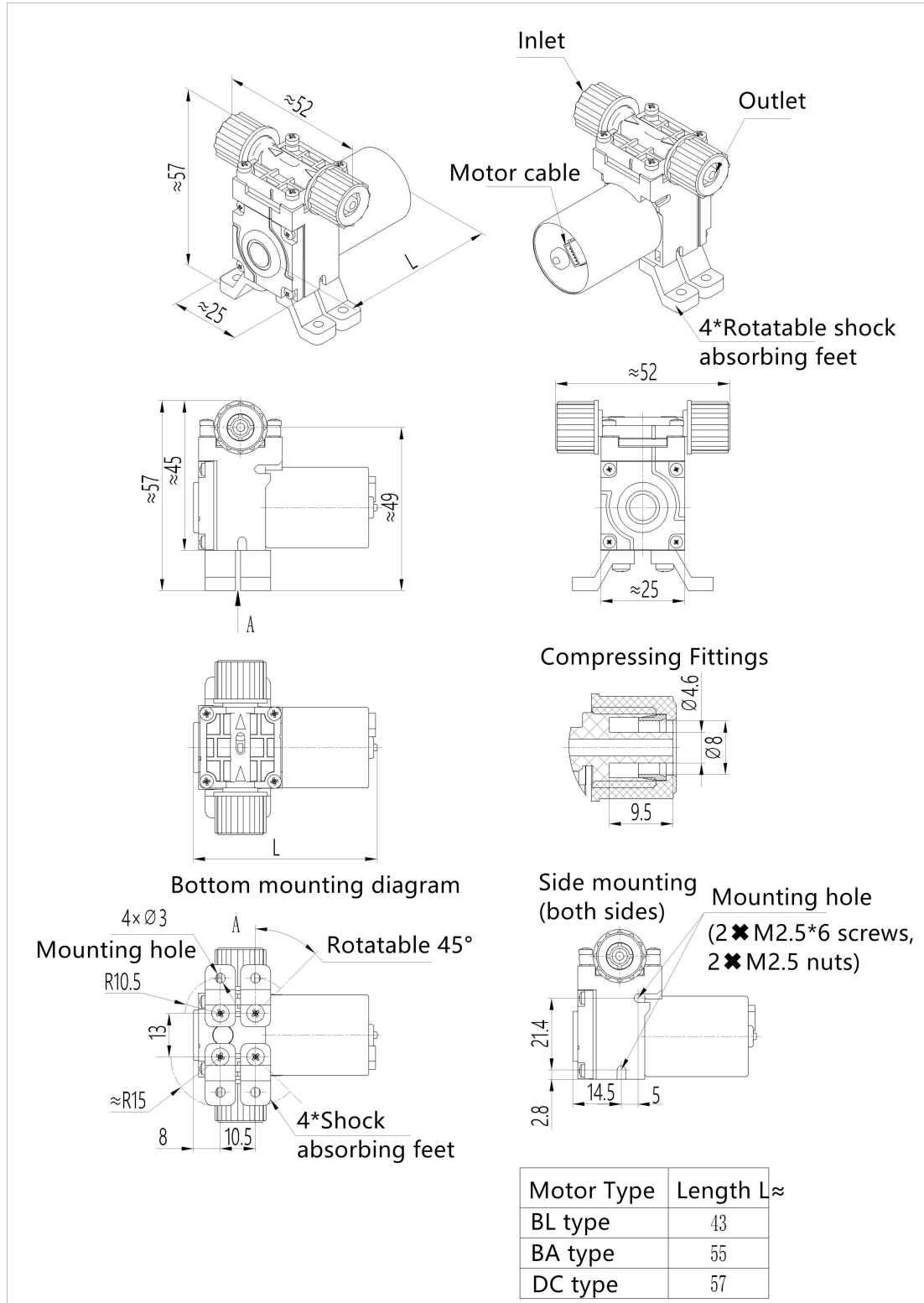
5

Installation Instructions

S18LS regular pump head with hose connector



Installation dimension diagram of S18LS regular pump head with compressing fittings

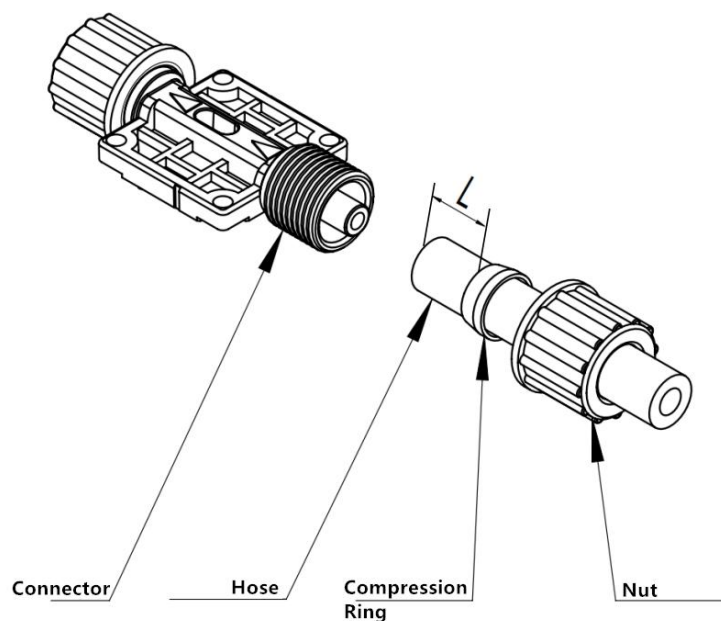


5.1 Pipe connection of hose connector

When choosing a hose connector pump head, it is recommended to use a hose with an inner diameter of 3-4mm and an outer diameter of no more than 8mm. When the working pressure of the pump is within 100kPa, rolled strips or clamps can be used to additionally reinforce the connection between the hose and the pagoda joint to prevent the hose from loosening due to pipeline pressure. When the working pressure exceeds 100kPa, it is recommended to choose a pump head equipped with a compression fittings to achieve better pipeline connection strength and sealing.

5.2 Pipe connection of compression fittings

When selecting a pump head equipped with a ferrule joint, please connect the pipelines as shown in the following diagram.



When using a compression fittings, please choose a hose with an inner diameter of 3mm and an outer diameter of 8mm, or a hard pipe with an inner diameter of 4mm and an outer diameter of 6mm, and match the compression fittings with an outer diameter of 6mm or 8mm. Both specifications of compression fittings are the same. It is shipped with the pump. You need to select the correct model for installation according to the outer diameter of the pipe.

Step 1: First unscrew the union nut that is pre-screwed on the pump head, and take out the compression fittings pressure ring placed inside the union nut;

Step 2: Place the union nut and compression fittings pressure ring on the hose connection end in sequence in the direction and order shown

in the figure, making sure that the outer diameter of the hose is smaller than the inner diameter of the ferrule pressure ring. ($L \geq 8\text{mm}$ needs to be ensured to ensure that the hose can be inserted in place)

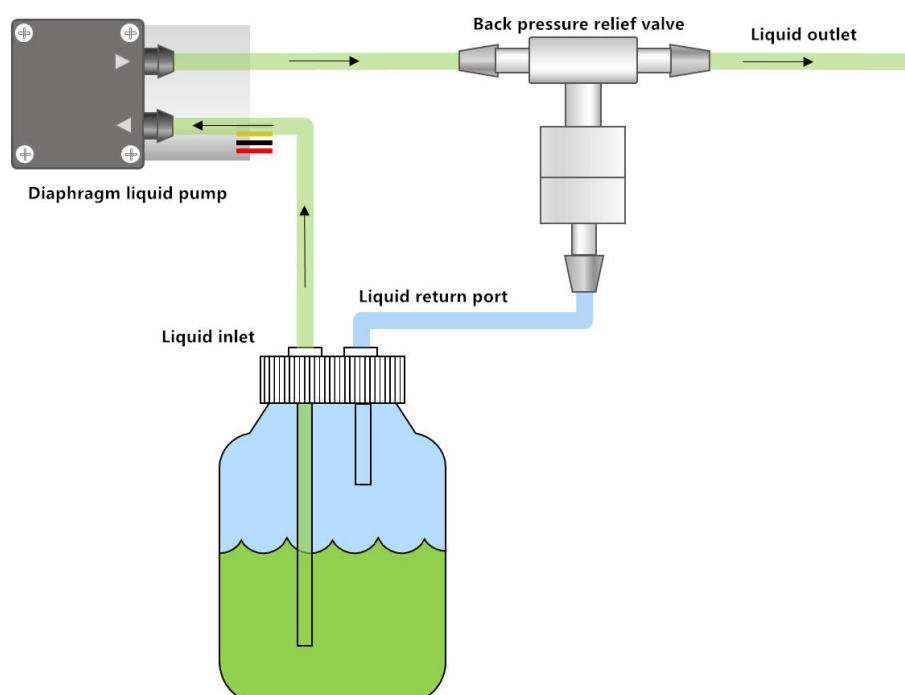
Step 3: Insert the hose with the compression fittings ring and union nut into the inlet and outlet of the pump and push the hose inward until it can no longer be pushed.

Step 4: Push the compression ring of the ferrule to the position closest to the end face of the hose until it can no longer be pushed.

Step 5: Keep the hose and compression fittings pressure ring still, screw the union nut clockwise until it can no longer be tightened by hand, and check whether the pipeline is firmly connected.

5.3 Install a back pressure safety valve to protect the pump and liquid line

When the liquid pump is in normal pumping operation, when the drain port or drain pipeline is accidentally blocked, the pressure at the drain end will gradually increase as the pump works, which may cause damage to the liquid pump or liquid pipeline under high pressure conditions. . In order to prevent damage to the liquid pump and liquid circuit facilities due to excessive back pressure, Hilin Technology BP100 back pressure safety valve is optional. This safety valve is installed at the liquid outlet end of the liquid pump and opens when the back pressure exceeds $100\text{kPa} \pm 20\%$. The liquid in the liquid outlet will overflow and be released through the liquid return port, thereby reducing back pressure and protecting the liquid circuit and liquid pump.



6 Electrical Connection

The wiring instructions are for the external power and signal cable connections for this product. This product comes with a standard set of connection cables, and the cables are defined by color.

6.1 S18 Wiring Diagram for DC Brushed Motors

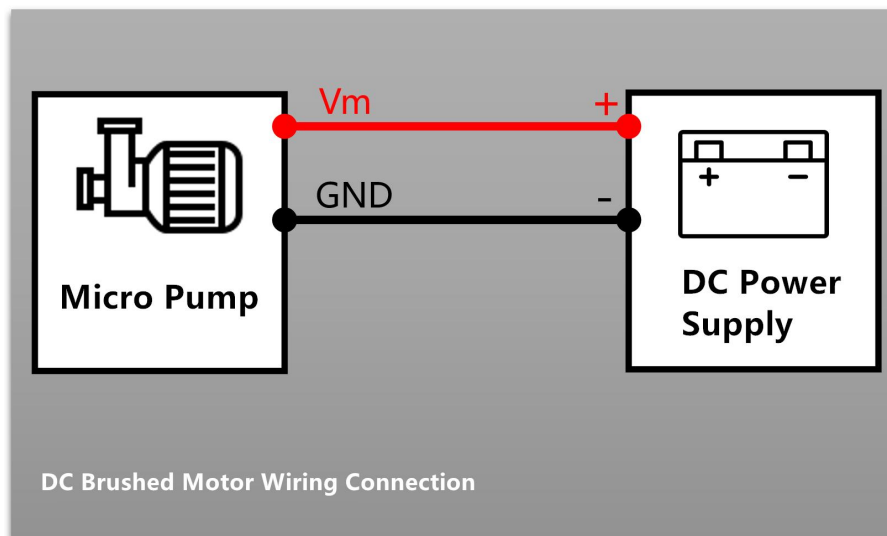


Figure 6-1 Wiring Instructions for DC Brushed Motors Type

Description: The red wire of the motor lead is connected to the positive terminal of the DC power supply, and the black wire is connected to the negative terminal of the power supply.

| S. N. | Wire | Input | Function | Signal Definition | Description |
|-------|------|----------------|---------------|-------------------|--|
| 1 | Red | V _m | Positive pole | DC 5V DC 12V | The product model with DC5 represents 5V motor, and the product model with DC2 represents 12V motor, see the model description in Chapter 3. |

| | | | | | |
|---|-------|-----|-----------------------|--------|---|
| | | | | | The input voltage should not exceed the maximum voltage range, otherwise it will burn out the motor |
| 2 | Black | GND | Negative pole, Ground | Ground | |

Note: The red DC power supply of the motor lead needs to have sufficient output power, and the pump may fail to start when the power is insufficient, or cannot reach the rated pressure.

6.2 S18 with Brush Motor Speed Control

DC brush motors can control the motor speed by adjusting the motor input voltage. When using the motor voltage for speed regulation, the input voltage must not exceed the rated voltage of the motor, otherwise the motor will be damaged in advance.

When the pump operates with load below the rated voltage, or when the pipeline pressure exceeds the rated pressure, it may cause stalling or startup failure due to excessive load; the power supply should be cut off immediately after stalling occurs. To avoid motor burnout, it is recommended to add a circuit module with stall/overcurrent protection to the power supply line to avoid motor damage.

When the micro pump needs to start and stop frequently, or the DC brush motor needs to be controlled by PWM signal for speed regulation, it is recommended to add an H-bridge drive module between the power supply and the pump power supply to protect the power supply and perform PWM speed regulation.

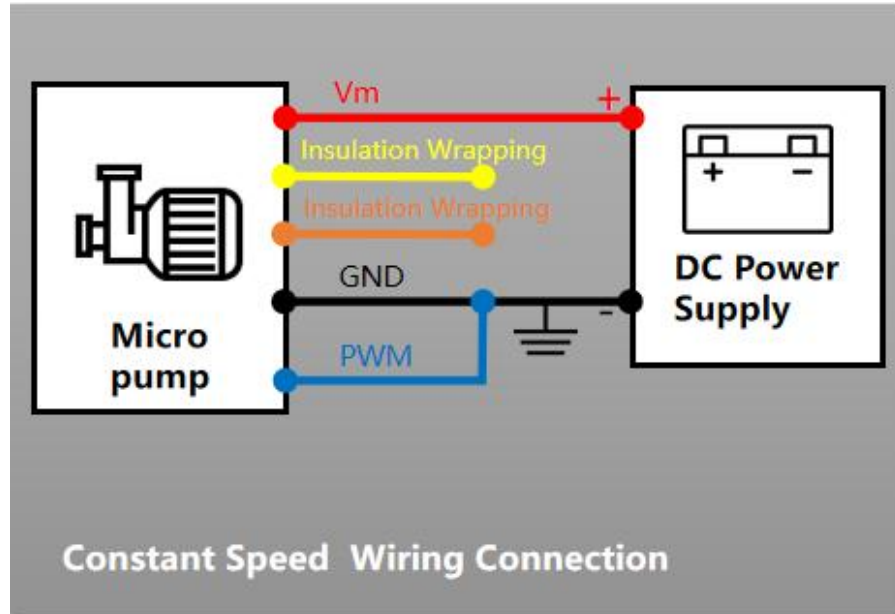
Choosing an H-bridge drive module with stall and overcurrent protection can further protect the micropump from accidental damage.

Note: Stalled rotor will cause the motor current to increase significantly and cause heating and burning. Models equipped with brush motors need to avoid working conditions that may cause stalling, or install a stalled rotor/overcurrent protection module to protect the motor from burning.

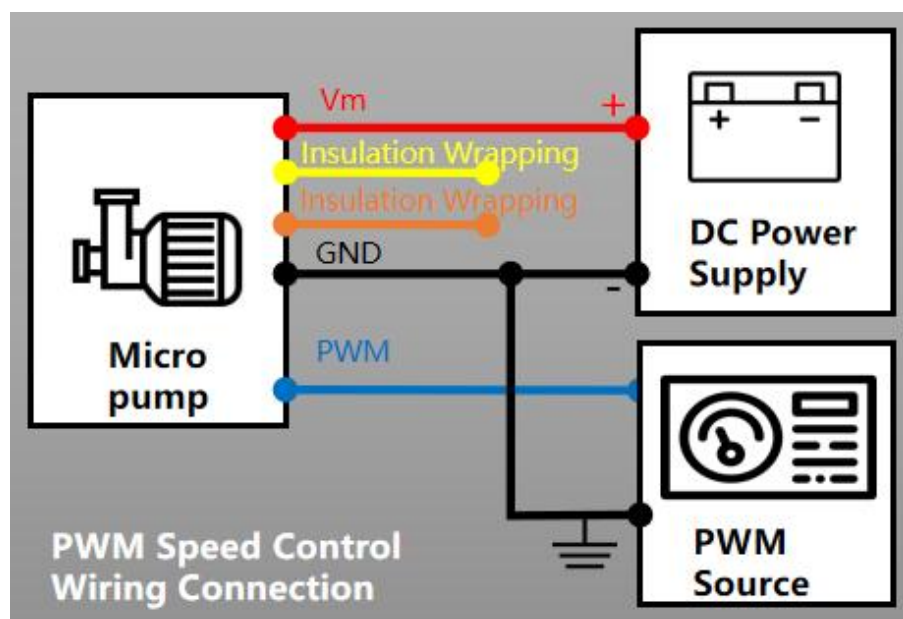
6.3 Wiring of S18 equipped with BL and BA brushless motors

The product model with the words BL5/BL2 or BA5/BA2 means that the product is equipped with a brushless DC motor with a rated voltage of 5V/12V DC. For example, the BL2 in S18MS-BL2ES2PH4 represents a BL-type brushless motor equipped with a rated voltage of 12V DC.

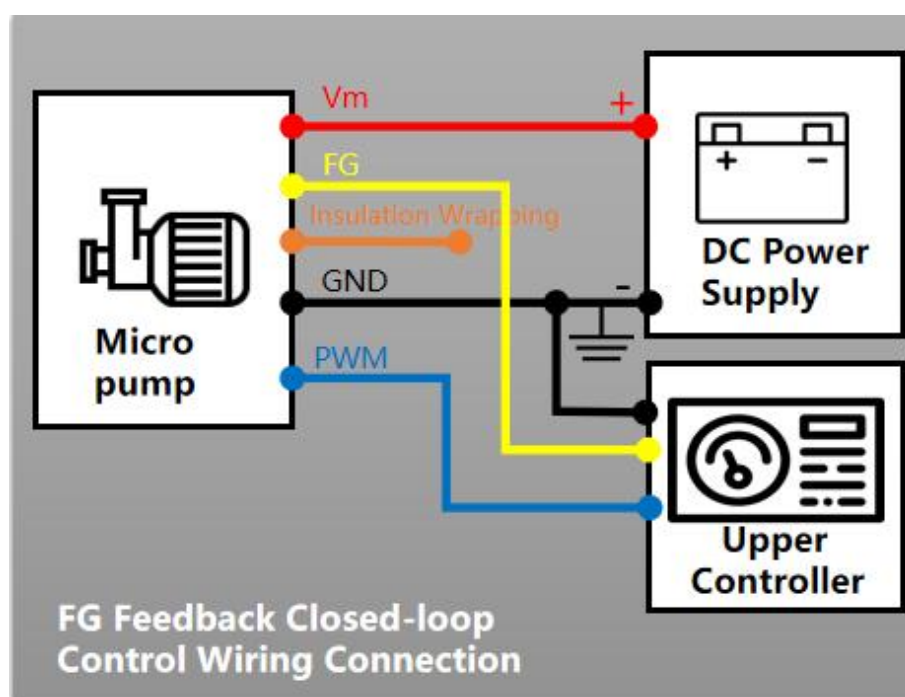
If there is no need for speed regulation and speed feedback, the red wire is connected to the positive pole of the power supply, and the black and blue wires are connected to the negative pole of the power supply; the yellow and orange wires are insulated and wrapped, and the pump will work at the rated speed.



When you need to use the PWM speed control function, you need to use a signal source that supports PWM signal output (function signal generator, MCU, PLC and other controllers), connect the signal source output to the blue PWM input cable, and connect the PWM signal source ground to the DC power supply ground, and the yellow and orange wires are insulated and wrapped. At this time, the motor speed can be controlled in an open loop through the PWM signal.



When you need to use the PWM speed control function and monitor the pump operation through FG signals or perform closed-loop feedback control, you need to use a host controller (MCU, PLC, host computer, etc.) that supports PWM signal output and FG signal input. Connect the source output to the blue PWM input cable, and connect the PWM signal source ground to the DC power supply ground. The yellow FG feedback signal output cable is then connected to the FG signal input end of the host controller. The host computer detects the FG signal to monitor the motor speed and control the PWM. The signal output performs closed-loop speed control.



6.4 BL and BA type brushless DC motor signal definition

There are 5 leads. The wiring and usage instructions are shown in the following table.

| S. N. | Wire | Function | Signal Definition | Description |
|-------|--------|--|---|---|
| 1 | Red | Positive pole | DC5V ($\pm 10\%$) DC12V ($\pm 10\%$) | Determine the voltage according to the model, see Chapter 3 for details |
| 2 | Yellow | FG feedback signal (motor speed feedback signal, pulse signal), the motor outputs 6 pulses per rotation. | Output: $3V \leq \text{high level}$ $\text{Low level} \leq 0.6V$ The maximum rated current of the FG feedback signal | |

| | | | | |
|---|--------|---------------------------------|---|---|
| | | | is 3mA. | |
| 3 | Orange | No function for this model (FR) | Grounding or insulation wrapping is recommended | |
| 4 | Black | GND | Negative pole of power supply, ground | Ground |
| 5 | Blue | Pulse Width Modulation (PWM) | Input: $0V \leq V_{IL} \leq 0.8V$ $2V \leq V_{IH} \leq 5V$ (10KHz~15KHz) | Use PWM to change the motor speed and adjust the flow. PWM input signal frequency range: 15KHz. This port cannot be used to control the start and stop of the pump. |

7

Cautions



Please read the instructions in this chapter carefully and follow the instructions strictly before use.

- 1. Only technicians with corresponding skills training can install, use, test and maintain the pump!**
- 2. This product has no waterproof, dustproof or explosion-proof properties and cannot be used in flammable and explosive environments!**
- 3. Please use this product within the environmental and medium temperatures, fluid and electrical parameters specified and nominal in this document. Use outside the range may cause damage and safety hazards!**
- 4. Before pumping the medium, it is necessary to evaluate the corrosion resistance and chemical compatibility of the chemical composition of the medium and the pump head, diaphragm, one-way valve, and sealing materials!**
- 5. Before pumping toxic, corrosive, biohazardous and other dangerous media, in addition to chemical compatibility assessment, the sealing of the pump must be tested and periodically inspected, or secondary sealing must be performed to ensure safety.**
- 6. The extracted medium must not contain crystalline precipitation and solid particles. After extracting the medium that is easy to adhere, crystallize, and precipitate, the pump chamber needs to be flushed and cleaned, otherwise the micropump will be damaged!**
- 7. Electrical connection cables should be kept away from heat sources and the connectors and cables should be insulated and protected!**
- 8. Supporting piping components and containers must have sufficient strength to ensure personal safety!**

9. Before thorough harmless treatment, our company will not accept toxic, harmful and corrosive products that have been extracted that may pose a threat to personal harm and return them to the factory for maintenance services for the reasons of employee personal safety protection and social safety. If any For related product maintenance needs, please sign the harmless declaration form and contact our company in advance!

10. Self-disassembly and repair without the permission and guidance of the original manufacturer will cause product damage and will result in the loss of the original manufacturer's warranty service!

8

Customer Repair Declaration of Harmlessness

In order to protect the personal and environmental safety of our employees, logistics company personnel and related personnel in the whole society, please check the toxic, harmful, corrosive, biohazardous and radioactive materials before sending the repaired and returned products back to Hailin Technology. Products containing hazardous media and other hazardous media should be thoroughly cleaned and detoxified, and this detoxification statement should be included with the pump. Otherwise, our company will refuse to carry out further repairs on the above products.

| Item | Content |
|--|---|
| Model | |
| S.N number | |
| List of medium components that have been extracted | |
| | |
| | |
| | |
| | |
| | |
| Statement content | This repair/replacement product has been thoroughly cleaned and decontaminated, and does not contain potentially corrosive, radioactive, biohazardous or other toxic and harmful hazardous components, and is not harmful to the personal safety of the carrier, maintenance personnel and other related handling personnel. Security does not pose a risk. |

 Company Stamp

 Signature/Date

9 Appearance

S18 BL brushless motor with hose connector



S18 BA brushless motor with compressing fittings



S18 DC brush motor with hose connector

