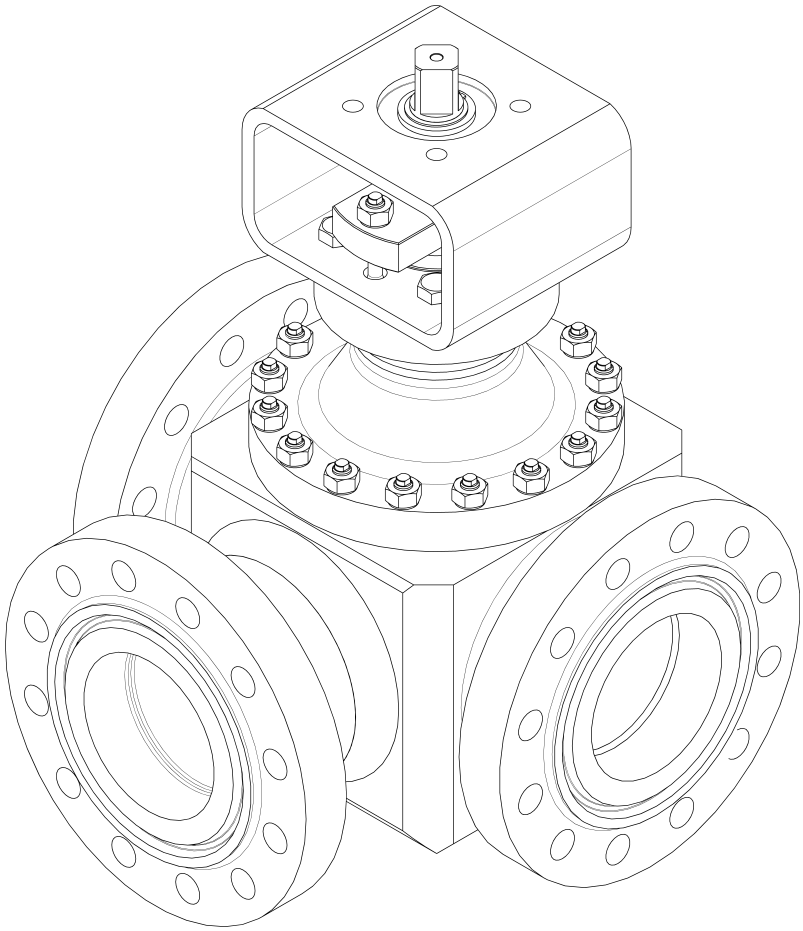
TECHNICAL
DESCRIPTION

Three-way Rotary Valve



A MEMBER OF THE ARCA FLOW GROUP

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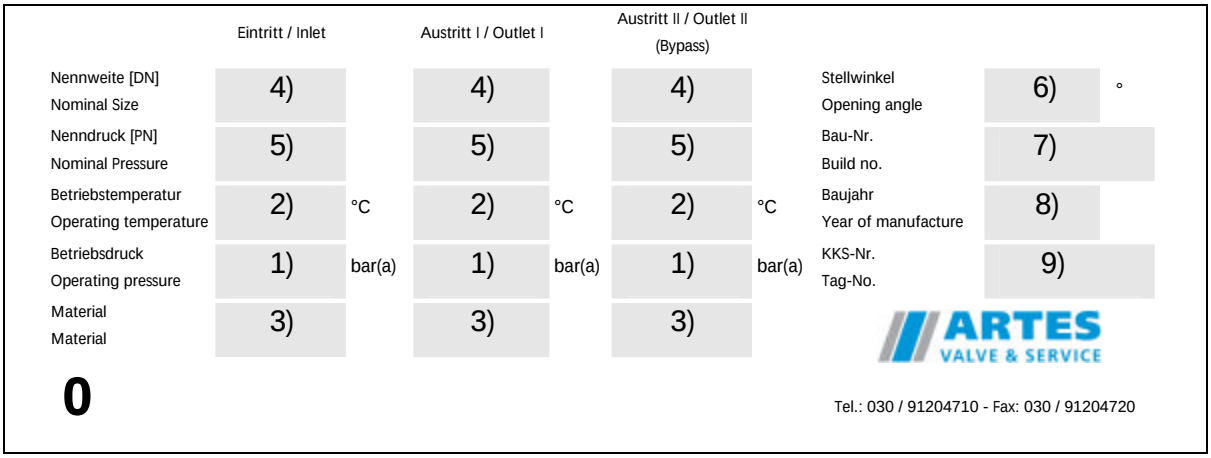
Contents

1 IDENTIFICATION

1.1 VALVE TYPE PLATE



	Eintritt / Inlet		Austritt I / Outlet I		Austritt II / Outlet II (Bypass)			
Nennweite [DN] Nominal Size	4)		4)		4)		Stellwinkel Opening angle	6) °
Nenndruck [PN] Nominal Pressure	5)		5)		5)		Bau-Nr. Build no.	7)
Betriebstemperatur Operating temperature	2)	°C	2)	°C	2)	°C	Baujahr Year of manufacture	8)
Betriebsdruck Operating pressure	1)	bar(a)	1)	bar(a)	1)	bar(a)	KKS-Nr. Tag-No.	9)
Material Material	3)		3)		3)			

1) Maximum operating pressure of valve
2) Maximum operating temperature of valve
3) Valve case material
4) Nominal diameter [DN] – Inlet / Outlet I / Outlet II (Bypass)
5) Nominal pressure [PN] – Inlet / Outlet I / Outlet II (Bypass)
6) Valve travel
7) Valve serial number
8) Year of manufacture of valve
9) Identification number (*power plant ID system no.*) of valve

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2 GENERAL

2.1 USE

The three-way rotary valve has been specially designed for distributing and mixing vapours.

The vapour flow is distributed and/or mixed by moving the rotary valve by 90°.

Other applications must be agreed upon separately.

The rotary valve is manufactured from forged pieces. The pipelines can be connected using flanges or welded ends.

The rotary valve supported within the valve. When the valve is rotated by 90°, it switches to connect to the line situated at a right angle to the previous line. Closing one line opens the next line.

The servo function has an approximately linear characteristic. (For more on this, see fig. 3.3)

There is a small gap between the line connections on the rotary valve. There is no sealing function. However, the gap flow is definite and can be designed to meet your operating conditions.

2.2 INTENDED USE

The three-way rotary valve is solely intended for the media specified in the valve data sheet and the respective operational and design parameters. Any other or additional uses require separate contractual agreements.

You must comply with this technical description and the operating data listed on the type plate (*see section 1.1 "Valve type plate"*).
The system is intended to be operated in compliance with local accident prevention and environmental protection regulations as well as with all customer specifications.
You must read the safety instructions included with the technical descriptions before you transport, install or repair the three-way rotary valve. The technical description must be carefully stored so that the information is available at all times.

The technical description must be accessible to the operating and service personnel at all times.
This technical description is intended for service personnel from **ARTES** Valve & Service GmbH and technicians instructed by **ARTES** Valve & Service GmbH.

Any repair work performed by untrained personnel will cause all guarantees to become null and void.

2.3 WARNING SYMBOLS

The safety instructions and warnings are intended to eliminate all physical and life-threatening hazards for operating or maintenance personnel and prevent property damage. They are highlighted using the symbols and keywords defined here. Furthermore they are designated by warning symbols (pictographs) wherever they occur. The meanings of these are as follows:

DANGER!

Direct danger to health and life or danger of extensive material damage in the event of non-adherence to the instructions.

CAUTION!

Dangerous situation

Instructions on avoiding damage

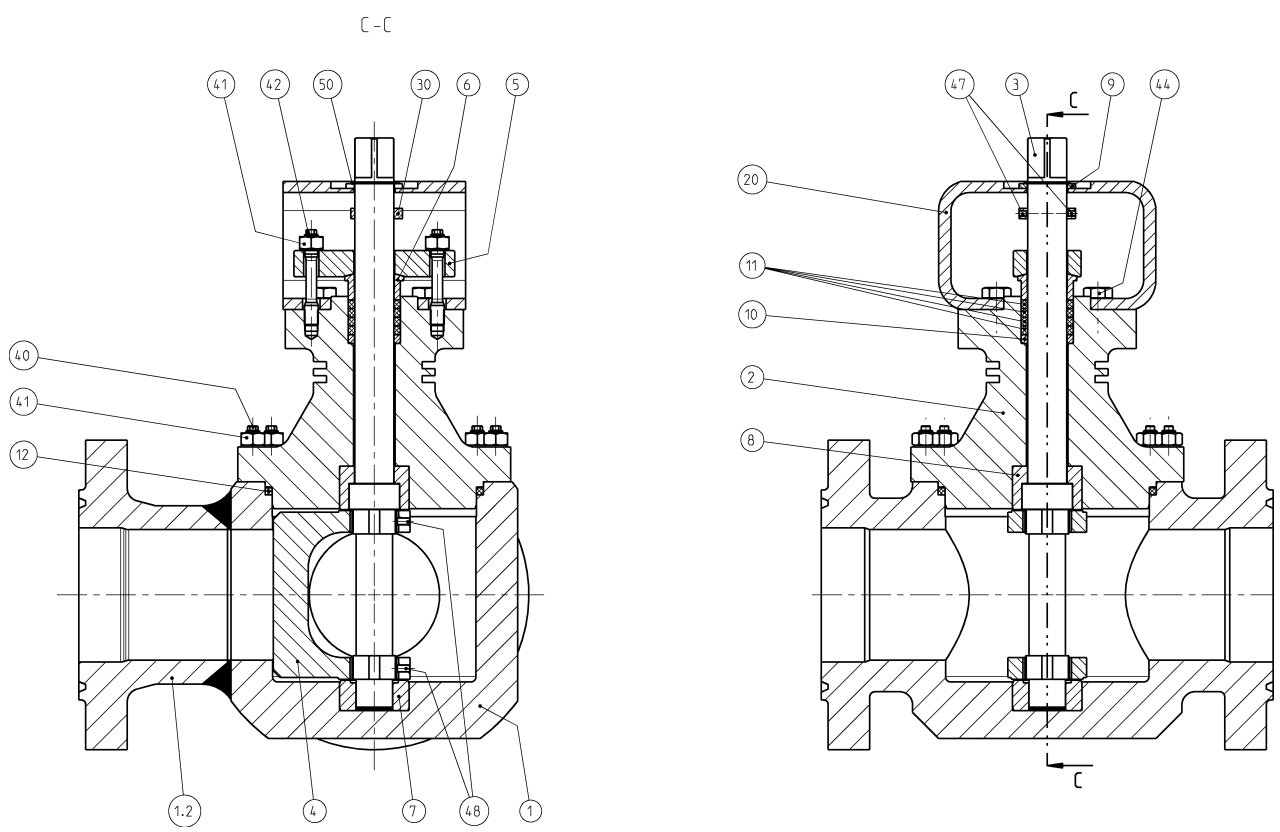
NOTE!

Help, suggestions or hints

Regarding a procedure

3 DESCRIPTION

3.1 STRUCTURE OF THREE-WAY ROTARY VALVE



Pos. 1	*- Housing*	*Pos. 9*	*- Disc*
Pos. 1.2	*- Flange connection*	*Pos. 10*	*- Main ring*
Pos. 2	*- Packing case*	*Pos. 11 & 12*	*- Seals*
Pos. 3	*- Stem*	*Pos. 20*	*- Frame*
Pos. 4	*- Rotary valve*	*Pos. 30*	*- Indicator*
Pos. 5	*- Gland follower*	*Pos. 40 & 42*	*- Stud bolt*
Pos. 6	*- Pressure piece*	*Pos. 41*	*- Hexagon nuts*
Pos. 7	*- Case for bearing bush*	*Pos. 44*	*- Hexagon bolt*
Pos. 8	*- Bearing bush of packing case*	*Pos. 47 & 48*	*- Set screws*
		Pos. 50	*- Circlip*

Fig. 3.1 Sectional view of three-way mixing valve

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3.2 FUNCTIONING OF THREE-WAY ROTARY VALVE

The three-way rotary valve functions by adjusting the diameter depending on the signal sent by the controller. The controlled diameters are determined by the angle of the rotary valve across the circular opening of the valve.

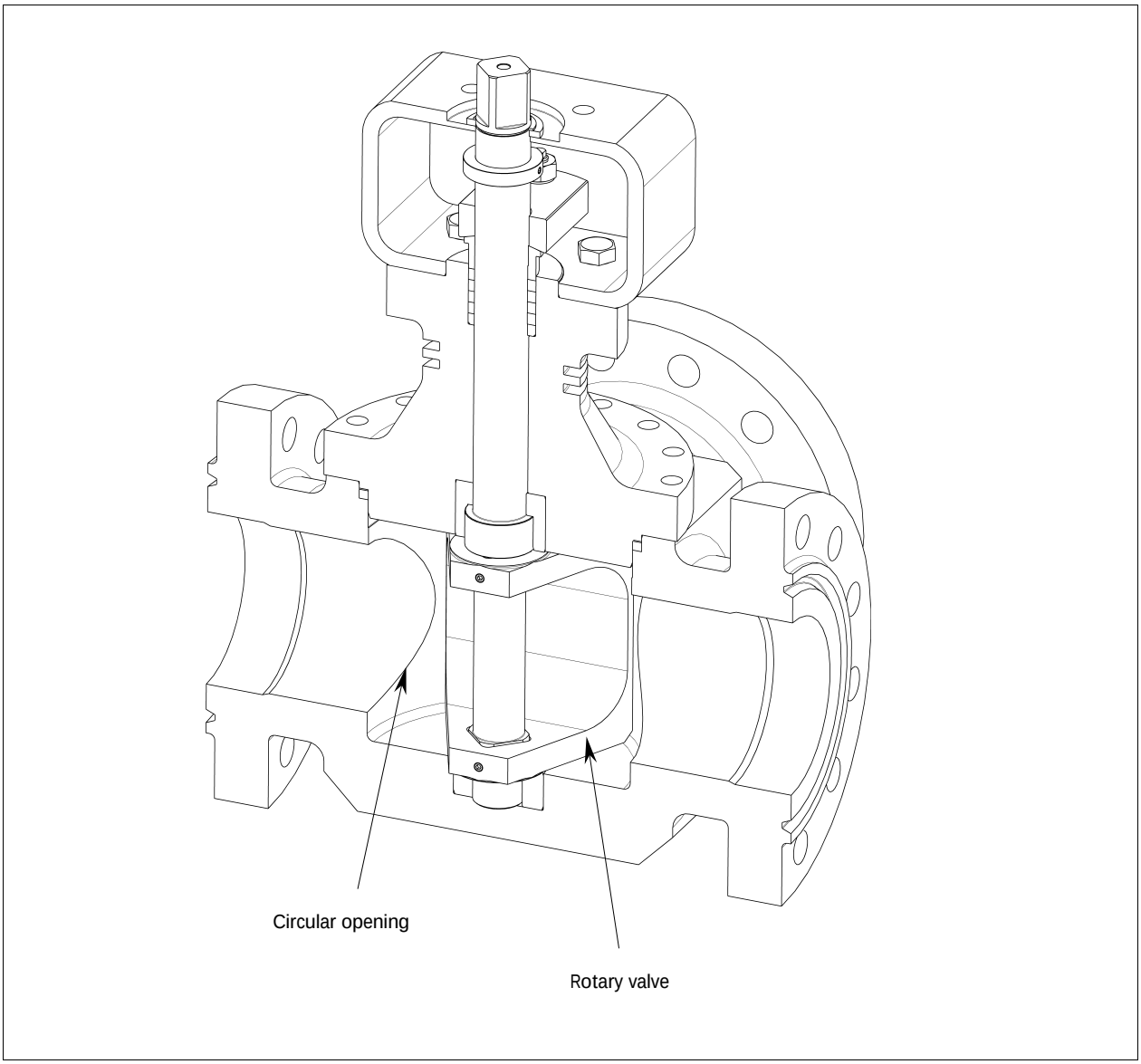

Fig. 3.2 Three-way mixing valve – rotary valve / lines (horizontal lines are open)
Closing any of these lines opens the line at a right angle to these.

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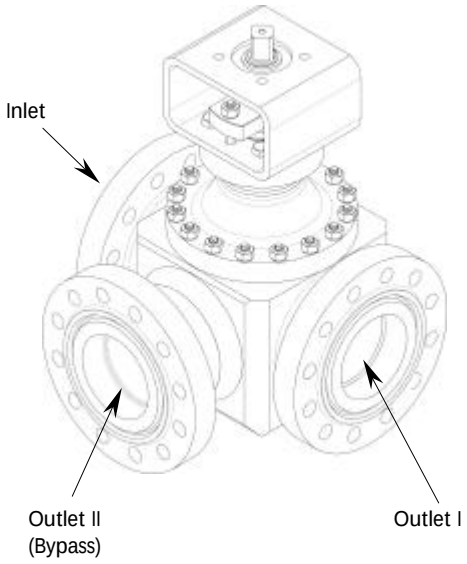
The controller contour of the three-way rotary valve is displayed in the following figure.
Additional characteristics must be agreed upon separately.



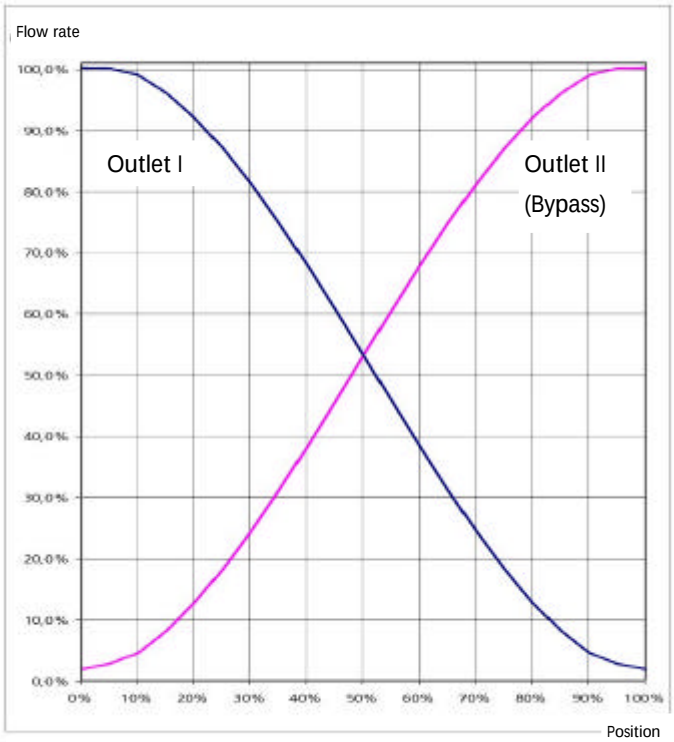


Fig. 3.3 Linear characteristic

It cannot be guaranteed that the three-way rotary valve will remain free of leaks. You can affect the amount of leakage by minimising the gap flow between the rotary valve and case.
If the gap flow has to be limited to a maximum value, this must be agreed upon separately.

The case version is adapted to the available or planned line. Models with flange connections or welded ends are also possible. The model for the given project is given in the dimension sheet.

The stem is sealed in the packing case using a gland packing consisting of pure graphite rings (*see fig. 3.4*).

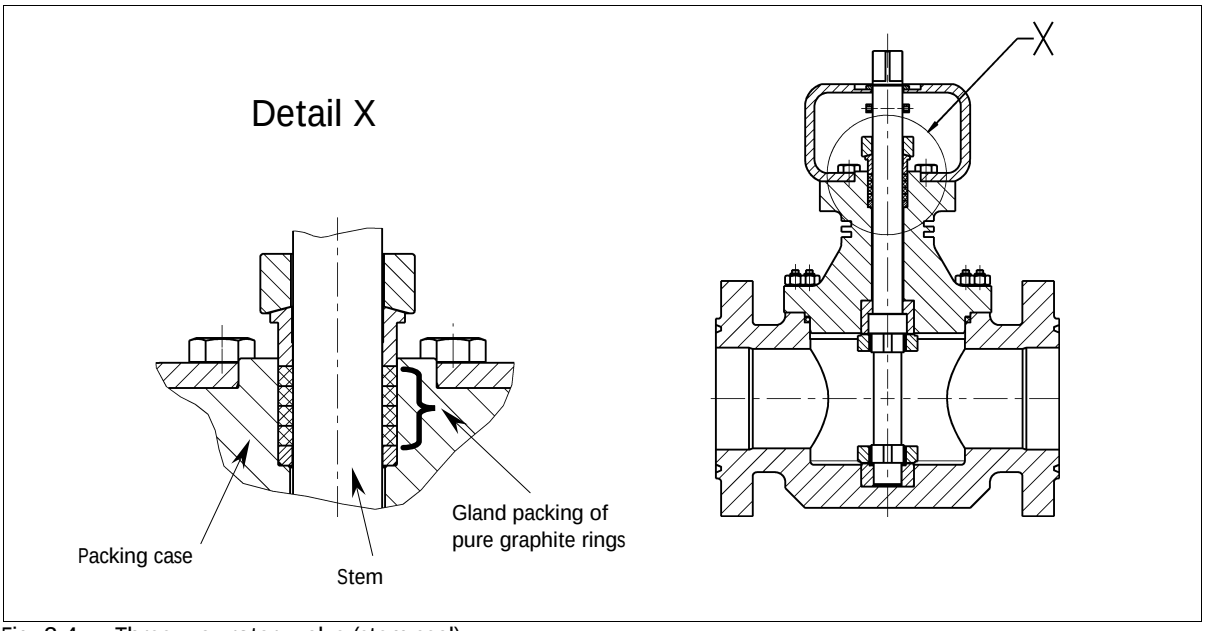


Fig. 3.4 Three-way rotary valve (stem seal)

Depending on the pressure level of the three-way rotary valve, the packing case can be sealed using a conventional flange connection or a cap seal (“Brettschneider” cap seal), (*see fig. 3.5*).

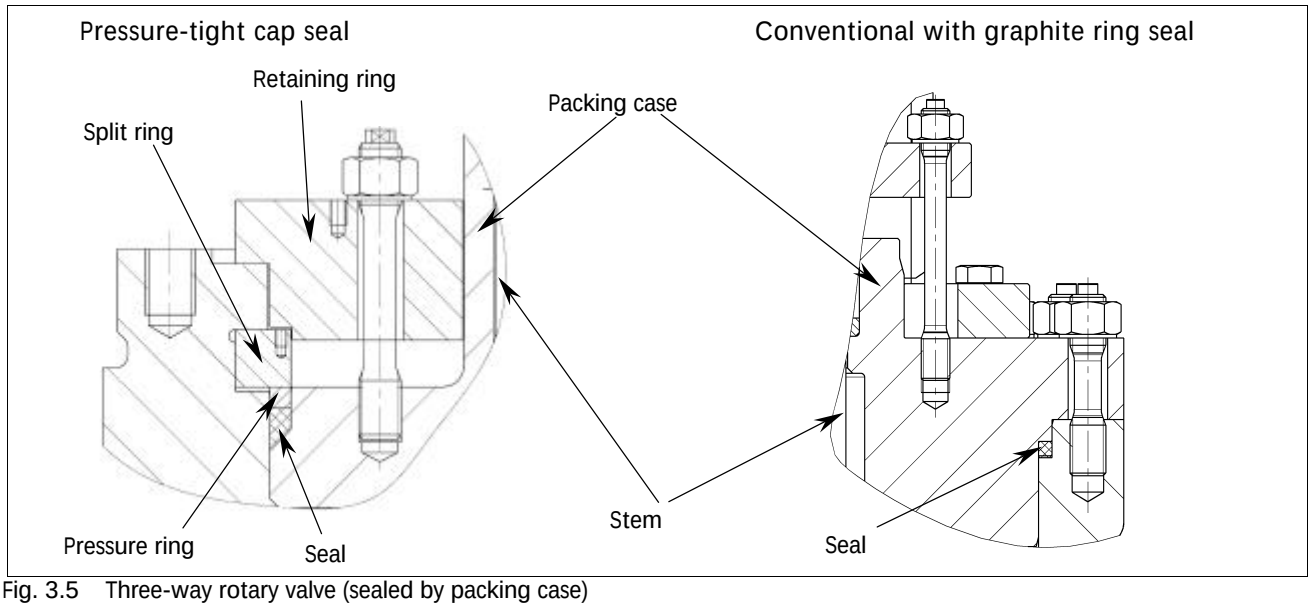


Fig. 3.5 Three-way rotary valve (sealed by packing case)

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The valve stem is supported by the case and packing case. The servo functions of the rotary valve are transmitted via the square ends of the stem / rotary valve (*see fig. 3.6*).

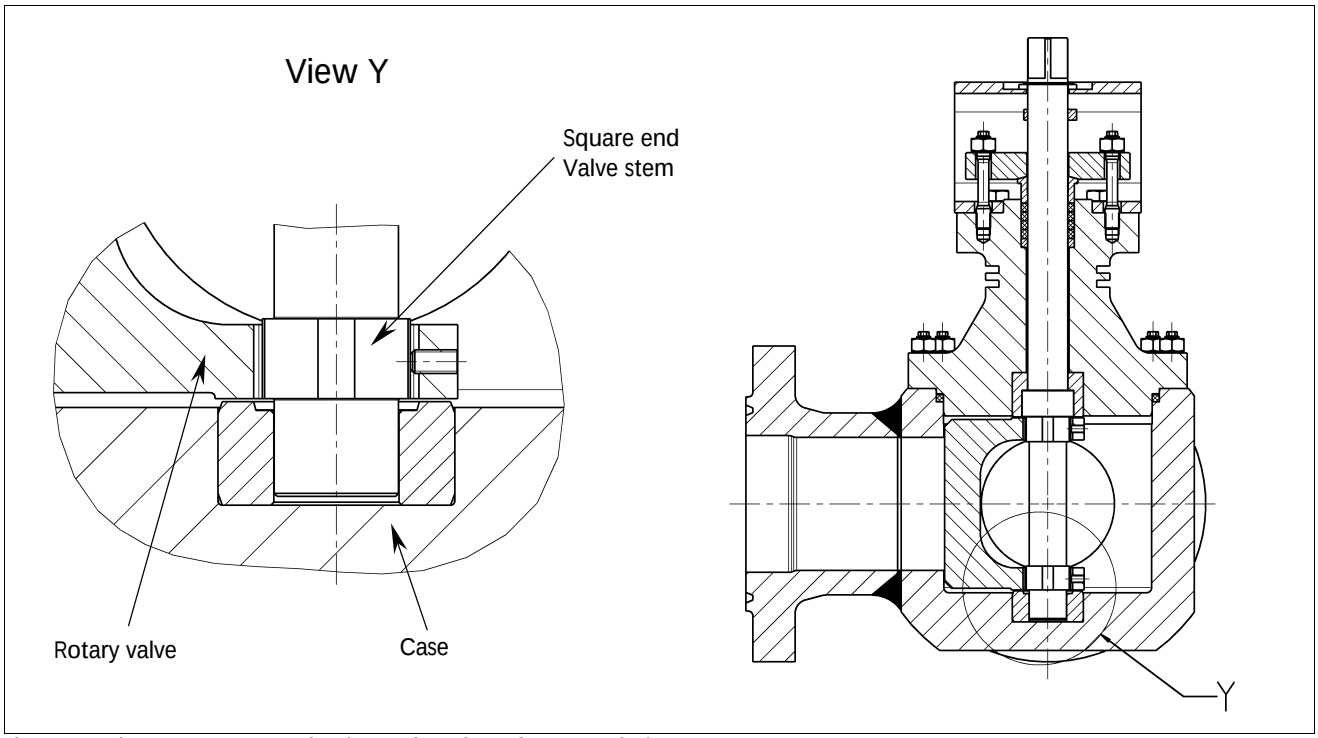

Fig. 3.6 Three-way rotary valve (servo function of rotary valve)

3.3 CONTROLLER FUNCTIONALITY

If no special agreements have been made, **ARTES** Valve & Service GmbH. will not include the controller functionality with the three-way rotary valve and drive unit.
If no special agreements have been made, **ARTES** Valve & Service GmbH will not guarantee the proper functioning of the control system (because it is not included in the scope of the delivery).

Electric, pneumatic or hydraulic variable speed drives can be used with the three-way rotary valve.
The three-way rotary valve and drive are assembled at the our factory and subjected to a functional test before being delivered.
Our warranty becomes void if the drive is installed by a third party.

4 TRANSPORT, RECEIPT OF GOODS, AND STORAGE

4.1 TRANSPORT

If no other agreements have been made, the three-way rotary valve is painted with a protective coating.
If no other agreements are made, the protective coating will applied in compliance with *Technical Specifications TB-01 "Coating"* .
When shipped, the rotary valve is configured to close the lateral outlet. The flange or welded ends are closed on delivery.

In deliveries that do not include the drive, the stem is covered and conserved.
The inside of the valve is conserved.
If no additional agreements are made concerning special packaging, the three-way rotary valve will be fastened to a wooden transport pallet.
For larger units, the three-way rotary valve and the drive are fastened onto separate transport pallets.

Only use the transport equipment for transporting the valve.
While removing the packaging, secure the valve against tipping to the side.
Remove the packaging in such a way that the delivered parts are not damaged.

For all deliveries shipped ex works, we recommend purchasing transport insurance.
With 'free deliveries', **ARTES** Valve & Service GmbH will purchase the required transport insurance. All risks will be assumed up to the unloading ramp of the receiver.

4.2 RECEIPT OF GOODS

The delivery must be inspected immediately for damage.
In case of damage the conditions of the transport insurer need to be observed that require an immediate recording of facts by the carrier.
The delivery needs to be checked against the shipping papers and packing lists for completeness.
Late returns or complaints will not be honoured.

4.3 STORAGE

The three-way rotary valve is packaged so that it can be stored in a dry, dust-free environment for up to 3 months. If you intend to store it for a longer period of time, you must undertake additional measures.

5 ASSEMBLY INSTRUCTIONS

Non-adherence to the following assembly instructions voids the warranty claims.

5.1 GENERAL

Three-way rotary valve

- ⇨ Only service personnel from **ARTES** Valve & Service GmbH or specially trained technicians are permitted to install the three-way rotary valve.
- ⇨ Care must be taken that forces from the pipe cannot act on the three-way rotary valve.
- ⇨ For valves with flanges, ensure that the flange seals are selected in accordance with the operating data. You must comply with the manufacturer's specifications.

- ⇨ If welding work is required, you must observer the respective welding regulations.

Drive

- ⇨ The instructions in the technical description of the drive have to be observed. If these are not included in the appendix, you must order these instructions.
- ⇨ You must not modify the factory settings of the drive.
- ⇨ Do not allow the ambient temperature to exceed the maximum permisible temperature for the drive (observe the operating instructions of the drive!).

5.2 PREPARATIONS FOR INSTALLATION

5.2.1 Installation location

1. Choose an installation location where the three-way rotary valve is always accessible. When the installation location is at a great height, you must plan to install a gangway or similar. There needs to be space above the valve for assembly. At the very least, it should correspond to the height of the valve.
2. If the combined weight of the valve and the drive exceeds *30 kg*, you must provide means for attaching them to a hoist or an electric crane for installation. If the installation is outdoors, it must be possible to use a crane for the installation.
3. The drive must be easily accessible for adjustments.
4. There must be a straight pipe with ***10 x D*** upstream of the valve.

5.2.2 Installation in the pipeline

The following points have to be taken into account when installing the three-way rotary valve:

1. No forces or torques from the pipes may act on the valve. This also applies to any drainages or heat retainers that may be implemented.
2. Care must be taken that no contaminations from the line can damage the three-way rotary valve. In new plants, we recommend creating appropriately shaped weld seams.

   If you cannot be sure that all possible contaminants have been eliminated from the system prior to installing the three-way rotary valve, you must protect it using a suitable method before starting the system. For instance, this can be done by purging the vapour system. First disassemble the parts from the three-way rotary valve and install a purging unit. This has to be ordered separately.
3. The valve must be supported. If the valve is to be designed as a fixed point, this must be contractually stipulated.
4. The installation position is horizontal / vertical for the three-way rotary valve and horizontal / vertical for the stem. Should you wish to have a different installation position, this must be agreed upon separately. Special measures may need to be taken to support the weight, especially in the horizontal installation position.

5. You must plan to implement drainages that are suitable for the installation position.
6. You also have to ensure that the three-way rotary valve is kept warm.
7. The drive may need to be supported separately if necessary.
8. If your unit has flange ends, tighten the screw connections crosswise and evenly at the torque required for the selected seal and the respective application.

9. If your unit has welded ends, these are protected against corrosion by Tectyl when shipped. Clean the ends to be welded before beginning with welding. We recommend using trichloroethane for this.

   When welding, ensure that the temperature never exceeds the agreed upon operating temperature since otherwise interior parts of the valve can be damaged.

   You must comply with the welding regulations concerning procedural inspection, welder inspection, welding schedule, annealing schedule, testing schedule and so on.

   After welding the three-way rotary valve into the pipeline, measure the case in the region of the packing case and the lower guide rail of the rotary valve using an inside micrometer. You have to check the roundness of the surfaces. Document the measurement values.

   Any roundness deviations that exceed 0.03 % must be confirmed and released by **ARTES** Valve & Service GmbH before commissioning the three-way rotary valve.

5.2.3 Drive

The three-way rotary valve is typically supplied with an attached drive. If it is necessary to disassemble the valve and drive, please obey the following instructions. You also have to obey any technical descriptions supplied by the manufacturer of the drive.

1. Move the three-way rotary valve together with the drive to the defined stop position “lateral outlet closed”. In the factory, we move the valve to this position when we set the signal feedback to *4 mA* (typical) and adjust the final position switch. **This final position has to be used when you remount the valve and drive!** Mark the position (for example, using a *coloured marker*).
2. You can only adjust the torque on electrical drives after receiving written permission from ARTES Valve & Service GmbH.

3. When disassembling and installing, ensure that no forces and torques affect the valve stem. While assembling, tighten all bolts during evenly cross-wise at the required torque.

Never loosen the bolt connection and turn the drive on the three-way rotary valve. Otherwise, the settings for the limit and torque switches will no longer be correct!

5.2.4 Insulating the three-way rotary valve

Thermal insulation may be required to protect the unit against high temperatures.
The insulation must be fitted in such a way that the maximum ambient temperatures for drive, as prescribed by the manufacturer, are not exceeded.
The drive itself is not insulated.

The seals used in the three-way rotary valve permit the maximum temperature load specified in the valve data sheet.

You must comply with the permissible ambient temperatures for the drive.
You must ensure that there is sufficient air circulation at the installation location.

You must ensure that excessive vibrations cannot travel through the plant and act on the three-way rotary valve and, in particular, the drive.

6 STARTUP

You must comply with the operating conditions as stipulated in the purchasing contract. Otherwise the warranty will become null and void.

The operating data is given on the type plate of the three-way rotary valve. These values must not be exceeded.

In the delivery configuration, the rotary valve closes the lateral outlet.

6.1 STARTUP STEPS

1. Inspect all bolt connections while they are cold.
2. Run the drive through its entire range while it is cold.
   You have to inspect and calibrate the feedback signal and the final positions, as well as the intermediate positions (if applicable). You must comply with the manufacturer's specifications and operating manual for the drive.
3. Ensure that the vapour system drains properly.
4. You also have to ensure that the three-way rotary valve is kept warm. Implement a heat retention means in consultation with the manufacturer.
5. It is permitted to pickle the components of the three-way rotary valve. Rinsing and purging are not permitted. In general, we recommend removing the valve during these processes since foreign particles can damage the various components. Any use of rinsing, pickling and purging equipment must be additionally stipulated by contract.
6. Avoid temperature shocks during commissioning. **With temperature differences of 300 K, a differential temperature change of max. 2 K/min is permitted.**
7. Once the operating temperature has been reached, inspect all of the bolt connections and retighten them if necessary.

8. Check the gland follower for leaks while the plant is warm. After tightening the gland packing, you only have to ensure that the stem is not blocked.

Ensure that the stem is not blocked by excessive tightening of the gland follower!

6.2 DURING OPERATION

During operation, check the three-way rotary valve for leaks.
Clean the valve stem on a regular basis. Clean the stem using a soft cloth (do not use emery paper!).
The frequency of the inspections depends on your plant requirements; however, they should be performed quarterly at the very least. In particular, check that the gland packing forms a proper seal.
The revision intervals for the three-way rotary valve primarily depend on the differential pressure and the media purity. These criteria are responsible for the wear of the components. Normally servicing tasks are performed after 16,000 operating hours.
It is recommended that a general maintenance is carried out after 24,000 operating hours.
It is almost entirely impossible to cause damage to the pressurised components when the plant is operated in a proper manner.

Your warranty claims will only apply when you document the maintenance measures.

Only ARTES Valve & Service GmbH personnel or trained specialists are permitted to perform the servicing tasks, otherwise the warranty becomes void.

6.3 REMOVING FROM THE PIPELINE

1. Switch off the section of the plant. In doing this, you must comply with all plant regulations.
2. For toxic media, you must purge the line before removing the three-way rotary valve.
3. Obtain written confirmation that the plant is not pressurised (release).
4. Check the on-site temperature. The temperature of the components have to be lower than the temperature permitted by the relevant authorities.
5. Empty the system using the drainages.
6. Typically, the three-way rotary valve case remains in the pipeline during repairs. If there are damages that require removing the case of the three-way rotary valve from the pipeline, remove it by carefully loosening the flange connections. With welded joints, cut out the entire weld seam including the heat affected zone.
7. Remove from the line.

Do not use the drive to lift the entire unit. If required, remove the drive and valve separately (*see also section 5.2.3 "Drive"*)

With smaller valves, the case can be lifted for transport purposes using a strap.
Assembly aids are available for larger valves.

8. You must ensure that the transport is secure.

6.4 REMOVING THE THREE-WAY ROTARY VALVE

Mark all flange connections prior to loosening them and refit at the same positions when re-installing them.

1. Drive the valve to the “lateral outlet closed” position
2. Removing the drive
3. Open any drainages and or vents on the housing.

Be aware of sudden pressure release by the encapsulated medium!

4. Remove the position indicator
5. Removing the trestle
6. In the conventional model of the packing case, loosen the bolt connections of the case and remove the “packing case with stem and rotary valve” unit from the case. In the pressure-tight model of the cap seal, remove the split ring from the case. Prior to this, remove the retaining ring that holds the split ring in position (*see fig. 3.5*).
7. To remove the stem together with the rotary valve from the packing case, first disassemble the circlip, unscrew the trestle and then remove the gland packing .
8. Loosen the stem and the rotary valve from each other. Fasten the rotary valve using two square ends. Pull the rotary valve off of the stem towards the case bearing. Loosen the set screws first.
9. Check the lower guide rail of the stem in the case for signs of damage and measure the dimensions.

   If damage is found, remove the lower guide rail. Otherwise, this can remain in the case.
10. Clean all parts. Take special care while cleaning the sealing and gliding surfaces. A conventional degreaser can be used as a cleanser.

6.5 INSPECTION

All components have to be subjected to a visual inspection.
The degree of wear incurred on components that are subject to wear has to be determined.

If it cannot be guaranteed that the components will have high enough quality until the next service stop, then the components should be exchanged.
All components have to be inspected for damage and corrosion. Reconditioning is possible to a small degree. Damaged surfaces can be reconditioned using emery cloth (*400 grain, soaked in petroleum*). If the damage is larger, these components must be replaced.

Only use the original spare parts.

In general, all seals generally need to be replaced. The threaded bolts and nuts must be replaced once the operating hours exceed 16,000 hours. If the threads are damaged, replace the threaded bolts and nuts immediately regardless of the operating hours.

6.6 ASSEMBLY

Before commencing with assembly work, check the rotary valve for any signs of damage. Check the valve case for signs of damage in the vicinity of the rotating ball. Regrind with diamond paste (*800 and 1200 grit*) if required.

When installing, apply Ni paste to the gliding and sealing surfaces.
Brush conservation agents (*e.g., Tectyl 506*) onto components without sliding or sealing function.

When installing the pure graphite rings, observe the following points:

- ⇨ Do not jam or squeeze them forcibly.
- ⇨ Make sure the gliding surfaces are well lubricated.
- ⇨ The surface roughness of the grooves must not exceed *4 µm*.

1. Assembling the “stem with rotary valve” unit Push the rotary valve up to the stem and secure it using set screws. Grind the set screws so that they cannot loosen during operation.
2. Install the “stem with rotary valve” unit in the packing case. Carefully insert the gland packing. Check the surface properties along sealing surfaces of the packing housing and stem again before assembly.
3. Fasten the trestle on the case. Insert the circlip. Adapt the disc below the circlip so that the stem moves easily and the play between the rotary valve and the disc does not exceed 0.5 mm.
4. Press the lower stem guide rail into the case. Check the shape and positional tolerance as well as the dimension accuracy and document the results.
5. Install the “packing case with stem and rotary valve” unit into the case of the three-way rotary valve. Before fastening the packing case, check that the stem moves easily along the lower guide rail.

   For the conventional model, evenly tighten the case bolts crosswise and to the specified torque.

   For the pressure-tight cap seal model, press the pressure ring and the cap seal against the case with the inserted split ring. After successfully assembling the parts, rotate the stem and ensure that it moves easily. If it does not move easily, check the shape and positional tolerances of the guide rails again. Stiffness of movement or jamming are not permitted.
6. Install the trestle and adjust the stem height using the circlip.
7. Install the position indicator.
8. Fasten and closure of drainages, if available.
9. While installing the drive, check the positions of the valve and drive. Install the drive in the position “lateral outlet closed”. Any drive settings such as the limit switch and position sensor must be adjusted according to the manufacturer's specifications.

7 TESTS

The acceptance criteria for inspecting the valve must be agreed upon in writing.

The declaration of conformity is made for categories III, module H and the valve is delivered with a CE designation. A separate acceptance procedure is required for category IV or on customer demand.

Unless otherwise contractually stipulated, the acceptance is confirmed by an inspection certificate in accordance with DIN EN 10204 3.1.

7.1 PRESSURE TEST

When new, the three-way rotary valve is subjected to a pressure test. The test pressures are given in the documentation.
Depending on the repair work that has been done, a pressure test must be performed following maintenance work in agreement with the plant operator.
The test pressures must not be exceeded during repeat inspections.

The three-way rotary valve must be conserved following pressure tests!

7.2 FUNCTIONAL TEST

The functionality of the three-way rotary valve is tested together with the drive. The torque, the feedback signal, and the displacement switches are configured.
You also have to obey the technical descriptions supplied by the manufacturer of the drive.
The technical description of the drive can be found in the appendix.

8 HANDLING MALFUNCTIONS

Only **ARTES** Valve & Service GmbH personnel or trained specialists are permitted to carry out repair work.
In special cases, authorisation must be obtained from **ARTES** Valve & Service GmbH.
If work is done without obtaining the authorisation from **ARTES** Valve & Service GmbH, the warranty becomes void.

Observe the following points during repairs:

- Obtain a response from **ARTES** Valve & Service GmbH before starting the repair work.
- If new components are needed, use only original spare parts.
- The inspection of the three-way rotary valve must be documented in the inspection report. The “Inspection Report” is available on request from **ARTES** Valve & Service GmbH.
- In addition to the inspection report, we also recommend that you document any repair work and damage to components using photographs.
- Write down the cause of the damage, the actual damage and the measures taken to rectify the damage.

Fault	Possible Cause	Troubleshooting	Comments
Leaks to the outside	Stem seal is leaky	Tightening the gland packing during operation	Warning! Do not block the stem!
	Stem seal leak, not necessary to tighten the gland packing	Disassemble trestle and replace the gland packing	The work must not be performed in a depressurised state Always perform a pressure test following the test
	Defect in pure graphite ring in case (Cap seal or pure graphite ring)	Repair and replace seal for case	
Stiffness of movement	Fault in the gears or drive	Check the drive torque settings	After completion, perform a new function test; reset the torque and limit switches.
		Disassemble the drive unit, check functionality and repair if necessary	
	Gland packing is blocked	Remove the gland packing	Warning! When removing the gland packing during operation, be careful to prevent leakages from occurring.
	Damage to valve	Repairs are necessary (*see chapter 5*)	If the stiffness of movement is caused by wear, the maintenance intervals need to be shortened. If foreign objects or particles penetrate the valve and cause damage or jamming, you must take appropriate measures to prevent further damage (such as purging the system).

9 SPARE AND WEAR PARTS LIST

The listed wear and spare parts are recommended by the manufacturer.

Item	Description	Item	Description
3	Stem	10	Main ring
4	Rotary valve	11 & 12	Seals
5	Gland follower	40 & 42	Threaded bolts
7 & 8	Bearing bush	41	Hexagon nut
9	Disc	44	Hexagon bolt

The parts list for the given project contains binding specifications concerning the qualities of the materials.

For all orders and/or inquiries concerning wear and spare parts, please provide the build number of the valve as well as its position and name.
The build number can be found on the type plate.