

Medical Solenoid Valve Guide: How to Compare and Choose the Right Valve

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Reliable fluid control for safer, smarter medical devices.



Patient Safety
Leak-free & consistent performance



High Precision
Accurate flow control



Medical Grade
Biocompatible & CFR compliant



Compare Medical Solenoid Valve Types

Valve Type					
	Inline Solenoid Valve	2-Way Normally Closed (NC) Valve	2-Way Normally Open (NO) Valve	3-Way Valve	Custom / Manifold Valve
Flow Range	Low – Medium	Low – Medium	Low – Medium	Low – High	Medium – High
Operating Pressure	0 – 3 bar	0 – 4 bar	0 – 4 bar	0 – 5 bar	0 – 6 bar
Port Size	1/8" – 1/4"	1/8" – 1/4"	1/8" – 1/4"	1/8" – 1/2"	1/4" – 1/2"
Connection Type	Threaded / Barbed	Threaded / Barbed	Threaded / Barbed	Threaded / Flanged	Threaded / Custom
Media Compatibility	Air, O ₂ , N ₂ , CO ₂ , Water, Medical Gases	Air, O ₂ , N ₂ , CO ₂ , Water, Medical Gases	Air, O ₂ , N ₂ , CO ₂ , Water, Medical Gases	Air, O ₂ , N ₂ , CO ₂ , Water, Medical Gases	Air, O ₂ , N ₂ , CO ₂ , Water, Medical Gases
Typical Applications	Pneumatic systems, respirators, analyzers	Oxygen supply, ventilators	Waste gas, air release, control systems	Multi-port systems, ventilators, analyzers	OEM equipment, custom medical devices

Key Factors for the Right Choice

- 1. Fluid & Media**
Check compatibility with oxygen, medical gases, sterilization and chemicals.
- 2. Pressure & Flow**
Match valve performance to your system's pressure and flow requirements.
- 3. Port Size & Connection**
Ensure proper fit with your tubing or manifold (threads, barbs, or custom).
- 4. Materials & Biocompatibility**
Use stainless steel or approved materials for medical applications.
- 5. Environment**
Consider temperature, humidity, and cleanroom or sterilization needs.
- 6. Compliance**
Meet regulatory standards (e.g., ISO 13485, FDA, RoHS, REACH).



Quick Selection Steps

- 1 Define Application Needs**
(media, pressure, flow, environment)
- 2 Compare Valve Types**
(use the table above)
- 3 Check Material & Compliance**
(biocompatibility, certifications)
- 4 Validate with Manufacturer**
(samples, technical support)
- 5 Confirm & Specify**
(finalize part number and specs)

Dongguan, Guangdong Oct 11, 2026 ([Issuewire.com](https://www.issuewire.com)) -

- Introduction

Control of fluids and gases is a crucial function of many medical devices. Valves can be vital components of ventilators, oxygen delivery systems, diagnostic analyzers, laboratory equipment, dialysis systems, anesthesia delivery systems, suction devices and other medical devices, where controlling the flow, isolating the flow, measuring the flow or stopping the flow.

Selecting the proper medical [solenoid valve](#) goes far beyond the voltage and connection size.

Requirements for the leakage, reaction time, power consumption, heating, material compatibility, cleanliness, noise, life span and dimensional stability for the medical devices can be very demanding. For compact portable medical devices one of the key selection criteria may even be valve size and weight.

- What Is Medical Solenoid Valve?

Medical solenoid valve is an electric valve that is used to control the flow of gases or liquids in medical devices, diagnostic equipment, laboratory equipment and healthcare related devices.

The principle of work is fundamentally electromagnetic.

A typical solenoid valve includes:

Electromagnetic coil

movable armature or plunger.

Valve seat or orifice.

Sealing components

spring

Valve body

Inlets, outlets, exhausts.

The coil, when current passes through it, produces a magnetic field. This field moves the armature to open, close or change the flow direction.

Valve may be either simple on/off valve or more sophisticated flow-control system.

For medical devices small size, high accuracy and repeatability, low leakage, quick response, low power and compatibility with carefully controlled media become critical parameters.

Therefore, the choice of the medical solenoid valve should be made according to the application specification, and not catalog numbers.

- Define the Medium First

The first step in specifying valve is quite obvious:

What gas or liquid will be used in the valve?

Media can be:

Air Oxygen,

Nitrogen (N),

Water

Saline or any other appropriate aqueous solution

Reagent

Cleaning fluids

Vacuum

Other process gases or fluids

3.1 Medium confirmation

Medium compatibility affects almost every aspect of valve selection.

The medium should be considered for body, plunger, spring, diaphragm, seals, lubricants, adhesives and other wetted parts.

A valve suitable for clean air should not be considered as suitable for oxygen, aggressive reagents or biofluid related applications.

In case of equipment that processes sensitive media the detailed information on the composition of the fluid, its concentration, temperature, pressure and duration of the contact should be provided to the manufacturer.

The medical solenoid valve is an integral part of the whole fluid path.

3.2. Choice of Appropriate Valve Configuration

There are several flow configurations for medical valves.

2-Way Valve

2-Way Valve is commonly used for starting or stopping flow and generally has one inlet and one outlet.

It is useful for isolation, gas supply, liquid dispensing and simple on/off control.

3-Way Valves

3-Way valve provides the possibility of connecting a common port to two different flow paths.

This design is useful when the pressure should be alternated with the exhaust, or when the sample should be directed through two different paths.

Multiport Valves

For more complicated medical equipment the manifold, or several flow paths, can be required in order to decrease the amount of tubing and facilitate the assembly.

Correct medical solenoid valve configuration depends on whether the application requires isolation, venting, switching, distribution or other flow control function.

- Comparison of Direct Acting and Pilot Operated Designs 4.1

Another important parameter for selection is valve design.

Direct Action

In direct acting valve the electromagnetic force moves the sealing element directly away from or toward the valve seat.

Direct acting valves work without a minimum pressure differential.

That makes them especially good for:

Low pressure systems.

Vacuum cleaner.

Small flow paths.

Accurate Pneumatic Control

Compact medical devices

Pilot operated

Pilot operated valves use the pressure of the medium to help moving the main sealing element.

They require a minimum pressure differential but provide higher flow rate at relatively low coil power.

Direct acting technology can be beneficial for many compact medical applications with low flow and variable pressure.

But there is no universal solution. The medical solenoid valve design should correspond to the actual pressure and flow conditions of the application.

- Determine the required flow rate

The flow rate is one of the most critical specifications, but the largest valve available is not always the best solution.

A larger valve may provide the following:

Large dimensions.

Large internal space.

Higher electric current.

Higher cost

Weight

But a small valve may provide excessive restrictions.

Flow rate requirements should be determined accurately.

According to the application engineers should consider:

L/min Required

Standard L/min for gases

- Determine Pressure and Vacuum Requirements

The pressure requirements should be specified for the minimum and maximum operating pressures.

Vacuum performance may be important for some medical applications.

Such as:

Suction medical devices.

Diagnostics analyzers.

Laboratory sample systems.

Fluid handling : Negative Pressure

Pressure should be considered not only under normal operation.

Pressure transients, pressure spikes, vacuum level, back pressure and pressure differential across the valve should be considered.

In case of using pilot operation, the minimum pressure differential should be considered.

The margin to the pressure specification of the medical solenoid valve selected for near-edge operation may be less than that of the valve selected for realistic worst-case system conditions.

- Consider leakage

Leakage specification may be very important for many medical applications.

There are two general categories.

Leakage to the outside

External leakage means leakage of the media from the valve to the surrounding environment.

Internal Leakage

Internal leakage occurs by crossing one flow path to another through the closed valve seat.

Some applications may accept some leakage while others require very tight shut off.

The term "zero leakage" cannot be used unless a numerical test specification and defined test conditions are provided.

In case of critical leakage the professional specification of the medical solenoid valve should include the allowable leakage rate, test medium, test pressure and test method.

- Check Compatibility of Wet Materials & Seals

Material should be checked against the actual fluid path.

The valve body and internal materials can be typical such as stainless steel, engineering polymers, brass, elastomers and special materials depending on the application.

Seal materials may be such as:

Silicone EPDM FKM PTFE

FKM

Other elastomers for special applications

No seal material is ideal for every application.

For example material that is highly resistant to one chemical can perform poor against other. Temperature also can affect chemical compatibility.

Depending on the application, the medical-device manufacturers may also have additional requirements for extractable, cleanliness, biocompatibility, sterilization or approved material documentation.

The medical solenoid valve is not automatically qualified for contact with patients or regulated fluid paths just by the presence of the material name. Suitability should be tested for the intended application.

- Consider Response Time and Repeatability

Some applications switch a few times per hour. Some applications require fast and repeated actuation.

Response time depends on:

Coil design

Voltage

Weight of armature

Spring power

Strokes

Fluid pressure

Rubbing

Valve construction

Quick response may be critical for respiratory devices, pneumatic controls, diagnostic equipment, dosing and automated laboratory systems.

Repeatability is also important.

Valve that reacts fast during initial tests, but shifts noticeably during increase of the temperature may not be suitable for the precise device.

While selecting the medical solenoid valve engineers should find out how the response time is specified and what was the voltage, pressure, temperature and medium used for the measurements.

- Selection of the correct voltage and power consumption

Common DC supply voltages can be:

3V DC 5V DC

DC 6V DC 12V DC 24V

The correct voltage is defined by the electrical design of the equipment.

For portable battery-powered equipment low power consumption is especially important.

Power consumption is important because of another reason, heating.

During energization the coil converts some of its electrical energy into heat. This heat may affect electronics, sensors, plastics, tubing or fluid temperature in the small machine without sufficient airflow.

Thus, in case of selection of medical solenoid valves voltage, current, wattage, duty cycle, ambient temperature and available heat dissipation should be considered simultaneously.

- Thermal and duty cycle characteristics

Not all valves are designed to be energized constantly.

Continuously energized valve may require different coil design compared to the valve energized for 100 milliseconds in each machine cycle.

Too high coil temperature may:

Increase resistance

Decrease magnetism and force

Affect Valve Response

Accelerate aging

Decrease life span of components

Increase temperature of the components

Engineers should specify whether the operation is continuous, intermittent, or pulse.

In case when reduced power is important the discussion of the holding current techniques or optimized coil design should be conducted with the manufacturer.

For medical solenoid valves the ideal solution is thermal testing of the valve before installation in the final product.

- Evaluate noise and vibration

Noise may be the specification that gets often overlooked in industrial machinery, but it becomes crucial in patient-facing medical equipment.

The click of the armature reaching the end of the stroke may be heard when the valve is actuated.

This noise may affect the overall experience with the product for bedside equipment, respiratory devices, portable systems or equipment used in quiet environments.

Mechanical shock and vibration may affect delicate local components.

If low noise is a requirement this specification should be included during the discussion of the application with the medical solenoid valve manufacturer, and not during the discussion of noise after testing prototypes.

- Check Operating Life

Medical equipment might operate through millions of switching cycles throughout its entire life span.

Inquire about the definition of operating life of medical equipment vendors.

It will make "one million cycles" statements much more comprehensible, if the testing conditions will be indicated as well:

Pressure

Frequency

Voltage

Middle

Temperature:

Duty cycle (%) of valve activation

Leakage acceptance criteria

Operating life and accelerated life testing results might differ.

Therefore, it is recommended to test medical solenoid valves in such conditions which simulate application of the equipment.

- Why should [Weilong](#) be selected for medical solenoid valve development?

Selecting of the supplier can be more than just choosing of an existing component for an OEM manufacturer. Some special requirements can be put on valve: a certain range of pressure, flow rate, voltage, size, packaging and mounting, connectors, fluid-control function etc.

Weilong defines itself as an engineering oriented manufacturer with the capability of structural design, prototyping, tooling, testing, manufacturing and custom development of solenoids and solenoid valves. The current portfolio of products includes other electromechanical products like pumps, proportional valves and medical valves.

This product portfolio gives the additional advantage for OEM projects with a necessity of using several different fluid control components. For example, an application can require on/off valves in one part of the system, proportional flow control in another part and a small pump in the third one.

Quality Management is one of the criteria of selection of supplier. Weilong claims to have the quality-management systems certified in accordance with ISO 9001 and IATF 16949. It indicates the processes of design validation, process control, testing, traceability and continuous improvement.

A good discussion with the supplier will include topics like flow rate, pressure, leakage, response time, power consumption, materials, temperature, operating life, noise, size and production volumes.

This can help to detect design errors at the earlier stage and smooth the transition from prototype testing to production. If you have a project in hands and need a solution, please contact Weilong sales team today.

Contact email : weilongsolenoid@gmail.com

Mobile/WeChat/Wahtsapp : 86 136 4298 0378

- Frequently asked questions regarding medical solenoid valves

What is a medical solenoid valve?

Medical solenoid valves are electrically operated valves which are used to control the flow of gas or liquid in medical, diagnostic, laboratory or health care equipment. Internal armature movement is caused by the electromagnetic coil in order to open, close or redirect the fluid path .

Applications of Medical Solenoid Valves

Applications include ventilators, oxygen equipment, anesthesia systems, diagnostic analyzers, laboratory automation, suction equipment, dialysis related systems and other devices requiring automated gas or liquid control.

What is the distinction between a 2-way and 3-way medical valve?

In general a 2 way valve controls the flow of media from inlet to outlet. This allows changing , exhausting or diverting the media among different flow paths . Third port is used in a 3-way valve .

Do I want a normally open or a normally closed valve?

It depends on the fail state of the equipment. Normally closed valve stops the flow of media while being de-energized and normally open valve allows flow without electrical power. The selection should be determined by the safety and functional requirements of the equipment.

What voltage is preferable for medical solenoid valve?

There is no preferable voltage. The valve has to be compatible with the equipment's electrical system. Typical voltages are 5V, 12V and 24V, depending on the product. The availability depends on the valve design.

How important is the leakage performance?

Leakage is important, especially in gas isolation, vacuum systems, precise fluid control or sensitive analytical applications. Indicate the permissible internal and external leakage and the conditions of its measurement.

Choosing the Correct Valve Material

First of all you should take into account the process medium, temperature, pressure, cleaning method and material requirements of application. All wetted parts including body, seals, plunger, diaphragm, lubricants and adhesives are to be checked.

Are medical solenoid valves designed for continuous duty?

Some are, some are not. Before running the valve in continuous mode, check the coil duty cycle, power consumption, allowable temperature rise, ambient conditions and manufacturer's operating specifications.

When should I use a proportional valve instead of an on/off valve?

Simply start, stop, or change flow paths using an on/off valve. For continuous variation of flow or pressure in response to an electrical control signal, use a proportional valve.

What information is required to order a custom medical solenoid valve?

Process medium, flow rate, pressure, leakage requirement, voltage, duty cycle, temperature, response time, desired valve configuration, port style, available installation space, wetted material requirement, required service life, annual volume and special quality requirements.

- Conclusion

The correct selection of medical solenoid valve should be performed on system level.

Start with the medium and determine how the valve has to operate with it. Then define the flow rate, pressure, vacuum, leakage, temperature, electrical supply, duty cycle, response time, operating life, dimensions, materials, cleanliness and environmental requirements.

Do not select the valve just because of its port size, voltage or price.

A valve satisfactory in one medical application might not be suitable for another because its media, operating pressure, flow rate accuracy, thermal environment or reliability requirements are absolutely different.

For OEM projects the early cooperation with the valve manufacturer is highly recommended. With the right operating conditions engineers will be able to select the suitable standard product or customize the valve.

For detailed product specifications or to discuss custom solenoid requirements, reach out through:
<https://www.smartsolenoid.com/>



Media Contact

Weilong Technology

*****@gmail.com

<http://www.smartsolenoid.com/>

Source : Weilong Intelligent Technology Co., Ltd.

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