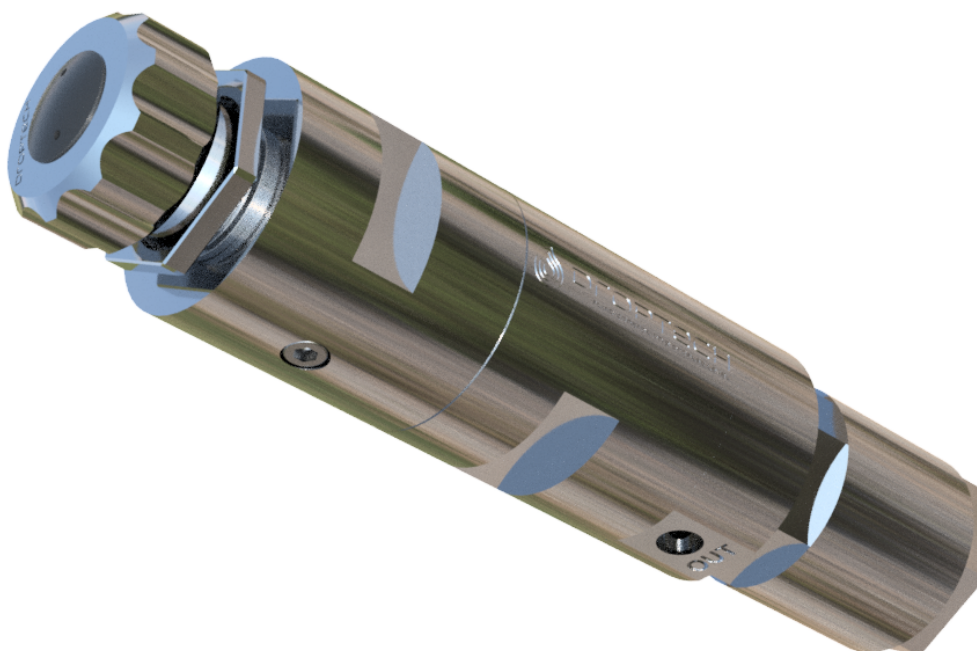


## DT1 - Installation, Operation and Maintenance Manual



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## 1 Introduction

The Droptech DT1 is a variable orifice flow control valve, specialised towards chemical injection, and designed to provide an adjustable flow rate of liquid supplied from a fluid pressure supply unit. The unique feature of the DT1 is its ability to sustain and precisely maintain minute flow rates, and with the same valve configuration able to reach flow rates in excess of 200 l/h. Maximum flow rate is depended on a proper differential pressure across the valve. The DT1 have an *equal percentage* flow rate gain, which makes it easy to accurately control both very low flow rates and very high flow rates.

The required actuation force on the DT1 is only slightly affected by fluid pressure and it is designed to be used either manually or with a variety of different rotary and linear actuators. If the valve is to be operated in an environment with large variations in upstream and/or downstream pressure and/or large fluid viscosity variations, it is recommended to install the DT1 in a control loop with a valve actuator and a dedicated flow sensor.

The valve is designed by craftsmen, for craftsmen. With a high focus on simplified maintenance, few parts and assembly principles that are easy to understand. The valve can easily be integrated and adapted into both new and existing infrastructure.

### 1.1 Key Specifications

- Operating pressure range: 0.1 - 690 barg / 1 - 10,000PSI(g).
- Min. flow rate: 0.01l/h or lower, depending on pressure drop and fluid parameters.\*
- Max. flow rate: 200l/h or higher, depending on orifice, pressure drop and fluid parameters.
- Equal percentage flow gain.
- Operating temperature: -20°C - 85°C.
- Design temperature: -20°C - 120°C.
- Valve housing material in S316L (options available).
- Vetted seals in FKM (Viton A) or FFKM
- Weight 5.3kgs (with manual actuator).
- Pressure balanced valve stem for low torque requirement on valve handle.
- Screw type body connections for fast assembly and disassembly.
- Multi-orifice options are available for high maximum flow rates or high flow gain responses.

\*The DT1 has a calibrated leakage rate that define minimum flow rate. The minimum flow rate is dependent on fluid parameters and pressure drop across the valve.

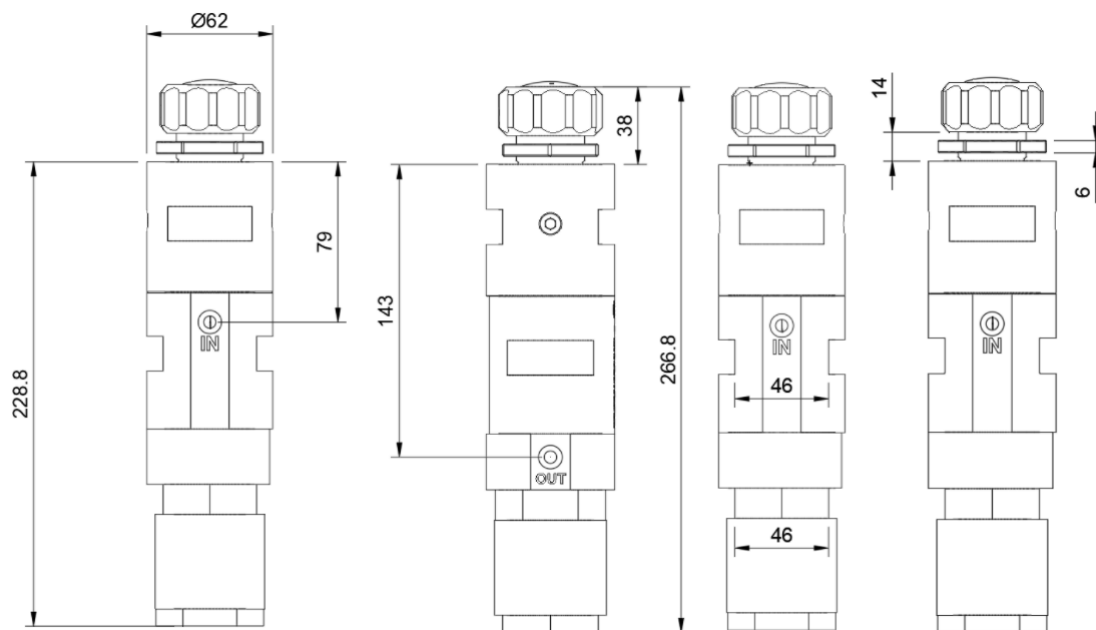


Figure 1: DT1 - Dimensions

### DT1 Technical Details

Name	Flow rate ID	Dp range	Pressure rating	Connections
DT1	55 / 75 / 90 / s*	1 - 150 barg**	690 barg	1/4" BSPP - 1/4" NPT - 1/4" Autoclave

\*Special orders available, contact Droptech for additional information.

\*\*Proven up to 600 barg dp, however restrictions due to cavitation.

### DT1 Materials and Dimensions

Metallic components	Non-metallic components	Length	Diameter	Weight
316L/SS*, 304, CW307G, NKT40	PTFE, FKM and/or FFKM	275mm	62mm	5.3kg

\*Options available.

### DT1 Flow Performance - Orifice Size

Flow ID	Range @10barg dp	Range @50barg dp	Range @100barg dp	Test fluid data
-55-	0.01 - 15 l/h	0.01 - 63 l/h	0.01 - 97 l/h	29cSt 858kg/m <sup>3</sup>
-75-	0.01 - 30 l/h	0.01 - 136 l/h	0.01 - 186 l/h	29cSt 858kg/m <sup>3</sup>
-90-	0.01 - 59 l/h	0.01 - 164 l/h	0.01 - 214 l/h	29cSt 858kg/m <sup>3</sup>

Contact Droptech for additional data, other differential pressures, or special orifice sizes.

### Operational limits

Full range turns	Full range linear travel	Valve stem torque limit	Valve stem force limit
38 rotations	38mm / 1.5in	6.4Nm / 4.7ft-lb	1000N / 225lbf

## Order Specification

Example: **DT1-55-VMB** for the DT1 with variable orifice size 0.55mm, Viton A o-rings, actuator body for manual handle or adaptor for rotary actuators, 1/4 female BSPP connection ports.

### Order Specification - DT1-AA-B-C-D

AA - flow range	B - elastomers	C - actuation	D - ports
55	V = Viton	M = Manual or adaptor**	B = 1/4" BSPP
75	F = FFKM	A = Linearly actuated**	N = 1/4" NPT
90			A = 1/4 Autoclave
SS = Special*	S = Special*		S = Special*

\*Special orders available, contact Droptech for additional options.

\*\*Rotary and linear actuators available. Contact Droptech for details.

## 1.2 Marking



## 1.3 Safety Information

- ⚠ Do not use outside specified pressure and temperature limits.
- ⚠ Do not use fluids incompatible with 316L or internal seal materials.
- ⚠ Do not use in explosive atmospheres not suited for ATEX Group II Category 2.
- ⚠ Service and maintenance should be performed by qualified personnel.
- ⚠ Do not perform any maintenance on the valve when the fluid is pressurised.
- ⚠ The valve must be handled with care to avoid damage to body housing.
- ⚠ Care must be used when handling threaded parts. Damage to threads can cause galling or premature wear.
- ⚠ Do not use more than  $6.4Nm$  of torque on the valve Hand Wheel or Center Rod Assembly.
- ⚠ Do not use more than  $1,000N$  of axial force on the internal Center Rod Assembly.
- ⚠ Care must be used to not bend the Center Rod Assembly during maintenance.
- ⚠ The DT1 is not designed to handle large amounts of fluid particle contaminants like sand or metallic debris. If your fluid system is contaminated by such debris it may damage all in-line equipment.
- ⚠ To ensure safe removal or in-line maintenance of the DT1 in a pressurised system, isolation valves upstream and downstream of the DT1 should be installed with the possibility of bleeding internal pressure to equalise atmospheric pressure.
- ⚠ A check valve downstream of the DT1 is also considered good practice to avoid reverse flow from the process. If reverse flow should occur, the DT1 should not be damaged, but other in-line equipment might be damaged by reverse flow.

## 1.4 BOM

The BOM of this document is used as reference for the maintenance steps. Please refer to the document **DT1 General Arrangement Drawing and Detail Cross Sectional Drawing with Parts List** applicable to your DT1 serial number for correct part numbers.

Parts List				
Item	Qty	Part Number	Description	Material
1	1	10-02781	Actuator Body	Stainless Steel 316L
2	1	10-02782	Upstream Body	Stainless Steel 316L
3	1	10-02783	Downstream Body	Stainless Steel 316L
4	1	10-02784	End Cap	Stainless Steel 316L
5	1	10-02760	Mounting Nut	Stainless Steel 316L
6	1	10-02786	Hand Wheel	Stainless Steel 316L
7	1	10-02790	Lock Disk	Stainless Steel 316L
8	1	10-02752	Center Rod Downstream End Stop	Stainless Steel 316L
9	1	10-02791	Center Rod Downstream	Stainless Steel 316L
10	1	10-02789	Center Rod Upstream	Stainless Steel 316L
11	1	10-02748	Sleeve Steering	CW307G
12	1	10-02785	Actuator Screw	Stainless Steel 316L
13	1	10-02762	Washer, Hand Wheel	Stainless Steel 316L
14	2	40-E 0010_ISO 4762 M4 x 8	ISO 4762 M4x10	A4-80
15	1	10-02698	Valve Plug	Wolfram Carbide NKT40
16	1	10-02694	Valve Seat	Wolfram Carbide NKT40
17	2	10-02704	Mupuseal Holder	Stainless Steel 316L
18	2	10-02751	Mupuseal Ring	Stainless Steel 316L
19	2	39-00214	Mupuseal Ø12	KEFLOY
20	1	10-02750	Sleeve Guide	Stainless Steel 316L
21	2	40-G0012	ISO 4762 M6x12	A4-80
22	2	39-00244_DIN 711 - 51103 - 12, SI, NC, 12_68	Thrust Bearing	Stainless Steel
23	1	25-00017 square	Wear Ring 4.2	PTFE
24	1	49-D0004	Set Screw DIN 916 M3x4	A4
25	1	15-00348	Cover	POM
26	1	19C 00528	O-ring	VTON 90
27	1	18A01200	O-ring	VTON 70
28	1	19C 01560	O-ring	VTON 90
29	2	19C 02195	O-ring	VTON 90
30	1	19C 02352	O-ring	VTON 90

Figure 2: 00-00219 Rev.A

## 1.5 Exploded View

The Exploded View of this document is used as reference for the maintenance steps. Please refer to the document **DT1 General Arrangement Drawing and Detail Cross Sectional Drawing with Parts List** applicable to your DT1 serial number for correct part numbers.

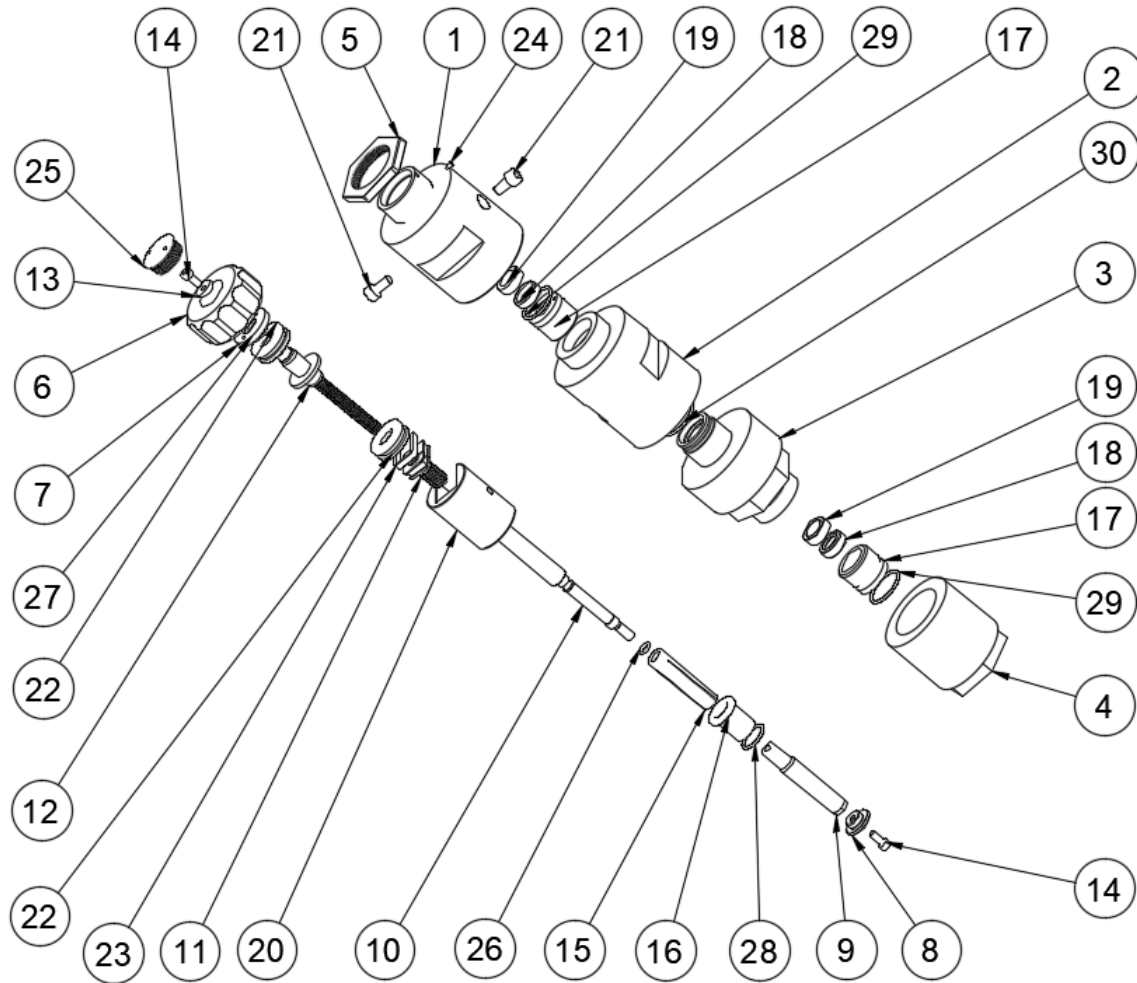


Figure 3: 00-00219\_2 Rev.A



## 1.6 Section View

The Section View of this document is used as reference for the maintenance steps. Please refer to the document **DT1 General Arrangement Drawing and Detail Cross Sectional Drawing with Parts List** applicable to your DT1 serial number for correct part numbers.

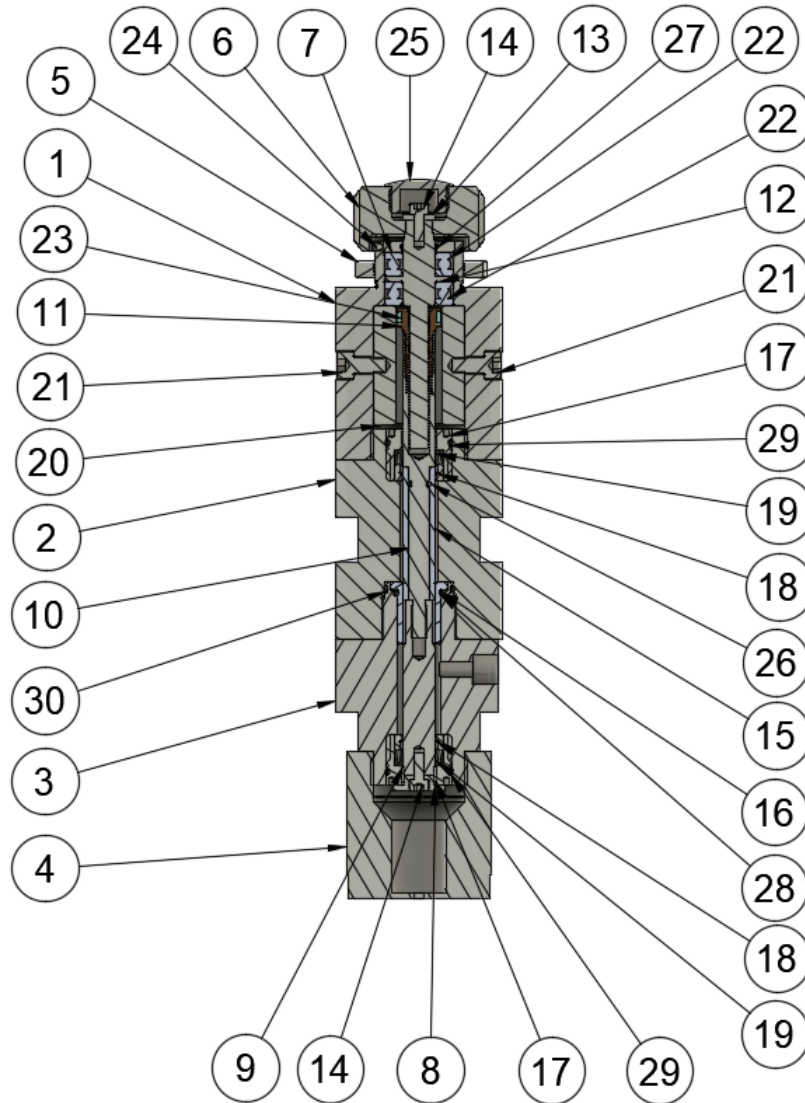
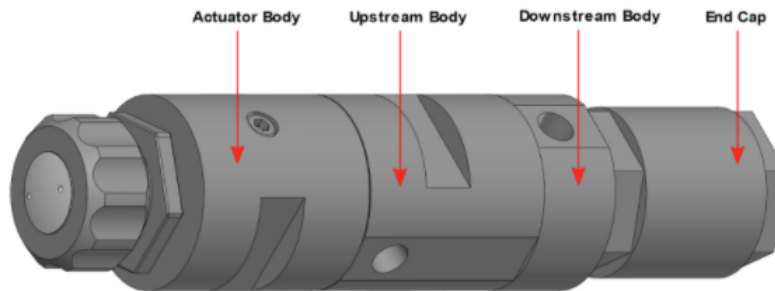


Figure 4: 00-00219\_2 Rev.A

## 1.7 Assembly Overview

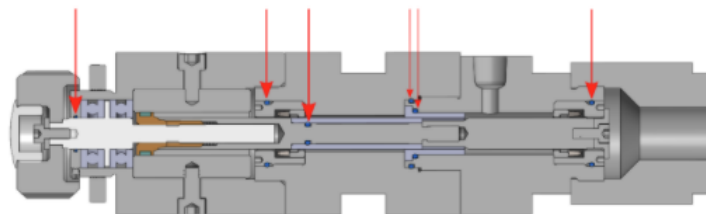
The valve housing consists of 2 main parts, Upstream Body (2) and Downstream Body (3). In addition, a manual valve configuration and a rotary actuated valve configuration also has an Actuator Body (1). All configurations come with an End Cap (4) body, whose purpose is to protect the axial movement of the center rod assembly during valve actuation. All bodies have a threaded connection for easy assembly and disassembly. ⚠ Care must be used when handling threaded parts. Damage to threads can cause galling or premature wear. CCW rotation will disassemble the body parts, CW rotation will assemble the body parts. Please refer to maintenance section for further details. A center rod assembly extends through the center of the valve, and can be moved in the axial direction. Axial movement of the center rod assembly will open and close the valve.



## 1.8 Seal Kits

The DT1 uses a total of 6 o-rings to fully seal the valve and protect its components, of which 5 are vetted. Standard O-rings are VITON A<sup>TM</sup> (FKM), but other qualities are available depending on fluid compatibility. FFKM-type o-rings are recommended for special chemical compatibility.

⚠ Only use pre-approved o-rings within the DT1. Contact Droptech AS for Seal-Kit options.



The DT1 also uses 2 KEFLOY® MupuSeals (PTFE) to seal between the center rod assembly and the valve housing to enclose the pressurised fluid.

## 2 Installation

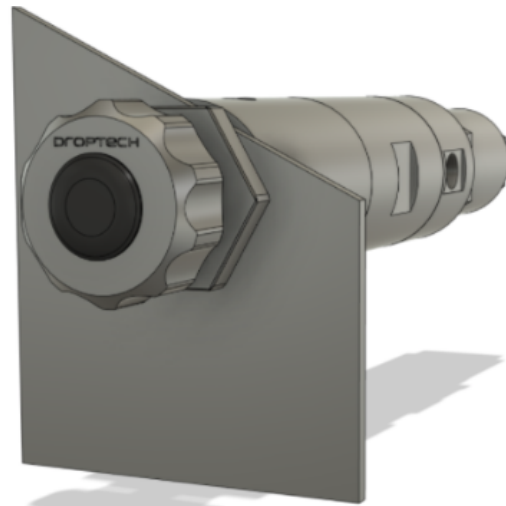
The DT1 comes standard with a Ø62mm housing for installation in a wide variety of new and existing infrastructures. An Ø50mm housing is available on request. Specialised housings, like cartridge type housings are also available. The functionality of the DT1 is unaffected by housing selection and orientation of installation. Refer to Maintenance *Step 11* and **Step 12** for panel mounting instructions and rotary actuator installation instructions.

### 2.1 Installation Interface

The DT1 is typically mounted horizontally with the fluid inlet on top. Alternatively the valve is mounted vertically. The Mounting Nut (5) can be used to fasten the valve to a Ø35mm panel hole. Body clamps can also be used. The DT1 has 2 wall/bracket mounting options, depending on if the Actuator Body (1) is installed or not. A mounting nut for installations without the Actuator Body will be delivered for valve specifications with linear actuators.



A linear actuator is connected directly to the Center Rod Assembly (9) (10) . The Mounting Nut (5) are used on the Upstream Body (2) threads to fix the DT1 to a bracket.



A manual valve is panel-installed and the Mounting Nut (5) are used on the Actuator Body (1) threads to fix the DT1 to a wall-panel. A rotary actuator can use the same installation, but with a gearbox instead of the Hand Wheel (6).

The DT1 fits different rotary actuators. If installed with a rotary actuator, the Hand Wheel (6) is typically changed to an adaptor that fits the selected actuator. Contact us for additional details.

## 2.2 Installation Procedure; Panel Mount and Rotary Actuator Mount

To mount/dismount valve (also refer to **Step 11** and **Step 12** in maintenance section):

1. Remove hand wheel Cover (25) with a set of locking ring pliers.
2. Unscrew and remove hand wheel screw M4x10 (14). Remove Washer (13) and Hand Wheel (6).
3. Unscrew Mounting Nut (5) if needed.
4. Install DT1 in a Ø35mm panel or bracket hole and, if needed, secure with Mounting Nut (5).

Recommended fastening torque is 5Nm. Use thread locker if required or recommended by site policy.

## 2.3 Installation Precautions

⚠ To ensure safe removal or in-line maintenance of the DT1 in a pressurised system, isolation valves upstream and downstream of the DT1 should be installed with the possibility of bleeding the internal pressure to equalise atmospheric pressure.

⚠ A check valve downstream of the DT1 is also considered good practice to avoid reverse flow from the process. If reverse flow should occur, the DT1 should not be damaged, but other in-line equipment might be damaged by reverse flow.

## 2.4 Filtering

Fluid cleanness is important in all chemical injection processes. Frequent substitution of filter elements, in accordance with filter manufacturer specification, is highly recommended. At very low flow rates, or at low flow rates coupled with high differential pressures, the internal orifice has a very small opening area. This will increase the filtering requirements of the fluid. The table below are general recommendations for selecting a suitable filter. Please refer to flow charts and tables for flow rate references. If the DT1 is used as a manual valve, a general recommendation is to use a high filtration grade (low micron classification). If actuated, the valve will have self-cleaning capabilities, and a lower filtration grade is possible.

Valve Identifier	Filter recommendation [microns]	5.0µm	10µm	50µm
DT1-55	Valve opening in % (valve turns)	0-5% (0-2)	5-20% (2-8)	20-100% (8-38)
DT1-75	Valve opening in % (valve turns)	0-5% (0-2)	5-15% (2-6)	15-100% (6-38)
DT1-90	Valve opening in % (valve turns)	0-5% (0-2)	5-10% (2-4)	10-100% (4-38)

⚠ The DT1 is not designed to handle large amounts of fluid particle contaminants like sand or metallic debris. If your fluid system is contaminated by such debris it may damage all in-line equipment.

### 3 Start Up

⚠ The critical part of operating the DT1 is the startup sequence since wrong operation can cause high-pressure releases, water hammers or very high flow rates.

⚠ Systems may vary from procedure described below. Consult your system IOM for system specific start up.

1. Make sure any connections and port adaptors are tightened to the specified torque.
2. It is recommended to start the procedure with the DT1 in fully closed position (CW) not to damage in-line equipment. Pressurising the valve when in open position may cause high-pressure releases, water hammers or very high flow rates.
3. Make sure any inlet valve and outlet valve is closed.
4. Open outlet valve slowly, check for leakage.
5. Open inlet valve slowly, check for leakage.
6. Turn Hand Wheel ⑥ counter-clockwise (CCW) for 4-5 turns and verify flow. Note that the flow rate may be very low and require a very sensitive flow transmitter to detect. If your system cannot detect any flow, turn hand wheel an additional 4-5 turns.
7. If no leakages are detected, continue to turn Hand Wheel ⑥ to set correct flow rate for system initialisation, then let the system run for sufficient time to completely vent any air.
8. Let DT1 continue to run while operating the Hand Wheel ⑥, and set the desired flow rate.




DT1 is now ready for operation.

## 4 Operation

The Hand Wheel (6) is turned CCW to increase flow rate, and CW to decrease flow rate. Rotary actuation can also be performed by a rotary actuator. A linear actuator will move the Center Rod Assembly (9)(10) outwards for an increased flow rate, and inwards for a decreased flow rate.

A constant flow rate is achieved when the differential pressure over the valve is stable and the fluid viscosity is stable. If the differential pressure or fluid viscosity fluctuates, the flow rate will also fluctuate. If your system has large temperature and/or pressure variations, it is recommended to install the DT1 in a control loop with a valve actuator and dedicated flow measuring device. In a control loop, any deviations to flow rate due to fluid pressure or fluid temperature fluctuations, will automatically adjust to the flow rate set point (with the correct control parameters).

### 4.1 Operational Precautions

-  Do not use valve outside specified pressure and temperature limits.
-  Do not use fluids incompatible with 316L or internal seal materials.
-  Do not use in explosive atmospheres not suited for ATEX Group II Category 2.

### 4.2 Retrofit of DT1 into Existing Actuators and Control Loops

If retrofitting the DT1 into an existing infrastructure with actuators and control loops, the DT1 normally benefits from a more aggressive control policy to achieve high flow accuracy performance. This is due to a low flow gain of the DT1 compared to similar flow control valves. It is recommended to adjust the control parameters after installation of the DT1. Consult Droptech for additional information and assistance.

## 5 Maintenance

The unique design of the DT1 allows easy removal of valve bodies to allow easy access to internal parts. If the DT1 is panel mounted with the Mounting Nut<sup>(5)</sup>, the body parts can be unscrewed without removing the valve from its mounting. Only fluid connections must be removed to allow disassembly of the required valve body parts.

Before assembly of parts, make sure all metallic parts are sufficiently clean, and that all threads and O-rings are sufficiently coated with applicable coating.

Recommended equipment:

- Set of Hex keys (1.5mm, 4mm, 5mm).
- Locking ring pliers
- Small wrench(or similar) that fits to hexagonal pattern on Center Rod Downstream<sup>(9)</sup>.
- MOLYCOTE<sup>®</sup>111 Compound, or similar, for O-ring lubrication
- MOLYCOTE<sup>®</sup>DX Compound, or similar, for thread lubrication

Contact Droptech AS if in doubt about any step of the maintenance process, or if any assistance is required.

- ⚠ Service and maintenance should be performed by qualified personnel.
- ⚠ Do not perform any maintenance on the valve when the internal fluid is pressurised.
- ⚠ Care must be used when handling threaded parts. Damage to threads can cause galling or premature wear.
- ⚠ Do not use more than  $6.4Nm$  of torque on the valve Hand Wheel or Center Rod Assembly.
- ⚠ Do not use more than  $1,000N$  of axial force on the internal Center Rod Assembly.
- ⚠ Care must be used to not bend the Center Rod Assembly during maintenance.

## Valve Body and Center Rod Assembly and Disassembly

Before disassembly, it is recommended that the valve is in closed position (CW).

### Step 1

**Disassembly instruction:** Remove End Cap (4) by unscrewing it from the Downstream Body (3).

**Assembly instruction:** Install End Cap by screwing it onto the Downstream Body. The threaded connection should be secured by significant hand force. If using wrenches or spanners, a slight locking torque thrust is required.

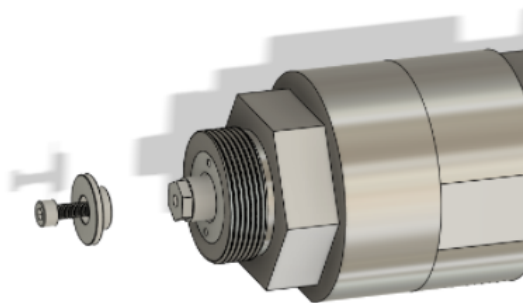
**Assembly precaution:** The End Cap function as a travel limiter. If the End Cap does not install flush with the Downstream Body, turn Valve Handle (6) 2 full CCW turns, then turn End Cap into flush position.



### Step 2

**Disassembly instruction:** Unscrew M4x10 (14) with a 3mm Hex key and remove Center Rod Downstream End Stop (8). If the Center Rod Downstream (9) rotates while applying torque through the Hex key, gently use a small wrench or 8mm spanner on the hexagonal end of the Center Rod Downstream to stop rotation of the rod.

**Assembly instruction:** Insert and fasten Center Rod Downstream End Stop and M4x10 into Center Rod Downstream. Tighten the M4x10 sufficiently. 1-3Nm is recommended.



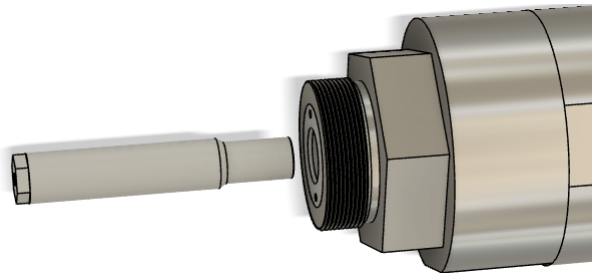


### Step 3

**Disassembly instruction:** Use a small wrench or an 8mm spanner to unscrew and remove Center Rod Downstream<sup>(9)</sup>.

**Assembly instruction:** Insert Center Rod Downstream into Downstream body<sup>(3)</sup>. Depending on valve position, the rod may need a small pop to pass the pack-box sealing. Make sure to tighten the Center Rod Downstream sufficiently. 1-3Nm is recommended. ⚠ Do not use more than 6.4Nm of torque on the Valve Hand Wheel or Center Rod Assembly.

**Caution:** Be careful not to damage or scratch the polished surface of the Center Rod Downstream. This is a sealing surface, and any damage might cause external leakage from the valve.

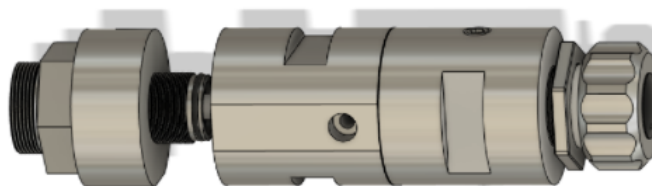


### Step 4

**Disassembly instruction:** Unscrew Downstream Body<sup>(3)</sup> and gently pull it away from the Upstream Body<sup>(2)</sup>. Be careful to pull straight, not to damage the internal MupuSeal on threads or sharp edges. Do not induce a bending moment on the Center Rod Upstream<sup>(10)</sup>.

**Assembly instruction:** If the Valve Seat<sup>(16)</sup> is installed into downstream body, carefully and correctly align the Valve Seat with the Valve Plug<sup>(15)</sup> before engaging the threaded connection between the valve bodies. The threaded connection should be secured by significant hand force. If using wrenches or spanners, a slight locking torque thrust is required. Use alternative assembly instructions below if alignment is difficult.

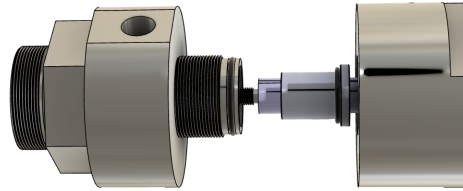
**Assembly precaution:** The tolerance between the Valve Plug and Valve Seat are minute, thus careful alignment and insertion is required. Small relative rotations of the two bodies may aid correct alignment. A small amount of lubricant may be used to aid Valve Plug and Valve Seat engagement.



**Assembly alternative:** Insert the Valve Seat (16) onto the Valve Plug (15) before mounting the Downstream Body (3) with Upstream Body (2). Make sure that the O-ring Seat (28) is correctly positioned below the lip on the Valve Seat (16). Use compound (Molycote 111 or similar) to lubricate O-ring.

**Assembly precaution:** The inlet and outlet should be positioned relative 90 degrees to each other, with full connection between Upstream and Downstream Body. Insufficient connection between Upstream and Downstream body may be caused by position error of the O-ring Seat (28). If so, use small CV and CCW back and forth rotations on the Downstream Body to force/push the O-ring into correct position. Correct alignment and valve body assembly should then be achieved.

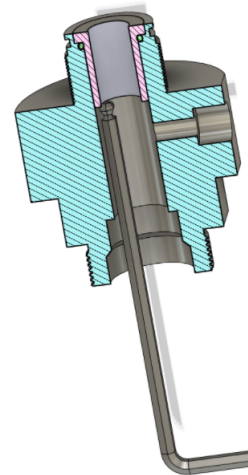
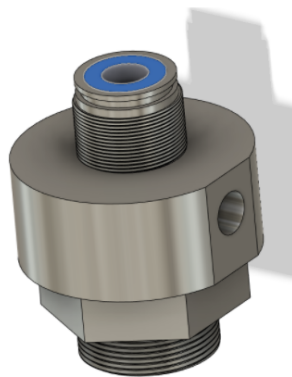
**O-ring Installation:** The O-ring Body Connection (30) can be installed into o-ring groove on Downstream Body. Use O-ring compound for lubrication.



## Step 5

**Disassembly instruction:** The Valve Seat (16) can be removed from the Downstream Body (3) by pushing up under the valve seat with a 4mm L-shaped Hex key. Do not push valve seat with sharp tools. The O-ring Seat (28) can be removed from the assembly.

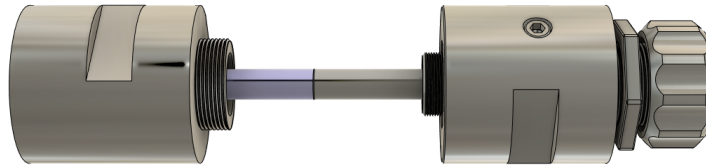
**Assembly instruction:** Lubricate O-ring Seat with applicable lubrication. Install o-ring onto Valve Seat, in contact with lip, then push Valve Seat into correct position on Downstream Body. For full connection, see **Step 4**.



## Step 6

**Disassembly instruction:** Unscrew Upstream Body (2) and gently pull it away from the Actuator Body (1). Be careful to pull straight, not to damage the internal MupuSeal or induce a bending moment on the Center Rod Upstream (10).

**Assembly Instruction:** Correctly align and insert Upstream Body onto Valve Plug (15), before engage the threaded connection with the Actuator Body. A small pop may be required to push the Upstream Body due to the pack-box sealing. Take care to not to cause impact on threaded sections. The threaded connection should be secured by significant hand force. If using wrenches or spanners, a slight locking torque thrust is required.



## Step 7

**Disassembly instruction** Firmly pull down Valve Plug (15) from Center Rod Upstream (10).

**Disassembly tip:** The Valve Plug (15) may stick due to friction from O-ring Plug (26). If so, clamp the Valve Plug with a soft and high friction material, then apply rotation and pull simultaneously. Be careful not to damage the surface finish of the Valve Plug.

**Assembly Instructions:** The inscribed end of the Valve Plug (15) shall be inserted first, i.e. the large end of the V-groove should face away from the Actuator Body (1). When mounting, some force may be required to push the plug over the O-ring. Make sure the O-ring Plug is lubricated. The Center Rod Downstream (9) may be used as a tool to screw the Valve Plug into correct position. Confirm that the identifier of the valve plug matches the valve seat.

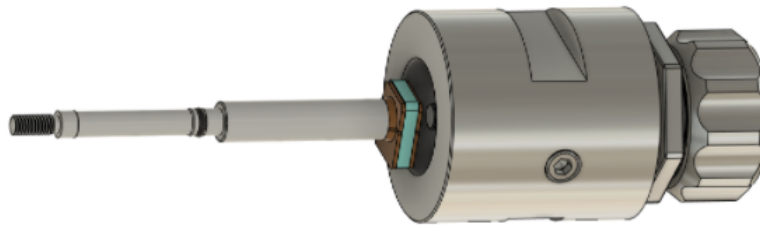


### Step 8

**Disassembly instructions:** Use your hand to hold Center Rod Upstream (10) in place and turn Hand Wheel (6) CW to disengage the Center Rod Upstream from Actuator Screw (12).

**Assembly instructions:** Use your hand to hold Center Rod Upstream in place and engage the threads between Sleeve Steering (11) and Actuator Screw (12). Turn Hand Wheel CCW to engage threaded connection. When the Sleeve Steering reaches the edge of the Actuator Body (1), insert the Wear Ring (23) into the grooved surface of the Sleeve Steering and use your fingers to gently hold the Wear Ring in correct position while turning the Hand Wheel. Position the Sleeve Steering sufficiently inside the Actuator Body.

**Caution:** Be careful not to damage or scratch the polished surface of the Center Rod Upstream. This is a sealing surface, and any damage might cause external leakage from the valve.



### Step 9

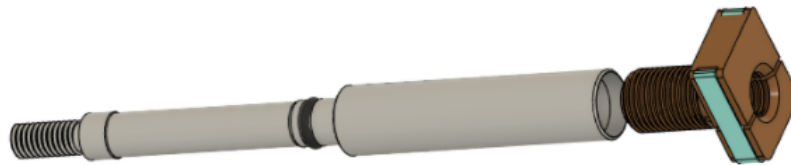
**Disassembly instruction:** The Center Rod Upstream (10) is assembled together with the Sleeve Steering (11), O-ring Plug (26) and the Wear Ring (23). Center Rod Upstream and Sleeve Steering can be disconnected by the threaded connection.

**Disassembly precaution:** Do not remove O-ring Plug if you do not have a DT1 Seal-Kit Replacement. O-ring is easily damaged if tooling is not available.

**Assembly instruction:** Use threaded connection to assembly Center Rod Upstream to Sleeve Steering. Install Wear Ring at **Step 8**.

**O-ring Plug installation:** Use thread protector tool from *DT1 Seal-Kit Replacement* on threaded area of Center Rod Upstream. Lubricate O-ring Plug with applicable lubrication and push O-ring onto the thread protector tool. Push and guide O-ring Plug up to the O-ring groove.

**Backlash adjustment** The backlash is a trade-off with the required torque to actuate the valve, and can be set by adjusting the fit between the Center Rod Upstream and the Sleeve Steering. The required torque to actuate the valve should be low (easy to turn the Hand Wheel (6) by hand), and the backlash should be less than 20 degrees. For final back-lash adjustment, see **Step 14**.

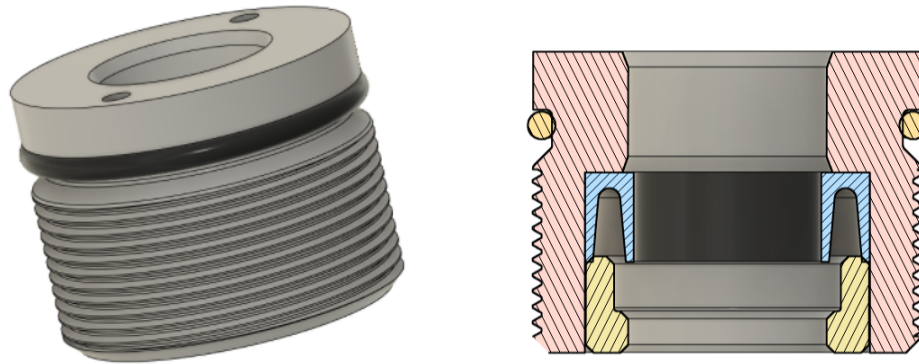


## Step 10

**Disassembly instructions** DT1 has two pack-boxes, one in the Upstream Body (2), and one in the Downstream Body (3). The pack-boxes consist of a Mupuseal Holder (17), a Mupuseal Ring (18), the Mupuseal Ø12 (19) and a O-ring Body Connection (29). Each pack-box can be removed by unscrewing it from the valve bodies with a locking ring pliers. O-ring Body Connection can be removed from its groove from the non-threaded side. MupuSeal Ring and MupuSeal can be disassembled with a finger or a soft tool.

**Assembly instructions:** Assemble pack-boxes as shown in figures. O-ring Body Connection can be installed into groove by using applicable O-ring compound and pushed over non-threaded surface of Mupuseal Holder.

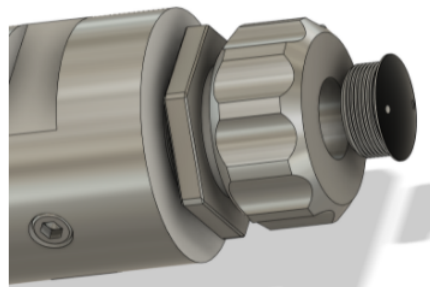
**Caution:** Do not use sharp tools when working with the MupuSeal. Damages to MupuSeal surface may cause valve leakage.



## Step 11

**Disassembly instructions:** Remove hand wheel Cover (25) gently using locking ring pliers.

**Assembly instructions:** Insert Cover into threaded connection of Hand Wheel (6). Use locking ring pliers to gently set the Cover into final position.

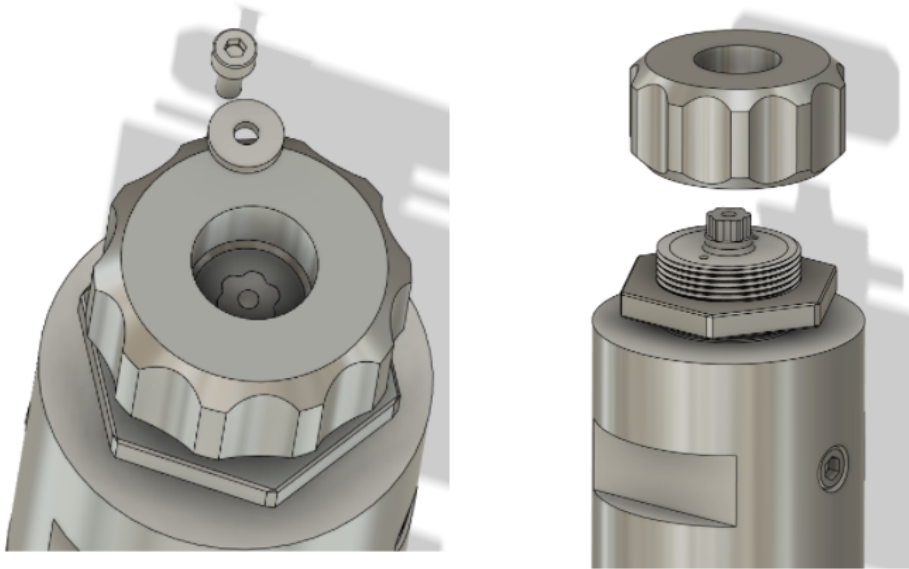


## Step 12

**Disassembly instructions:** Unscrew hand wheel M4x10 (14) with an 4mm Hex key, and remove screw, Washer (13) and Hand Wheel (6).

**Assembly instructions:** Install Hand Wheel, Washer and M4x10 screw. Use a 4mm Hex key to fasten. Recommended 1-3Nm tightening torque.

**Rotary Actuator Adaptor:** If adaptor for rotary actuator is used with your DT1, then the adaptor shall be installed into the petal pattern instead of Hand Wheel. The adaptor is manufactured to a tolerance so that no fastening material is needed.



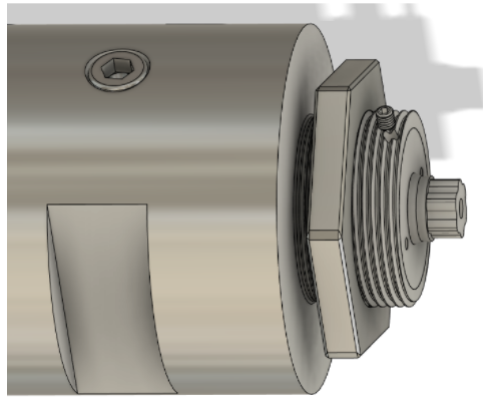
**Panel Mounting:** If the DT1 is mounted using the Mounting Nut (5), then the Mounting Nut can be unscrewed after **Step 11** and **Step 12**, and the DT1 can now be panel mounted as required. After the DT1 is installed into the panel, the Mounting Nut can be screwed on again.

**Actuator Mounting:** Depending on type of rotary actuator used, the Mounting Nut can be removed if needed. Store Mounting Nut if needed for later use. If adaptors are needed for your actuator installation, they will be supplied with the order. Contact us for details.

### Step 13

**Disassembly instructions:** Remove Set Screw M3x4 (24) with 1.5mm Hex key. The set screw is small, thus it is recommended not to completely unscrew it unless necessary.

**Assembly instructions:** Use a 1.5mm Hex key to carefully lock the Set Screw. Do not use excessive torque. The set screw is used to lock the rotation of the Lock Disk (7).

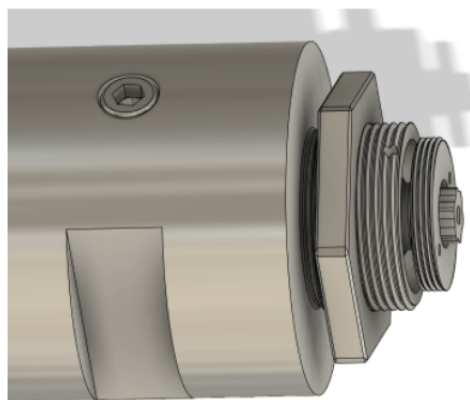


### Step 14

**Disassembly instructions:** Unscrew and remove Lock Disk (7) with locking ring pliers.

**Assembly instructions:** Insert Lock Disk into Actuator Body (1) and lock in place with locking ring pliers.

**Backlash Adjustment:** Also refer to **Step 9** and **Step 15**. The position of the Lock Disk has the most influence on valve backlash and Valve Handle torque. It is recommended to fasten the Lock Disk securely onto the Thrust Bearings, then open the Lock Disk about 10-20 degrees. If a firmer handle is preferred, then open less. If softer handle is preferred, and more backlash is acceptable, then open more. Then secure by **Step 13**.



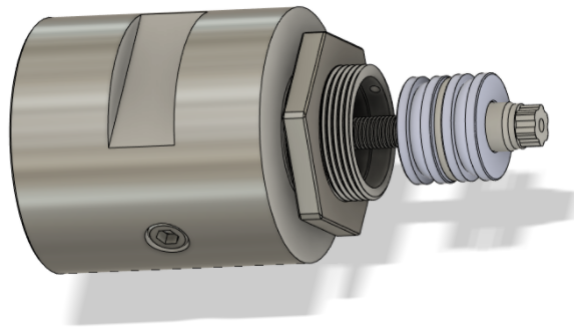


### Step 15

**Disassembly instructions:** Pull out Thrust Bearings (22) and Actuator Screw (12). Take note on the orientation of the Thrust Bearings.

**Assembly instructions:** Install Thrust Bearings onto Actuator Screw in the same orientation as disassembly, and insert into Actuator Body (1).

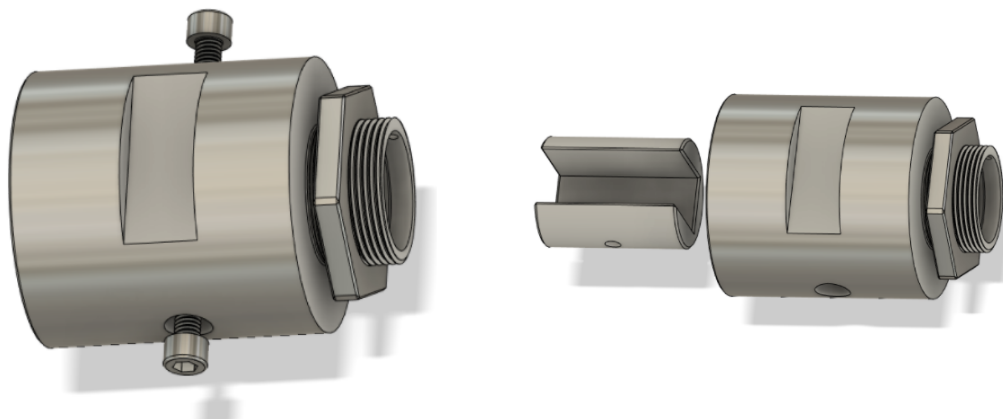
**Assembly tips:** To avoid the valve assembly to be over-constrained, the DT1 is designed with some slack in the Actuator Screw and head of the Actuator Body. The slack may cause some uneven friction during rotation of the Actuator Screw. If uneven friction is experienced, the inside of the head of the Actuator Body and the radial outside of the Thrust Bearings may be coated with grease to reduce metal-to-metal friction. Molycote DX Compound, or similar can be used.



### Step 16

**Disassembly instructions:** Unfasten the Sleeve Guide (20) by unscrewing both M6x12 (21) with a 5mm Hex key. Gently pull out the Sleeve Guide from the Actuator Body (1).

**Assembly instructions:** Insert and align threads on Sleeve Guide with Actuator Body. Fasten and secure both M6x12 screws with a 5mm Hex key.



## 6 Troubleshooting

Problem	Action & Possible solution
No flow rate	Check differential pressure across valve. Set valve to full flow (CW). Disassemble valve and clean groove on Valve Plug ( <b>Step 1 - 7</b> ).
External Leakage	Check valve bodies fully connected. Check O-ring Body Connection ( <b>Step 4</b> ) Check MupuSeal and O-ring in pack-boxes for damage ( <b>Step 10</b> ). Check for damage on polished surface on Center Rod Downstream ( <b>Step 3</b> ) Check for damage on polished surface on Center Rod Upstream ( <b>Step 8</b> )
Handwheel hard to turn	Check if actuator is correctly assembled. Adjust backlash setting ( <b>Step 14</b> ) Replace Actuator Screw.
To much backlash	Check if actuator is correctly assembled. Adjust backlash setting ( <b>Step 14</b> ) Replace Actuator Screw.
Uneven Hand Wheel torque	Check if actuator is correctly assembled. Adjust backlash setting and alignment ( <b>Step 14</b> ). Apply grease in head of Actuator Body ( <b>Step 15</b> ). Replace Actuator Screw.
Unstable Flow	Check for unstable process conditions. Replace O-ring Seat ( <b>Step 4</b> ) and O-ring Plug ( <b>Step 9</b> ).

If you require any assistance, do not hesitate contact us.

**7 Packing, storage, preservation, lifting, transportation and handling procedure**

## 7.1 Packing and Transportation

From Droptech each DT1 will be packed and shipped in a single unit cardboard box. Each cardboard box contains an inner and an outer layer of protective cardboard. Any empty volume inside the cardboard box will be filled with a cushioning material. In addition, the DT1 will be wrapped in a lint-free soft cloth. The valve inlet and outlet shall be sealed off to prevent ingress of sand, dust, debris and liquid.



Each single unit cardboard box may contain additional spare parts, adaptors, documentation or similar.

If several units are shipped simultaneously, the finished packed DT1 units will:

- For up to 2 units; single unit card boxes will be stripped/taped together.
- For up to 5 units; single unit card boxes will be packed into a cover box
- For more than 5 units; single unit card boxes will be packed into several cover boxes, or single unit card boxes to be stacked on pallets.

In case of repackaging, it is recommended to replicate the standard packaging. If not possible, the equipment shall be packaged to sufficiently protect the units from shocks, damages and ingestion

that can arise from shipment handling and transportation.

Seaworthy packaging available on request.

## 7.2 Storage and Preservation

Units should be stored in a sheltered and dry area. Uniform temperature between 0 and 40°C and moisture level below 55% are recommended as optimal storage conditions.

If the equipment is planned to be put away for storage for a significant length of time (6 months or more) it is recommended to ensure that all valve parts, internally and externally, are sufficiently cleaned beforehand. If the equipment is planned for long term storage before first use, Droptech may upon request perform a preservation service on the equipment before delivery.

If the units have been subject to flooding conditions, or rain- or seawater ingestion, a preservation service should be performed before additional storage.

## 7.3 Lifting and Handling

For handling and lifting the following guidelines should be observed.

- Handle equipment with care to prevent damage. If possible, transport equipment to installation site within original packaging.
- Do not drop equipment from any height.
- Use Personal Protection Equipment as required by site. Safety glasses and steel-toed shoes should be used at all times.
- If the equipment is packed in a cover box, make sure the lifting weight does not exceed the limits for manual handling.
- If the equipment is packed on a pallet, handling with a forklift is restricted to authorised personnel.

**If you require additional assistance, information or help, please contact us:**

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## 8 Revision history

**REV 1.1, published 10.05.2022.** Original document.

**REV 1.2, published 02.09.2022.** Added new ATEX identifier markings, page 3. Added series identification of validity of BOM and Views, page 4, 5, 6. Changed resolution, page 23. Added ATEX certificate, page 24, 25.

**REV 1.3, published 04.11.2022.** Updated ATEX marking, page 3. Updated BOM list for batch 3, page 4. Corrected publication date from rev. 1.2, page 1.

**REV 1.4, published 18.04.2023.** Major revision on all text. Added *Packing, storage, preservation, lifting, transportation and handling procedure* in IOM. Valve specific part list and drawings will be published as separate document. ATEX section is now separate document. Added *Contents* chapter. GA, BOM, Exploded View, Section View now only as reference for Maintenance section.

**REV 1.5, published 12.01.2024.** Minor revision. Update of filtering recommendations, and addition of information in *1.1 Key Specifications* and tables on page 3.