

OPERATING INSTRUCTIONS

Version 1.1

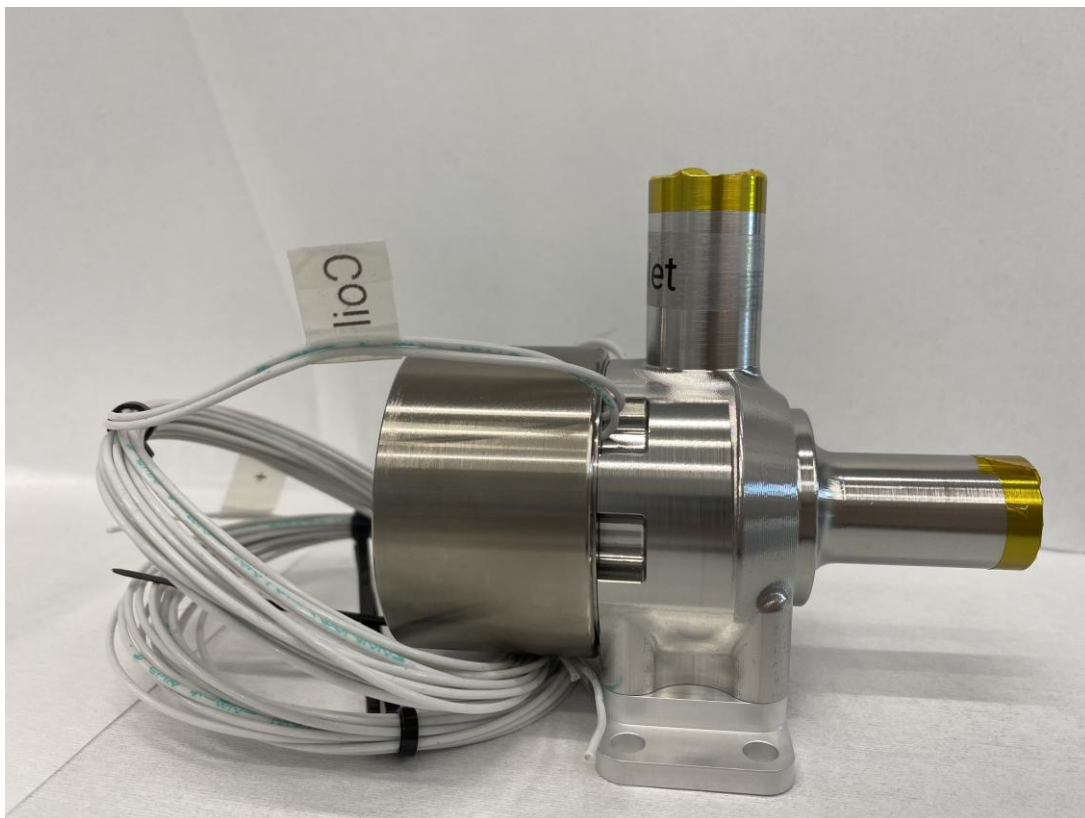
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Manufacturer

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Product

Solenoid Valve L17-Family



Changelog

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TABLE OF CONTENTS

1	SAFETY	4
2	VALVE CONFIGURATIONS	5
	L17-Family – References	5
3	HANDLING	6
3.1	Regular Handling	6
3.2	Cleanroom Handling	6
4	INTERFACES	7
4.1	Mechanical Interfaces	7
4.2	Fluidic Interfaces	7
4.2.1	Valve without purge ports	7
4.2.2	Valve with purge ports	8
4.3	Electrical Interfaces	9
5	INSTALLATION	10
5.1	Fluidic Installation	10
5.1.1	Valve with purge ports	10
5.2	Mechanical Installation	11
5.3	Electrical Installation	11
6	Operation	12
6.1	Commissioning	12
6.2	Nominal Operation	12
7	STORAGE	14
7.1	Regular Storage	14
7.2	Cleanroom Grade Storage	14
8	TROUBLESHOOTING	15
9	PACKING	17
9.1	Regular Packaging	17
9.2	Cleanroom-grade packaging	17
10	TRANSPORTATION	18

1 SAFETY



SAFETY

Strict compliance with these operating instructions is essential for the safe and enduring use of this product. No warranty is given in case of non-compliance with the operating instructions or improper handling of the product. This product is intended exclusively for use with the fluids specified in the respective data sheet of the valve. Use of the product under conditions not specified in the data sheet or contrary to the instructions contained therein is understood to be IMPROPER. The manufacturer assumes no liability for damage or loss resulting from improper use of the product.

No warranty is given in case the customer opens the product without prior written agreement of deltaVision GmbH.



WARNING

- The generally applicable safety regulations must be observed when planning, installing, and using the product. This encompasses, but is not limited to, regulations regarding safety in working with electrical systems, pressurized systems and hot objects.
- Appropriate measures must be taken to prevent unintentional incorrect handling or damage to the product.
- Valves or connections in the system must not be unscrewed or dismantled under pressure. Before dismantling pressure lines, make sure that they are depressurized.
- Before any intervention in the system, the supply voltage must be disconnected.
- Beware, there are permanent magnets in the L17 family valves. Keep parts sensitive to magnetic fields from direct proximity to the valves.



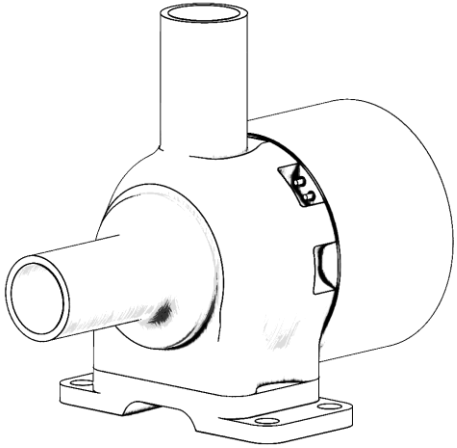
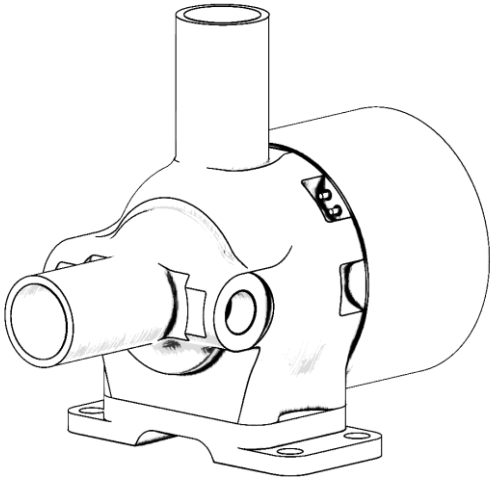
DANGER

Risk of injury! The coil can reach high temperatures during operation. Do not touch the valve during operation. Allow the valve to cool down for a couple of minutes after operation before touching it.

2 VALVE CONFIGURATIONS

L17-Family – References

The entire manual is applicable to the entire L17 valve family, except for the sections referenced in the table below, which provide model-specific operational details.

	<i>Valve without Purge Ports</i> For model-specific operational details, see Section 4.2.1
	<i>Valve with Purge Ports</i> For model-specific operational details, see Section 4.2.2 Section 5.1.1

3 HANDLING

Before opening any packaged valve, ensure that you identify the grade of cleanliness. If a note on the vacuum-sealed bag containing the valve indicates a cleanroom-processed grade, the steps outlined in Section 3.2 must be followed to warrant that the level of cleanliness is maintained. If no indication is present, follow the steps in Section 3.1.

3.1 Regular Handling

Open and handle the package and its contents only on a stable and clean surface, free from dust, chips/shavings, oil, and other substances. Remove the vacuum-sealed bag from the parcel and place it carefully onto the stable and clean surface. Cut open the vacuum-sealed bag at one of its sides with a clean, sharp knife or pair of scissors. Ensure that you do not damage the valve inside by keeping the utilized blades far from all parts of the valve, especially the cables. Remove the bubbled-wrapped valve from the vacuum bag and place it carefully on a stable, clean surface. Then start unwrapping the bubble wrap. Inside, you will find a hermetic plastic bag containing the valve. Always handle the valve with clean, washed hands or while wearing powder-free disposable gloves (e.g., from nitrile, latex, or similar materials)! Prepare yourself accordingly before opening the bag. Do not remove the orange Kapton tape covering the fluidic ports! To install the valve in a fluid system, follow the steps outlined in Section 5.1. When the valve is not in use, ensure it is stored in accordance with the procedures outlined in Section 7.

3.2 Cleanroom Handling

Open and handle the package and its contents only on a stable and clean surface, free from dust, chips/shavings, oil, and other substances. Remove the vacuum-sealed bag from the parcel and place it carefully onto the stable and clean surface. Cut open the vacuum-sealed bag at one of its sides with a clean, sharp knife or pair of scissors. Ensure that you do not damage the bubble-wrapped anti-static bag inside! Remove the bubbled-wrapped anti-static bag from the vacuum bag and place it carefully on a stable, clean surface. Then start unwrapping the bubble wrap. Inside, you will find a hermetic anti-static plastic bag containing the valve in a sealed extra bag. Do not open any contents of the anti-static bag outside of a cleanroom! Bring the bag near a cleanroom. Before entering the cleanroom with the bag, wipe the entire bag down with a lint-free wipe wetted with isopropyl alcohol (>90% concentration). Afterwards, blow all sides with pressurized, dry, and filtered gas and immediately commence entering the cleanroom. Inside, open the anti-static bag and remove the sealed bag containing the valve. Cut open the sealed bag at one of its sides with a clean, sharp knife or pair of scissors. Ensure that you do not damage the valve inside by keeping the utilized blades far from all parts of the valve, especially the cables. Always handle the valve while wearing powder-free disposable gloves (e.g., made from nitrile, latex, or similar materials), a cleanroom suit, and a hairnet. Prepare yourself accordingly before opening the bag. Do not remove the orange Kapton tape covering the fluidic ports! To install the valve in a fluid system, follow the steps outlined in Section 5.1. This shall only be done inside a cleanroom. The valve may only be removed from the cleanroom when its outlets are connected to a closed fluid system (see Section 5.1) or are securely capped (see Section 7). Beware that removing the valve from a cleanroom environment without putting it in a hermetically sealed bag or container beforehand, even with capped/connected fluid ports, will void the cleanliness standard of its outside. When the valve is not in use, ensure it is stored in accordance with the procedures outlined in Section 7.

4 INTERFACES

4.1 Mechanical Interfaces

There are four clearance holes in the bottom mounting plate of every valve. For dimensions, refer to the respective datasheet.

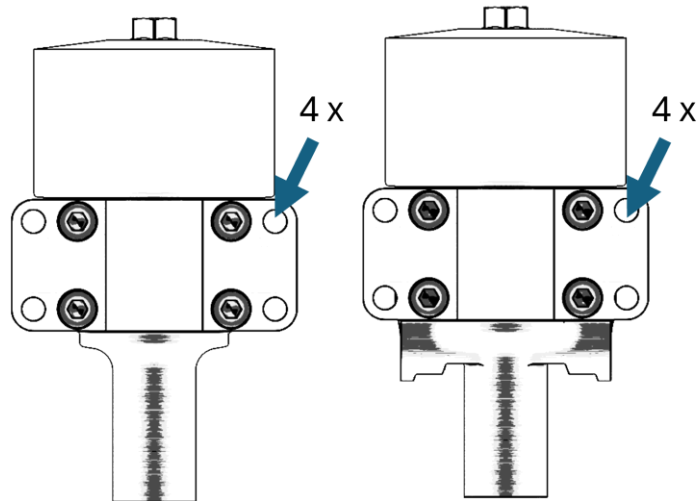


Figure 1: Mechanical mounting interface of the L17 family valves

4.2 Fluidic Interfaces

4.2.1 Valve without purge ports

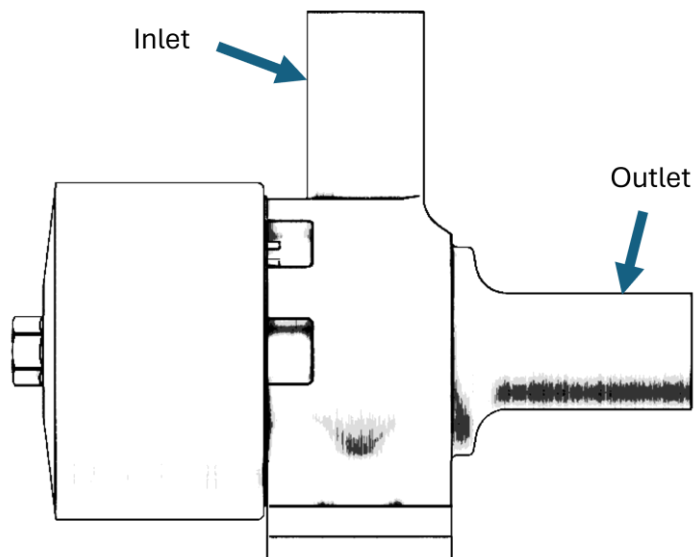


Figure 2: Fluidic interfaces of an L17a valve (no purge)

4.2.2 Valve with purge ports

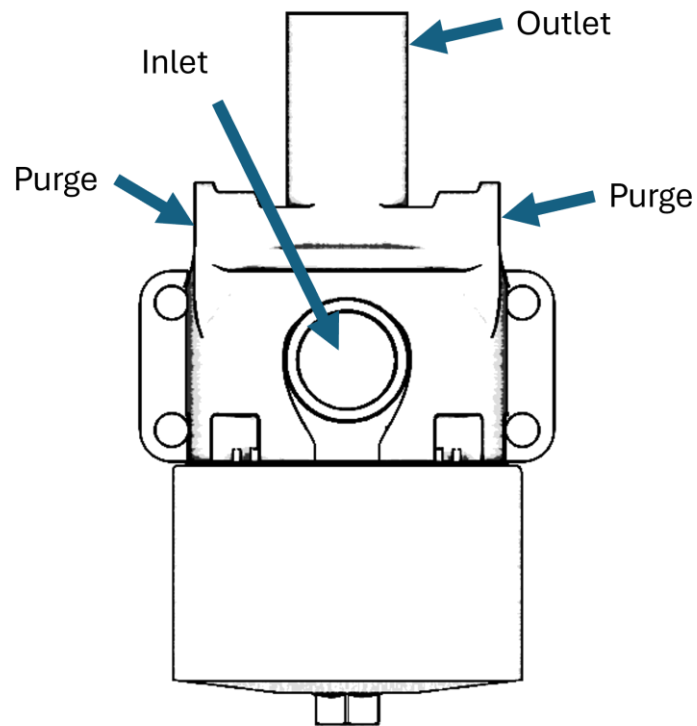


Figure 3: Fluidic interfaces of an L17a (with purge), top view

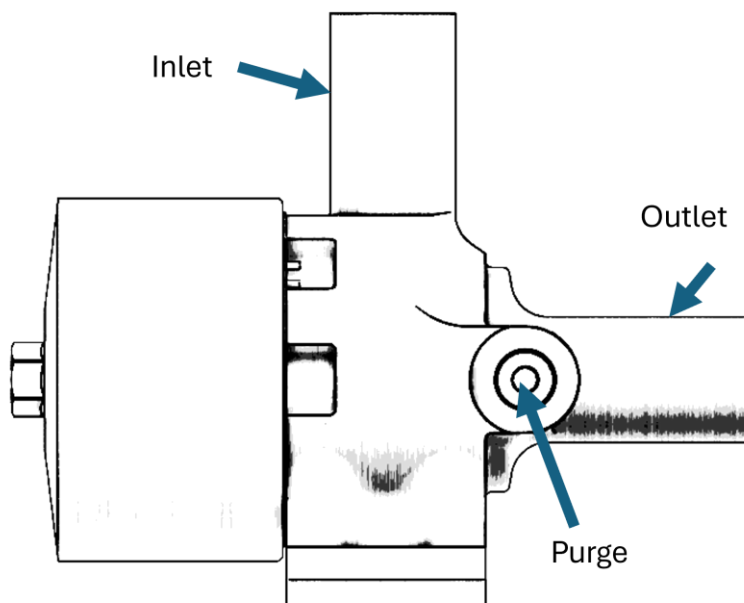


Figure 4: Fluidic interfaces of an L17a (with purge), side view

4.3 Electrical Interfaces

There are two tuples of cables in the valve. Each tuple powers one of the two internal coils, each of which is capable of fully actuating the valve, making it a redundant actuation system.

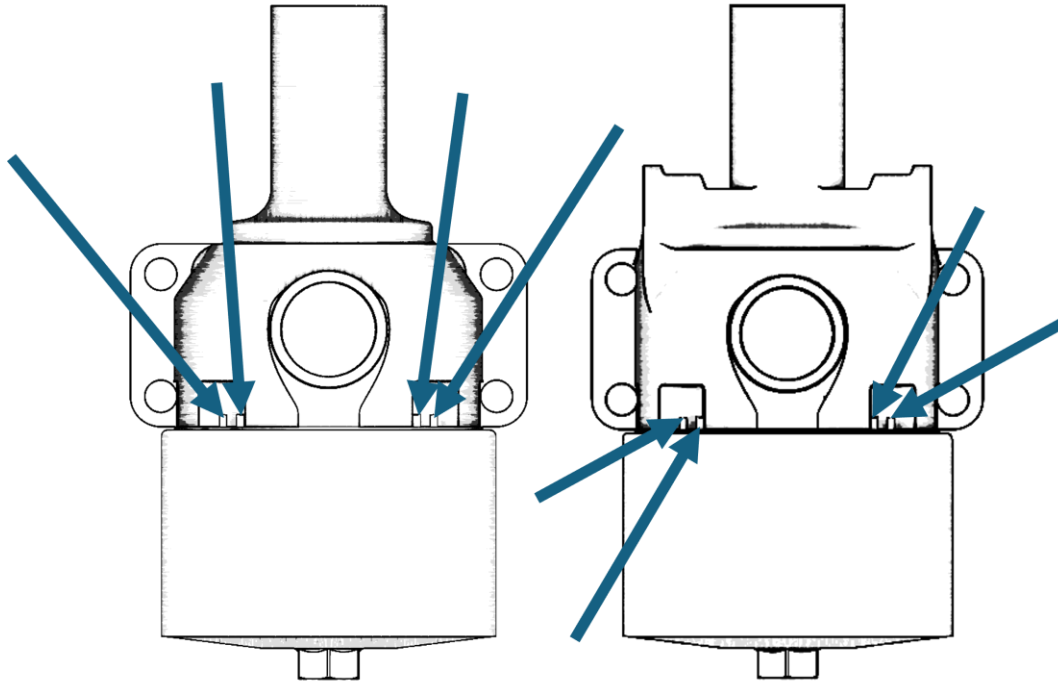


Figure 5: Electrical interfaces of the L17 family valves

5 INSTALLATION

Ensure that you always follow the handling instructions outlined in Section 4, relevant to your product, during the installation process.

5.1 Fluidic Installation

Ensure the valve is not connected to any power source before installing it. When not installed in a fluid system, all valve ports must always be covered with clean caps/plugs or Kapton tape. Only remove the covers immediately before installing the valve into a fluid system to prevent contaminants from entering and potentially impairing its functionality. All tubing connected to the valve must be free from dust, chips/shavings, oil, and other substances before installation. Only operate the valve with an appropriate filter (pore size of $\leq 50 \mu\text{m}$) installed upstream of its inlet. If the outlet is connected to an environment with a lower cleanliness grade than the valve itself, measures must be taken to prevent contaminants from entering the valve. This can be achieved by installing an appropriate filter (pore size of $\leq 50 \mu\text{m}$) or a check valve downstream of the valve.

The inlet and outlet of the valve are tubes that can be connected to a fluid system using either an appropriate tube fitting system or orbital welding to an existing metal tubing system. For applying a tube fitting system (offered by companies such as Swagelok Company or FITOK Group), choose a ferrule set that fits the outer diameter of the valve's inlet/outlet tubes (refer to the respective data sheet of the valve) and swage it according to the manufacturer's specification. Ensure the material of the ferrules is applicable for installation on the tube material of the valve.

When welding the valve into a fluid system, take appropriate measures to ensure the valve, apart from the inlet/outlet tubes, is not heated beyond the permissible maximum operating temperature (refer to the respective data sheet of the valve), as this could permanently damage the product. If the application of corrosive media is projected, ensure an appropriate amount of purge gas is used during the welding process to not compromise the material's corrosion resistance at the welding seam. For optimal results, we recommend testing and calibrating the welding process with a test tube from the same material and with the same dimensions as the valve's inlet and outlet. For exact material information, refer to the respective data sheet of the valve.

5.1.1 Valve with purge ports

If the model contains purge ports, screw-in fittings of an appropriate thread size must be used to connect fluid lines to the ports. If only one purge port is used, the other one must be closed with a screw-in plug of the same thread size. For information on the thread size of the port, refer to the respective data sheet of the valve. To seal the screw-in fitting/plug, apply a flat seal ring (from a material suitable for the applied media) fitting for the thread size on the shoulder of it. Furthermore, add an O-ring (inner diameter $\varnothing 6 \text{ mm}$, thickness $\varnothing 1 \text{ mm}$) made from FFKM (hardness $\leq 80 \text{ Shore A}$) in the bottom of the purge ports (see Figure 6). Then, tighten the screw-in fitting/plug with a torque wrench to 20 Nm. When countering with a wrench/vice against the valve housing, use only the key width provided directly around two sides of the purge ports. To prevent contaminants from entering the valve through the purge port, an appropriate filter (pore size of $\leq 50 \mu\text{m}$) must be installed upstream of the purge port in the feed line connected to it. The feed line can be connected to the fitting via an appropriate tube fitting system or orbital welding. For this, note the remarks in Section 5.1.

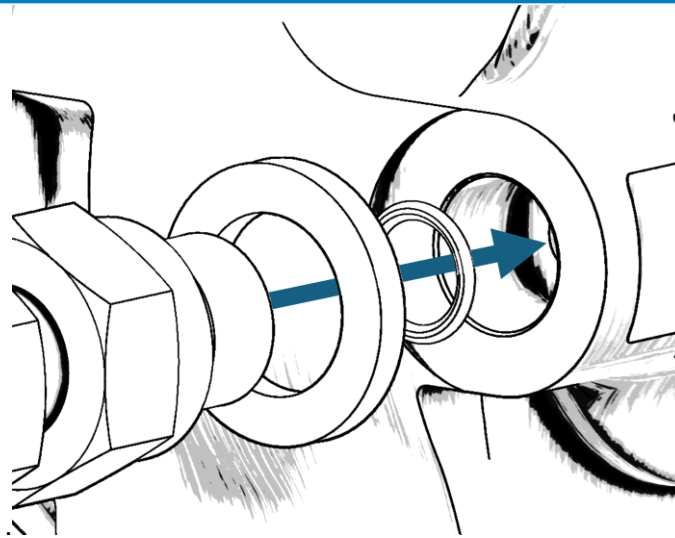


Figure 6: Seal assembly for a purge port fitting/plug

5.2 Mechanical Installation

The valve should be bolted to a sturdy surface using the clearance holes depicted in Section 4.1 and ISO 4762 or ISO 14579 cylindrical head screws. Insert the bolts from the side of the valve inlet into the mounting plate. The bolt size is to be chosen to fit the hole diameters (refer to the respective data sheet of the valve). The mechanical mounting should be implemented in a way that ensures there are no external strains on the valve's fluidic and electrical connections. The rigidity of the structure to which the valve is mounted, as well as the bolt material and the torque used to tighten the mounting bolts, should be chosen depending on the external forces acting on the valve (such as acceleration/vibration forces). Appropriate measures should be taken to prevent bolt loosening, depending on the expected vibrations the system will experience.

5.3 Electrical Installation

Each of the two cable tuples of a valve (see Section 4.3) forms the connection of one of the internal coils. They are each labelled with the respective polarity of the cable. If the cable is to be shortened, ensure that a record of this polarity assignment is kept. To connect the valve's cables, first remove 6 mm of insulation from their ends using stripping tongs suitable for the cable diameter (refer to the respective data sheet of the valve). To prevent damage to the cable core, press appropriately sized wire-end ferrules on the open wire ends using a crimping tool or install a plug. Use a multimeter to measure the resistance of each coil by measuring between the cables of each tuple and comparing it to the given values from the respective datasheet of the valve to verify there is no damage to the coils. Verify whether the temperature of the valve body falls within the same range as the temperature specified for the resistance in the datasheet, as different temperature levels influence the coil resistance. If the values are within specification, attach all four crimped wire ends/plugs to a suitable solenoid driver or power source with current reversal capability (for power requirements, refer to the respective data sheet of the valve) according to their polarity. One suitable solenoid driver is the SDA driver by deltaVision. For details on its installation, refer to its user manual. Ensure that no mechanical strains are placed on the cables during installation and in the final position. Should the cable length not suffice, do not attempt to pull on the cables, but elongate them by soldering an extension cable of the same specification as the original one (refer to the respective

data sheet of the valve for details on the cables) to its ends. Make sure to keep a record of the cables' polarity while doing so and apply suitable electrical insulation over the soldered joint.

6 OPERATION

Before beginning nominal operation, ensure that you follow the steps outlined in Section 5. Additionally, before every first usage in a system, perform the actions described in Section 6.1.

6.1 Commissioning

As the L17 family valves are bi-stable, first verify the internal state of your valve. To do this, apply a low pressure of an inert gas (such as Nitrogen) in the order of magnitude of 5 bar upstream of the valve. Afterwards, detect whether there is flow through the valve. This can be achieved by measuring the flow or pressure downstream of the valve. If flow or an elevated pressure is detected, this means the valve is currently in an open state. Alternatively, if there is an outlet to ambient conditions connected to the system downstream of the valve, a flow can also be detected audibly. If no flow can be detected by the described measures, the valve is in a closed state. Record the position as a baseline, as every actuation will change the internal valve state. To always know the current state of the valve, keep a record of the last actuation and the respective achieved state. If compliance with this should fail, the internal valve state can be determined by re-performing the aforementioned steps.

Before commencing nominal operation, we recommend conducting the following functional tests to verify the product's full functionality and to rule out any potential damage from transport that may impair its performance. Actuate the valve a couple of times (around 5 times suffices) by powering it and reversing the current direction or controlling it via a suitable solenoid driver to verify the actuator's functionality. Adhere to the nominal supply voltage given in the valve's respective data sheet. Afterwards, make sure the valve is in a closed state, before applying an inert gas (such as Nitrogen) at the maximum expected operating pressure (MEOP) of the system upstream of the valve. Ensure beforehand that the MEOP of the system is within the permissible operating range specified for the valve in its respective datasheet. Perform a flow measurement downstream of the valve to detect any potential leakage exceeding the value for internal leakage specified in the respective datasheet of the valve. If no behaviour outside of specification is detected, the valve can be operated nominally. When no flow measurement is possible, a pressure measurement upstream of the valve can pose an alternative way to test the valve's tightness. However, this will only lead to tangible results if the tightness of the fluid system upstream of the valve is qualified against external leaks exceeding the internal and external leak rates specified in the datasheet of the valve.

6.2 Nominal Operation

The valve has two possible internal states: "open" and "closed". Both are stable and kept after the last actuation, bringing the valve into one of the two states. Starting from a known internal valve state (if it is unknown, refer to Section 6.1 to determine it), power the valve with the nominal voltage given in its respective data sheet. For bringing the valve into the opposite internal state, the actuation voltage must be applied in the reverse direction. Figure 7 shows the qualitative actuation curve (current-time-plot) created by opening against the valve's maximum differential pressure (between upstream and downstream side) and closing it afterwards. The valve is to be powered only during actuation, meaning pulses. After the desired internal state is reached, ensure that the valve is no longer powered, as this will cause the actuator coil to heat significantly over time. Before

touching the valve during or after the operation, ensure it is not powered. To avoid potential burns, always verify whether the cylindrical housing of the valve is hot before touching it. This can be done with a thermometer. If no thermometer is available, always hover your bare hand a few millimetres over the cylindrical part of the valve. If you feel any heat radiating from the valve, proceed with caution and only touch the valve wearing protective gloves suitable to shield against elevated temperature levels (such as insulated gloves compatible with high temperatures or leather gloves). Before disconnecting and transporting the valve with your hands, even when wearing gloves, hold it in the mechanically installed state for 10 seconds. If you start to feel uncomfortable levels of heat, release the valve and allow it to cool for 5 minutes before retrying.

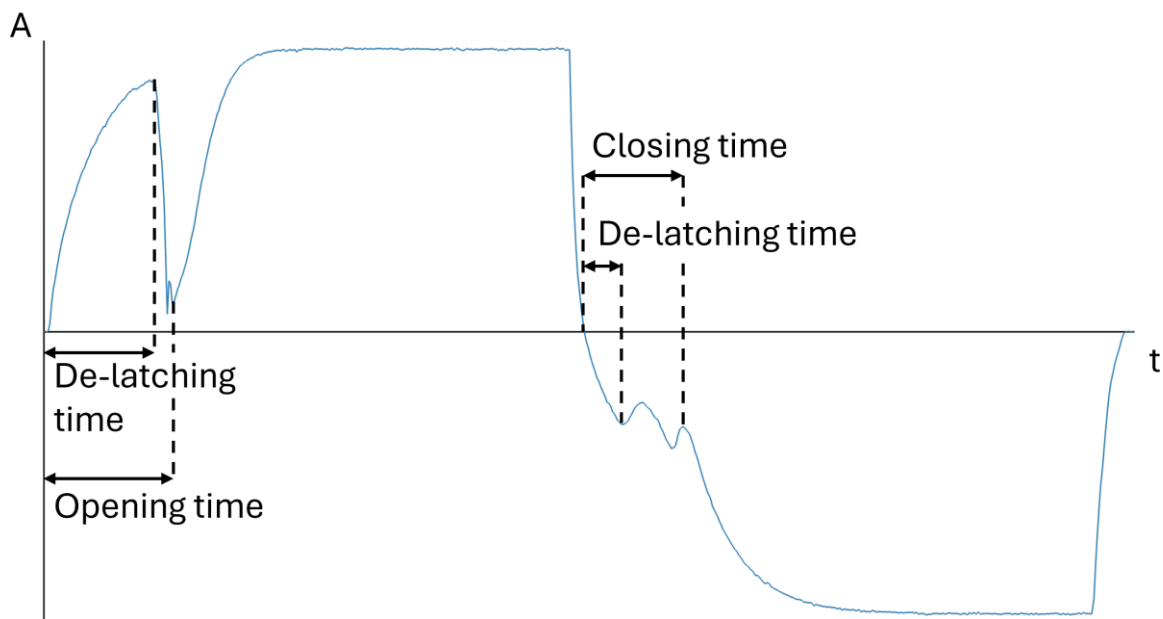


Figure 7: Qualitative current draw over time for an L17 family valve.

When working with an SDa solenoid valve driver by deltaVision GmbH, refer to the respective user manual for operational instructions.

7 STORAGE

In case the valve is not used in a fluid system, it must be appropriately stored to maintain its full performance capabilities. Depending on the cleanliness level of the product, adhere to the following respective steps. When uninstalling a valve, first disconnect its cables from the power source, roll them up, and secure them with a suitable measure, such as zip-ties. Be sure not to pinch any cables while doing so to prevent potential damage.

7.1 Regular Storage

After all cables are disconnected and secured, you can disconnect the fluidic connections one at a time. Ensure to directly close each valve port after disconnecting it. When a tube-fitting system is utilized to connect the valve, this may be done by applying suitable-sized, clean stainless-steel caps, free of chips/shavings, oil, and other substances. If no caps are available, the ports can be closed by applying clean Kapton tape on the ports. Ensure the tape is applied securely, with no gaps remaining. Do not use any tapes that leave residues, such as duct tape! After all fluidic connections are removed and the ports closed off as aforementioned, you may remove the mechanical mounting. Ensure that the valve is suitably supported before removing the last bolt securing the valve, to prevent it from dropping. After the valve is uninstalled, put it in a clean, sealable bag or container that does not contain any sharp objects. Make sure the cables are not pinched while doing so. Then store it in a clean, cool, and dry place.

7.2 Cleanroom Grade Storage

Only start disconnecting the fluidic connections once the valve is in a cleanroom environment! After the connections are removed, close each valve port. When a tube-fitting system is utilized to connect the valve, this may be done by applying suitable-sized, clean stainless-steel caps, free of chips/shavings, oil, and other substances. If no caps are available, the ports can be closed by applying clean Kapton tape on the ports. Ensure the tape is applied securely, with no gaps remaining. Only use caps or tape that meets cleanroom standards. Do not use any tapes that leave residues, such as duct tape! After all fluidic connections are removed and the ports closed off as aforementioned, you may remove the mechanical mounting. Ensure that the valve is suitably supported before removing the last bolt securing the valve, to prevent it from dropping. After the valve is uninstalled, put it in a clean, hermetically sealable bag or container that does not contain any sharp objects. Only then may you remove the valve in its packaging from the cleanroom environment. Store it in a clean, cool, and dry place.

8 TROUBLESHOOTING

There are numerous potential failure cases that may occur over a valve's lifecycle. The following presents a non-comprehensive list of relevant problems that may be encountered and how they may be addressed.

Problem	Measures
The valve does not actuate	Verify that the applied upstream pressure is within the valve's specifications.
	Check whether the valve is correctly connected to the power supply (note the polarity) and the cables are intact (no pinches or damage to their exterior).
	Check whether the power supply is functioning properly and supplying the correct voltage within the valve's nominal specifications. If feasible, supply the valve with a voltage at the upper end of its specification range.
	Perform a resistance measurement and continuity test of the coil with a multimeter. ▪ If the resistance deviates significantly from the value specified in the datasheet, see if the valve is hot. If it is, let it cool and retry the valve. If the deviation persists, please contact deltaVision. ▪ If there is no continuity, contact deltaVision.
The valve leaks	Ensure the valve is in its closed position. If unsure, follow the steps outlined in Section 6.1.
	Verify that the fluid system is clean and free of contaminants. ▪ If contaminants are detected, clean the system ▪ Look into the valve's ports under a microscope to check for contaminants ○ If contaminants are detected, flush the valve with > 99% concentration isopropyl alcohol and purge it with a dry, filtered inert gas afterwards ▪ If the leakage remains, contact deltaVision Under no circumstances open the valve without prior written authorization by deltaVision GmbH, as this will void the warranty!
The valve exhibits a higher pressure drop than specified	When performing a pressure drop test/Kv test, make sure no T-, cross- or elbow-connections are placed within a distance of 5 times the nominal diameter of the valve. Otherwise, this will distort the measurements.
	Verify that the fluid system is clean and free of contaminants. ▪ If contaminants are detected, clean the system ▪ Look into the valve's ports under a microscope to check for contaminants ○ If contaminants are detected, flush the valve with > 99% concentration isopropyl alcohol and purge it with a dry, filtered inert gas afterwards

	Under no circumstances open the valve without prior written authorization by deltaVision GmbH, as this will void the warranty!
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9 PACKING

9.1 Regular Packaging

Before packing the valve, ensure all fluidic ports are securely closed/capped, and the cables are rolled up and secured without being pinched, as specified in Section 7. Put the valve in a hermetically sealed bag together with a validated desiccant and a humidity indicator card.

Cushion the component securely within shock-absorbent foam and enclose it in a sealed, rigid container. Ensure the container is clearly marked as “Fragile” and “Magnets Inside” along with the component’s model number, identification code, and packaging date. Finally, close the container using tamper-evident tapes or seals to maintain integrity and provide assurance of proper handling.

9.2 Cleanroom Grade packaging

For all packaging efforts inside a cleanroom, exclusively use products cleaned to cleanroom-grade. Ensure the steps in Section 7.2 have been performed inside a cleanroom environment! The bag with the valve shall be added with a validated desiccant and a humidity indicator card. Afterwards put the hermetically sealed bag with the valve inside another plastic bag and heat-seal it. Place a brightly coloured sticker signifying the bag’s contents may only be opened in a cleanroom on a clearly visible spot on the outside of the bag. Only then may the bag with its contents be removed from the cleanroom environment! Cushion the component securely within shock-absorbent foam and enclose it in a sealed, rigid container. Ensure the container is clearly marked as “Fragile”, “Magnets Inside” and “Cleanroom Grade Components Inside” along with the component’s model number, identification code, and packaging date. Finally, close the container using tamper-evident tapes or seals to maintain integrity and provide assurance of proper handling.

10 TRANSPORTATION

To ensure safe and reliable transport, shipments should be maintained within a stable temperature range of 15°C to 25°C, avoiding fluctuations greater than $\pm 5^{\circ}\text{C}$. For added assurance, it is recommended to equip each package with active data loggers to monitor temperature, humidity, and shock throughout transit. Additionally, all shipments should be accompanied by proper documentation, including the transit manifest, cleanliness certificate, and verification of ESD protection, to confirm compliance with handling and quality requirements.