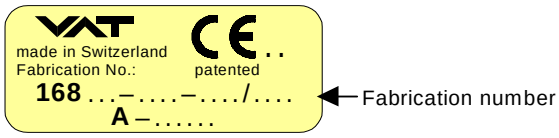
Large pendulum valve

This manual is valid for the valve ordering number(s):
16852-.A28/48
16854-.A28/48

The fabrication number is indicated on each product as per the label below (or similar):



Explanation of symbols:

Read declaration carefully before you start any other action!

Attention!

Product is in conformity with EC guidelines, if applicable!

Disconnect electrical power and compressed air lines. Do not touch parts under voltage!

Keep body parts and objects away from the valve opening!

Hot surfaces; do not touch!

Loaded springs and/or air cushions are potential hazards!

Wear gloves!

Read these **«Installation, Operating & Maintenance Instructions»** and the enclosed **«General Safety Instructions»** carefully before you start any other action!

Imprint:

Manufacturer VAT Vakuumventile AG, CH-9469 Haag, Switzerland

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Publisher VAT Vakuumventile AG, CH-9469 Haag, Switzerland

Editor VAT Vakuumventile AG, CH-9469 Haag, Switzerland

Print VAT Vakuumventile AG, CH-9469 Haag, Switzerland

Series 168, DN 400-500 (I.D. 16-20")

Contents:

1 Use of product

Use product for clean and dry indoor vacuum applications under the conditions indicated in chapter «Technical data» only! Other applications are only allowed with the written permission of VAT.

1.1 Technical data

Pressure range		$1x10^{-7}$ mbar to 1.2 bar (abs)	
Leak rate at body and valve seat		< $1x10^{-9}$ mbar ls $^{-1}$	
Max. differential pressure at opening		30 mbar	
Differential pressure on the gate		1.2 bar in either direction	
Molecular flow conductance		DN 400	DN 500
- Max.		50'000 ls^{-1}	90'000 ls^{-1}
- Min. adjustable (three pos actuator)		150 ls^{-1}	200 ls^{-1}
Cycles until first service - Open / Close		100'000 cycles [1])	
Admissible temperature [2])	Valve body	≤ 120°C (static i.e. plate not actuated) ≤ 80°C (dynamic i.e. plate actuated)	
	Actuator	≤ 80°C	
	Position indicator	≤ 80°C	
	Solenoid	≤ 50°C	
Position indicator	Contact rating	≤ 250 V AC ≤ 6 A	
Solenoid		see tag on solenoid	
Materials	Valve body	G-AlSi7Mg	
	Gate, counter-plate	AlMgSi1	
	Mechanism	AISI 301 (1.4310), AISI 303 (1.4305) AISI 420 (1.4034), AISI 304 (1.4301) AISI 52100 (1.3505)	
Weight valve		DN400 90.5kg (187 lbs)	DN500 120.5 kg (265 lbs)
Weight of single components		DN 400	DN 500
	Body	30 Kg (66 lbs)	42 Kg (93 lbs)
	Bonnet	16 Kg (35 lbs)	24 Kg (53 lbs)
	Mechanic	25 Kg (55 lbs)	31 Kg (69 lbs)
Mounting position			any

[1]) Under room temperature and clean conditions
[2]) Maximum values: depending on operating conditions and sealing materials

2 Installation

2.1 Unpacking

Open the box and install appropriated certified lifting eye bolts at the threads which are indicated in the valve drawing with the symbol ⛾ (Appropriate lifting eye bolt kit from VAT: P/N: 392932)
VAT recommends to install three eye bolts as shown in the picture below

Remarks: At some valve configurations the valve will already come with appropriate eye bolts installed

ATTENTION: Not appropriate lifting eye blots or installation of the lifting eye bolts at the wrong location at the valve can result in serious human safety issues

Install appropriate lifting strips and lift the crane hook slowly until the strips are under pull force. Keep lifting the hook and move the hook step by step in direction center of gravity until the valve is in horizontal position. Lift the valve out off the box and move it forward to the mounting chamber flange

Open the box

Install appropriate lifting eye bolts
Lift the valve out off the box

2.2 Installation into the system

1. Clean the sealing surface and the O-ring seal of the mating flange.
2. Move the pendulum valve in the correct mounting position with the crane. **ATTENTION:** Do not hit the sealing surfaces during manipulation!
3. Set 2 screws in one line
4. Set two additional two screws 90° to the line which is build by the first two screws.
5. Fasten the 4 screws crosswise until the O-ring seal gets in contact with the valve sealing surface.
6. Apply all remaining screws
7. Fasten all screws gradually in crosswise order. Suggested admissible torque for A2-50 screws with a friction coefficient of 0.1 see table below. (calculated screw pre load bellow is approx. 80% to 90%)

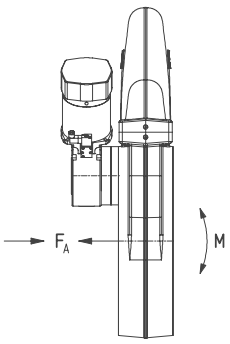
DN (nom. I.D.)		Tightening torque								
		ISO			JIS			ASA		
mm	inch	Torque <Nm>	Torque <ft lbs>	Screw size	Torque <Nm>	Torque <ft lbs>	Screw size	Torque <Nm>	Torque <ft lbs>	Screw size
400	16	19-21	14-16	M12	47-53	35-39	M16	-	-	-
500	20	19-21	14-16	M12	47-53	35-39	M16	-	-	-
-	ANSI 14.0	-	-	-	-	-	-	68-77	50-57	¾" UNC
-	ANSI 16.0	-	-	-	-	-	-	160-180	118-132	1" UNC
-	ANSI 18.0	-	-	-	-	-	-	160-180	118-132	1" UNC
-	ANSI 20.0	-	-	-	-	-	-	160-180	118-132	1" UNC

2.3 Admissible forces

Forces from evacuating the system and from the weight of other components can lead to deformation of the valve body and to malfunction of the valve. The stress has to be relieved by suitable means, e.g. bellows sections. The following forces are admissible:

DN (nom. I.D.)		Axial tensile or compressive force «FA»		Bending moment «M»	
mm	inch	N	lbf	Nm	lbf · ft
400	16	7840	1760	980	722
500	20	8820	1980	1078	800

If a combination of both forces («FA» and «M») occurs, the values mentioned above are invalid. Please contact VAT for more information.



2.4 Connections

2.4.1 Compressed air connection

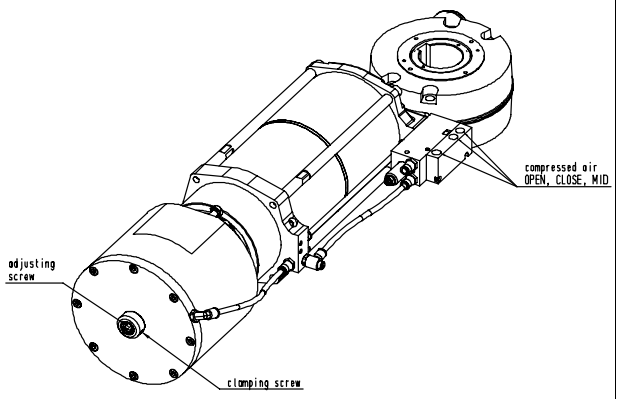
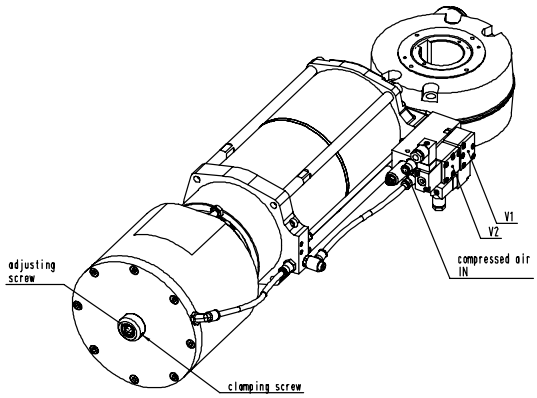
Connect compressed air only if
- valve has been installed to the vacuum system
- moving parts cannot be touched

With solenoid: Connections Connect compressed air to the **IN** port according the drawing below (one touch fitting for tube O.D. 6mm)

Without solenoid: Connect compressed air to connection to the **OPEN, CLOSE** and **MID** port according the drawing below (internal universal thread 1/8“ ISO/NPT)

Compressed air pressure (min. - max. overpressure): 5 - 7 bar / 75 - 100 psig

Use clean, dry or slightly oiled air only!

3-Pos actuator without solenoid	3-Pos actuator with solenoid
	

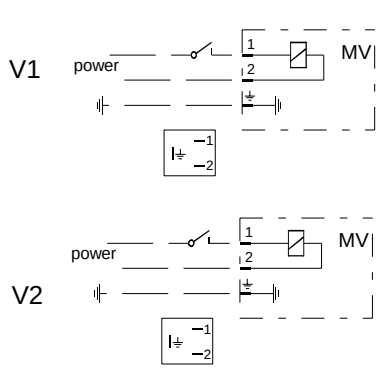
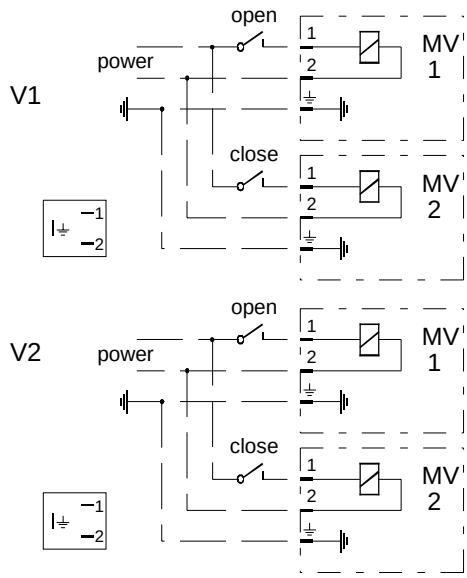
2.4.2 Electrical connection

Do not touch any electrically charged parts!

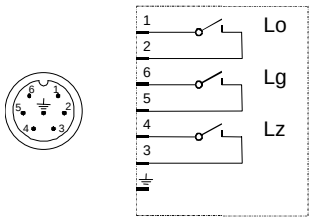
Connect electrical power only if
- valve has been installed to the vacuum system
- moving parts cannot be touched

Verify that mains voltage matches voltage stated on the solenoid! Sockets for position indicator and solenoid are supplied with the valve.

Wire solenoid and position indicator according to the following diagrams:

Solenoid	**Impulse solenoid (optional)**
	
V1 = Solenoid main cylinder V2 = Solenoid three position actuator	V1 = Solenoid main cylinder V2 = Solenoid three position actuator MV1 / MV2 = coils solenoid

Position Indicator



Lo = position indicator « OPEN»
Lg = position indicator « CLOSE»
Lz = position indicator « MID»

3 Operation

3.1 Normal operation

Valve is opened and closed by means of compressed air.

3.2 Operation under increased temperature

Cycling under temperatures above room temperature may reduce the number of cycle until first service.
VAT recommends an exchange of the locking balls after 50'000 cycles if the valve is cycled above room temperature. (see capture 5 to replace locking balls)

3.3 Behavior in case of compressed air pressure drop

Valve closed: valve remains closed
Valve open: valve position is undefined

3.4 Behavior in case of power failure

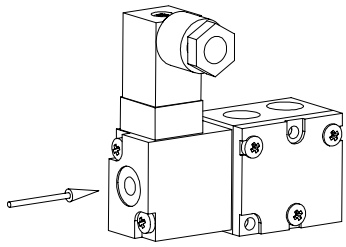
Standard solenoid: valve will close

Solenoid for impulse actuation (option): valve position does not change, but movement will be completed

3.5 Emergency operation at power failure

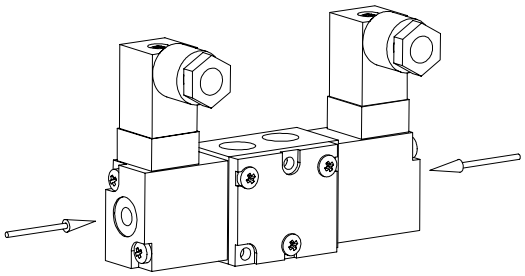
In case of a power failure, the valve can be actuated manually if compressed air is available.

Standard solenoid



Press push-button: valve opens
Release push-button: valve closes

Solenoid for impulse actuation (option)



Press push-button on the left: valve opens
Press push-button on the right: valve closes

3.6 Three position Actuator

3.6.1 Three position Actuator control logic

Without solenoid valve

Gate Position	Air inlet port		
	OPEN	CLOSE	MID
Open	+	-	-
Intermediate	-	+	+
Close	-	+	-

+ = air pressure applied on specific port
- = air pressure not applied specific port

With solenoid valve

Gate Position	Solenoid	
	V1	V2
Open	+	-
Intermediate	-	+
Close	-	-

+ = power on coil
- = no power on coil

Impulse Solenoid (Optional)

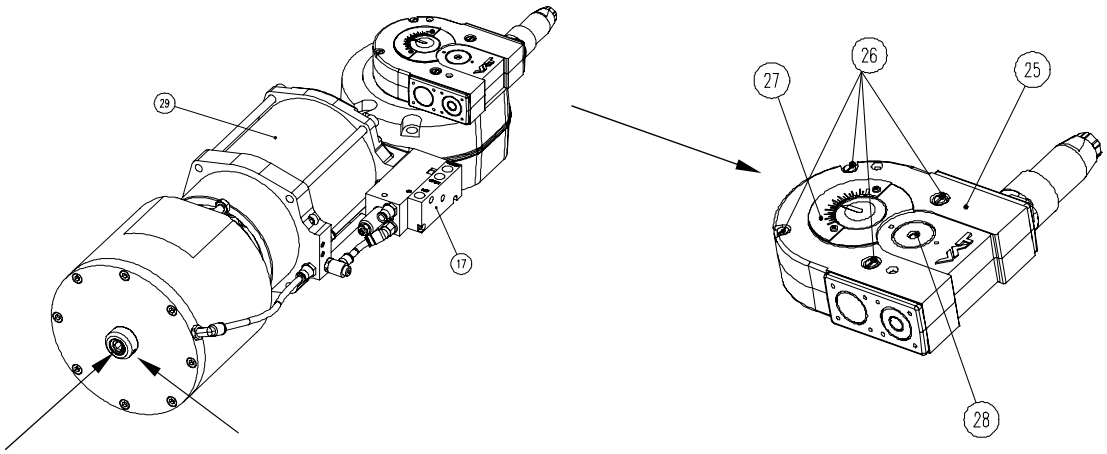
Gate Position	V1		V2	
	MV 1	MV 2	MV 1	MV 2
Open	+	-	-	+
Intermediate	-	+	+	-
Close	-	+	-	+

+ = power on coil
- = no power on coil

3.6.2 Adjustment procedure of third position

(Numbers in brackets refer to the pictures below)

1. Remove complete air pressure supply from the gate valve actuator
2. Unlock clamping screw (40)
3. Turn the adjustment screw (41) clockwise (closing direction) or counter clockwise (opening direction) to adjust the third position
4. Lock clamping screw (40)
5. Apply air pressure according section 3.6.1 to move the gate into the intermediate position. Repeat item 1 to 5 until required third position is adjusted.
6. Apply air pressure according section 3.6.1 to move the gate into the intermediate position.
7. Turn the adjustment screw (28) of the position indicator to the right or the left until the positing indicator switch for the intermediate position is closed . (Electrical contact between Pin 4 and Pin 3 of the position indicator connector; see section 2.4.2)



Adjustment screw (41)

Clamping screw (40)

4 Trouble shooting

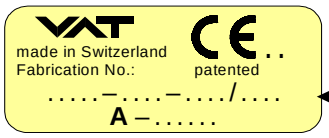
Valve does not close/open:	Power available? Compressed air available? Solenoid defective? Check voltage! Check air pressure!
Leak at gate:	Clean valve seat and gate seal! Replace gate seal, if damaged! Correct air pressure?
Leak at body:	Flanges leak tight? Screws at upper part of body tightened? Replace bonnet seal!
Gate stops in an undefined position during opening or closing movement	Check if compressed air pressure supply is according specifications. (see section 2.4.1)

If you need any further information, please contact one of our service centers. You can find the addresses on our website: http://www.vat.ch

5 Maintenance & repairs

Under clean operating conditions, the valve does not require any maintenance during the specified cycle life. Contamination from the process may influence the function and requires more frequent maintenance.

Before carrying out any maintenance or repairs, please contact VAT. It has to be individually decided whether the maintenance/repair can be performed by the customer or has to be carried out by VAT. The fabrication number on the valve



← Fabrication number

has always to be specified.

All supplies (e. g. compressed air, electrical power) must be disconnected for removal/installation of the valve from/into the system and for maintenance work.

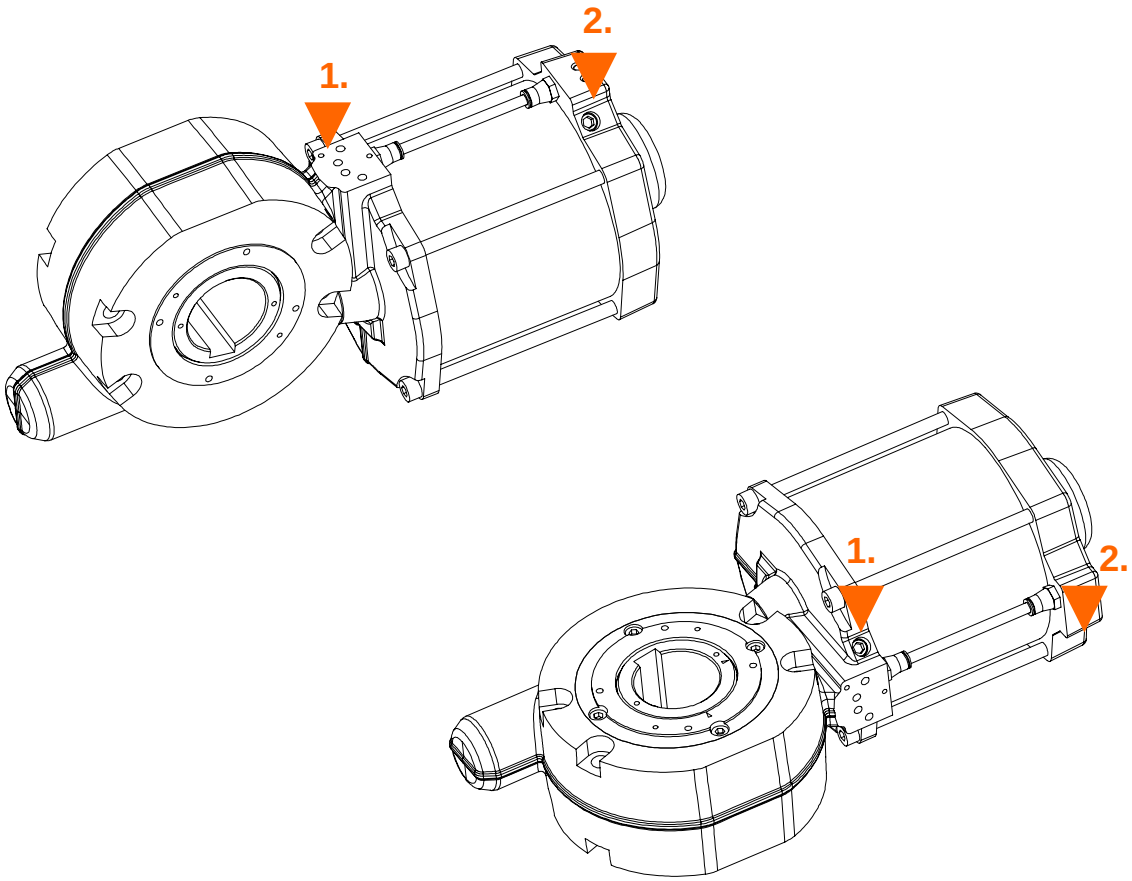

Even with disconnected supply, loaded springs and/or air cushions in cylinders can be potential hazards.


Keep fingers and objects away from the valve opening!

Products returned to VAT must be free of harmful substances such as e.g. toxical, caustic or microbiological ones. If products are radioactively contaminated, fill in the VAT form «Contamination and Radiation Report» and send it with the product. The form is available at VAT. The maximum values indicated in the form must not be exceeded.

5.1 Safety instructions

WARNING	
	**Serious personal safety hazard by air pressure loaded plugs** **The plug #1 or #2 can be catapulted out during manipulation at the plugs at pressurized actuator** **Do <u>not</u> turn or remove plug #1 or #2. (see pictures below)** **For all service or repair reasons at the actuator always contact VAT**



5.2 Maintenance procedures

5.2.1 Cleaning and replacing procedure of gate and bonnet seal

(Numbers in brackets refer to the picture on page 17 and 18)

1. Vent the camber on each side of the valve to atmosphere
2. Move the gate of the valve to the open position by applying compressed air to the open port
3. Disconnect complete air supply to the valve
4. Disconnect electrical main supply to the valve
5. **ATTENTION:** Heavy bonnet cover (2/1)! In advance of the following steps make sure, that the bonnet cover is securely supported to prevent any hazard due to the heavy weight of the bonnet cover. Use the attachments points indicated in the drawing on page 17 to mount eye bolts for lifting.
6. Remove the four bonnet screws (61/1)
7. Remove the bonnet cover carefully (2/1)
8. Place bonnet cover (2/1) on a clean and flat surface and securely support the cover (2/1) to prevent any hazards.
9. Unscrew the four position indicator screws (42/1/33)
10. Remove position indicator (42)
11. Unscrew the four centering ring screws (42/7)
12. Remove centering ring (42/4)
13. Unscrew the two tappet screws (42/6)
14. Remove tappet (42/5)
15. **ATTENTION:** Heavy gate mechanism (21)! In advance of the following steps make sure, that the gate mechanism is securely supported to prevent any hazard due to the heavy weight of the gate mechanism. Use the attachments points indicated in the drawing on page15 to mount eye bolts for lifting.
16. Unscrew the gate mechanism fastening screw (6110)
17. Remove gate mechanism (21)
18. Place gate mechanism (21) on a clean and flat surface and securely support the gate mechanism (21) to prevent any hazards
19. Clean gate seal (21/32) and counter gate seal (21/32) with alcohol or replace the seals if necessary
20. Clean seat and counter seat surface of the valve housing (1) with alcohol
21. Clean bonnet seal (2/2) with alcohol or replace bonnet seal if necessary
22. Clean bonnet seal surface at the valve housing (1/1) with alcohol
23. **ATTENTION:** Heavy gate mechanism (21)! In advance of the following steps make sure, that the gate mechanism is securely supported to prevent any hazard due to the heavy weight of the gate mechanism. Use the attachments points indicated in the drawing on page 15 to mount eye bolts for lifting.
24. Install gate mechanism (21)
25. Fasten the gate mechanism (21) with the mechanism fastening screw (6110) (Torque 128 Nm / 94.4 lbf.ft)
26. **ATTENTION:** Installed eye bolts on the gate mechanism can seriously damage the valve! Remove eye bolts of the gate mechanism in advance of the following steps.
27. Install the tappet (42/5) with the two tapped screws (42/6)
28. Install the centering ring (42/4) with the four centering screws (42/7)
29. Install the position indicator (42) with the four position indicator screws (42/1/33)
30. **ATTENTION:** Heavy bonnet cover (2/1)! In advance of the following steps make sure, that the bonnet cover is securely supported to prevent any hazard due to the heavy weight of the bonnet cover. Use the attachments points indicated in the drawing on page 17 to mount eye bolts for lifting.
31. Install bonnet cover (2/1) and fasten the four bonnet screws (61/1)

5.2.2 Replacement of locking balls

(Numbers in brackets refer to the picture on page 17 and 18)

1. Vent the camber on each side of the valve to atmosphere
2. Move the gate of the valve to the open position by applying compressed air to the open port

3. Disconnect complete air supply to the valve
4. Disconnect electrical main supply to the valve
5. **ATTENTION:** Heavy bonnet cover (2/1)! In advance of the following steps make sure, that the bonnet cover is securely supported to prevent any hazard due to the heavy weight of the bonnet cover. Use the attachments points indicated in the drawing on page 17 to mount eye bolts for lifting.
6. Remove the four bonnet screws (61/1)
7. Remove the bonnet cover (2/1)
8. Place bonnet cover (2/1) on a clean and flat surface and securely support the cover (2) to prevent any hazards.
9. Unscrew the four position indicator screws (42/1/33)
10. Remove position indicator (42)
11. Unscrew the four centering ring screws (42/7)
12. Remove centering ring (42/4)
13. Unscrew the two tappet screws (42/6)
14. Remove tappet (42/5)
15. **ATTENTION:** Heavy gate mechanism (21)! In advance of the following steps make sure, that the gate mechanism is securely supported to prevent any hazard due to the heavy weight of the gate mechanism. Use the attachments points indicated in the drawing on page15 to mount eye bolts for lifting.
16. Unscrew the gate mechanism fastening screw (6110)
17. Remove gate mechanism (21)
18. Place gate mechanism (21) with the gate downwards on a clean and flat surface and securely support the gate mechanism (21) to prevent any hazards
19. Gradually unscrew the four nuts in crosswise direction (21/27) of the gate mechanism (21)
20. Remove the four bushings (21/13)
21. Remove the four springs (21/15)
22. Remove the four bushings (21/12)
23. Place counter plate (21/2) with the counter place o-ring (21/32) downwards on a clean surface.
24. Place gate mechanism frame (21/3) which includes the ball guidance (21/4) and qty 14 balls (21/30) on a clean flat surface
25. Remove balls (21/30) from the ball guidance (21/4) and the gate (21/1)
26. Clean ball tracks of gate (21/1) and counter gate (21/2)
27. VAT recommends to replace gate (21/1) or counter gate (21/2) if wear at the ball track is visible
28. Clean the qty 28 ball bushings (21/5)
29. VAT recommends to replace ball guidance (21/4) if wear at the ball bushings (21/5) is detectable
30. Place qty 14 lubricated locking balls (21/30) into ball tracks of the gate (21/1)
31. Place the gate mechanism frame (21/3) which includes the ball guidance (21/4) on the gate (21/1) so that the guide pins (21/9) and the guide holes of the frame (21/3) match.
32. Place qty 14 lubricated locking balls (21/30) into the ball bushings (21/5) of the guidance piece (21/4)
33. Install counter gate (21/2) with the four bushings (21/12), the four springs (21/15) and the four bushings (21/13)
34. Fasten the four nuts (21/27) of the gate mechanism in crosswise direction (Torque 18 Nm / 13.3 lbf.ft)
35. Clean gate seal (21/32) and counter gate seal (21/32) with alcohol or replace the seals if necessary
36. Clean seat and counter seat surface of the valve housing (1/1) with alcohol
37. Clean bonnet seal (2/2) with alcohol or replace bonnet seal if necessary
38. Clean bonnet seal surface at the valve housing (1/1) with alcohol
39. **ATTENTION:** Heavy gate mechanism (21)! In advance of the following steps make sure, that the gate mechanism is securely supported to prevent any hazard due to the heavy weight of the gate mechanism. Use the attachments points indicated in the drawing on page15 to mount eye bolts for lifting.
40. Install gate mechanism (21)
41. Fasten the gate mechanism (21) with the mechanism fastening screw (6110) (Torque 128 Nm / 94.4 lbf.ft)
42. **ATTENTION:** Installed eye bolts on the gate mechanism can seriously damage the valve! Remove eye bolts of the gate mechanism in advance of the following steps.
43. Install the tapped (42/5) with the two tapped screws (42/6)
44. Install the centering ring (42/4) with the four centering screws (42/7)

45. Install the position indicator (42) with the four position indicator screws (42/1/33)
46. **ATTENTION:** Heavy bonnet cover (2/1)! In advance of the following steps make sure, that the bonnet cover is securely supported to prevent any hazard due to the heavy weight of the bonnet cover. Use the attachments points indicated in the drawing on page 17 to mount eye bolts for lifting.
47. Install bonnet cover (2/1) and fasten the four bonnet screws (61/1)

5.3 Retrofit procedures

5.3.1 Retrofit of standard valve with 3-pos actuator

(Numbers in brackets refer to the picture on page19)

1. Move the valve gate to the closed position by applying compressed air to the closed port
2. Disconnect complete air supply to the valve
3. Disconnect electrical main supply to the valve
4. Disconnect the compressed air tube (5) from the actuator bottom plate (6)

DN 400

5. Unscrew the QTY 4 screws (2)
6. Pull the actuator bottom plate (6) from the main cylinder (1)
7. Slide the 3-pos actuator (9 onto the main cylinder (1)
8. Fasten the QTY 4 screws (2) 10Nm / 7.38 ft lbs

DN 500

5. Unscrew the QTY 4 socked head screws (2)
6. Pull the actuator bottom plate (6) with the installed QTY 4 shafts (3) from the main cylinder (1)
7. Unscrew the QTY 4 shafts (3) from the actuator bottom plate (6).
8. Screw the QTY 4 shafts (3) into the threads located at the 3-pos actuator (9) 6Nm / 4.43 ft lbs
9. Slide the 3-pos actuator (9 with the installed QTY 4 shafts (3) onto the main cylinder (1)
10. Fasten the QTY 4 socked head screws (2) 10Nm / 7.38 ft lbs

11. Connect the compressed air tube (5) with the one touch fitting (10) located at the 3-pos actuator (9)
12. Connect the compressed air tube (12) with the one touch fitting (15) located at the control valve (13)

Valve without solenoid

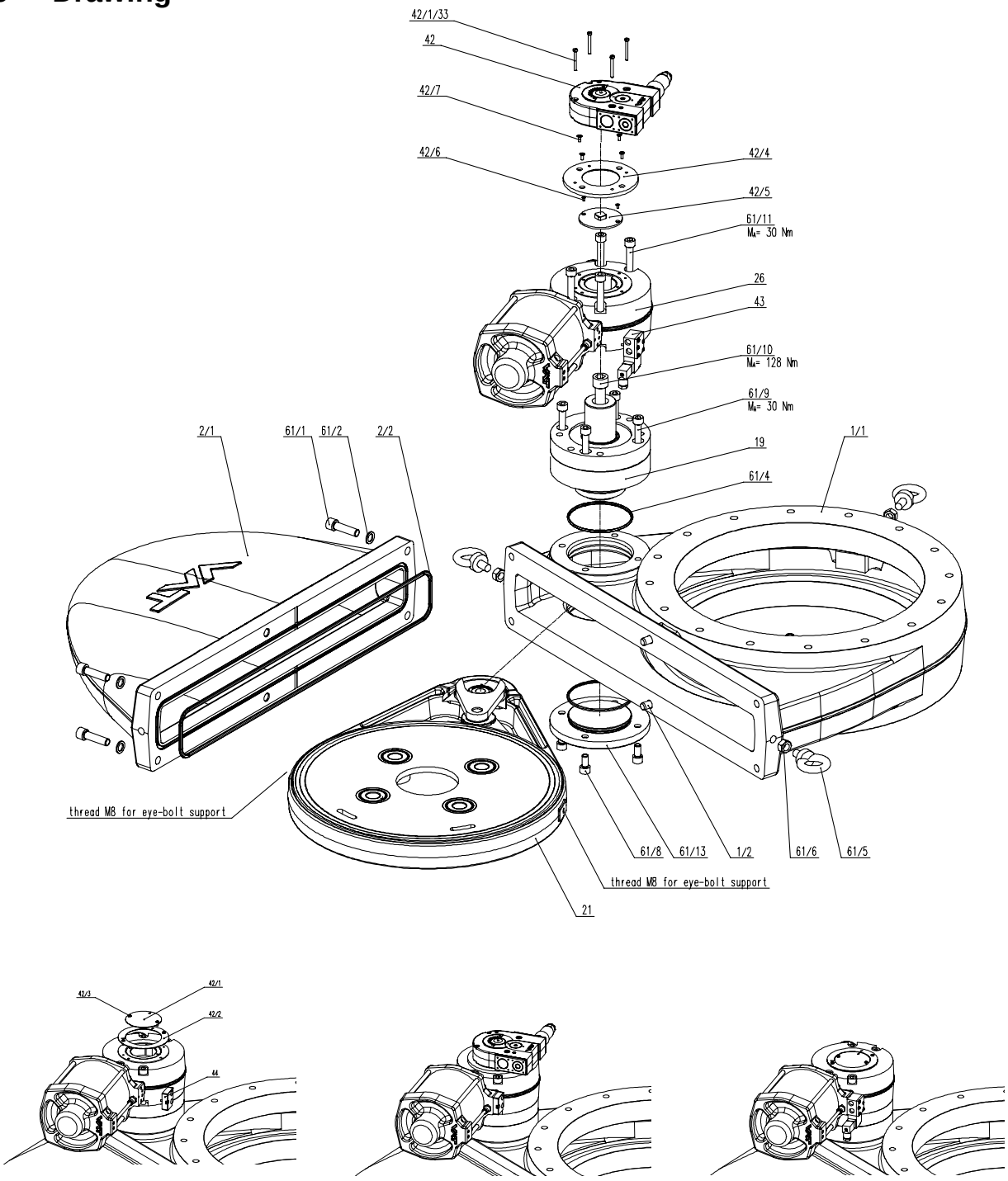
13. Mount control valve (13) to main cylinder (1) with the two socket head screws (14)
14. Connect compressed air tube (12) with one touch fitting (11) located at the 3-pos actuator (9)
15. Mount pneumatic interface adapter (17) with the QTY 4 screws (18) to the control valve (13)

Valve with solenoid

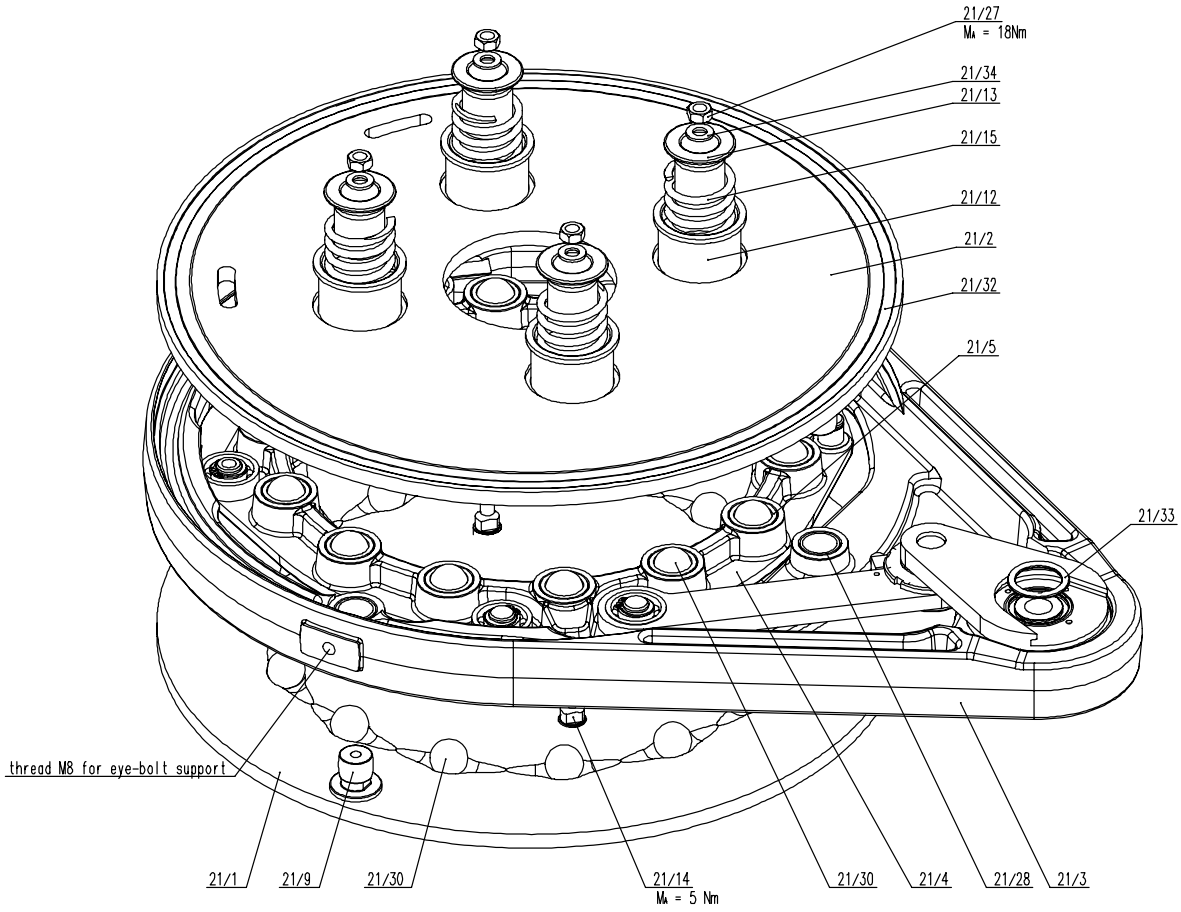
13. Remove the QTY 2 screws (8) to remove the solenoid (7)
14. Mount control valve (13) to main cylinder (1) with the two socket head screws (14)
15. Connect compressed air tube (12) with one touch fitting (11) located at the 3-pos actuator (9)
16. Mount the QTY 2 solenoids (21 and 19) to the control valve (13). Screws (22) and (20)

17. Remove standard position indicator (23) by removing the QTY 4 mountings screws (24)
18. Install 3-pos position indicator (25) with the QTY 4 mounting screws (26)
19. Depending on the mounting position of the actuator (A or B side) the position indication plate(27) has to be flipped over. Remove the QTY 2 screws to flip over the position indication plate (27). If the valve actuator is on the B-side a letter “B” should be visible beside the mounting screws of the installed indication plate (27). If the actuator is on the A-side a letter “A” should be visible beside the mounting screws of the installed indication plate.
20. Apply compressed air according section 2.4.1
21. Adjust 3-pos position indicator according section 3.6.2

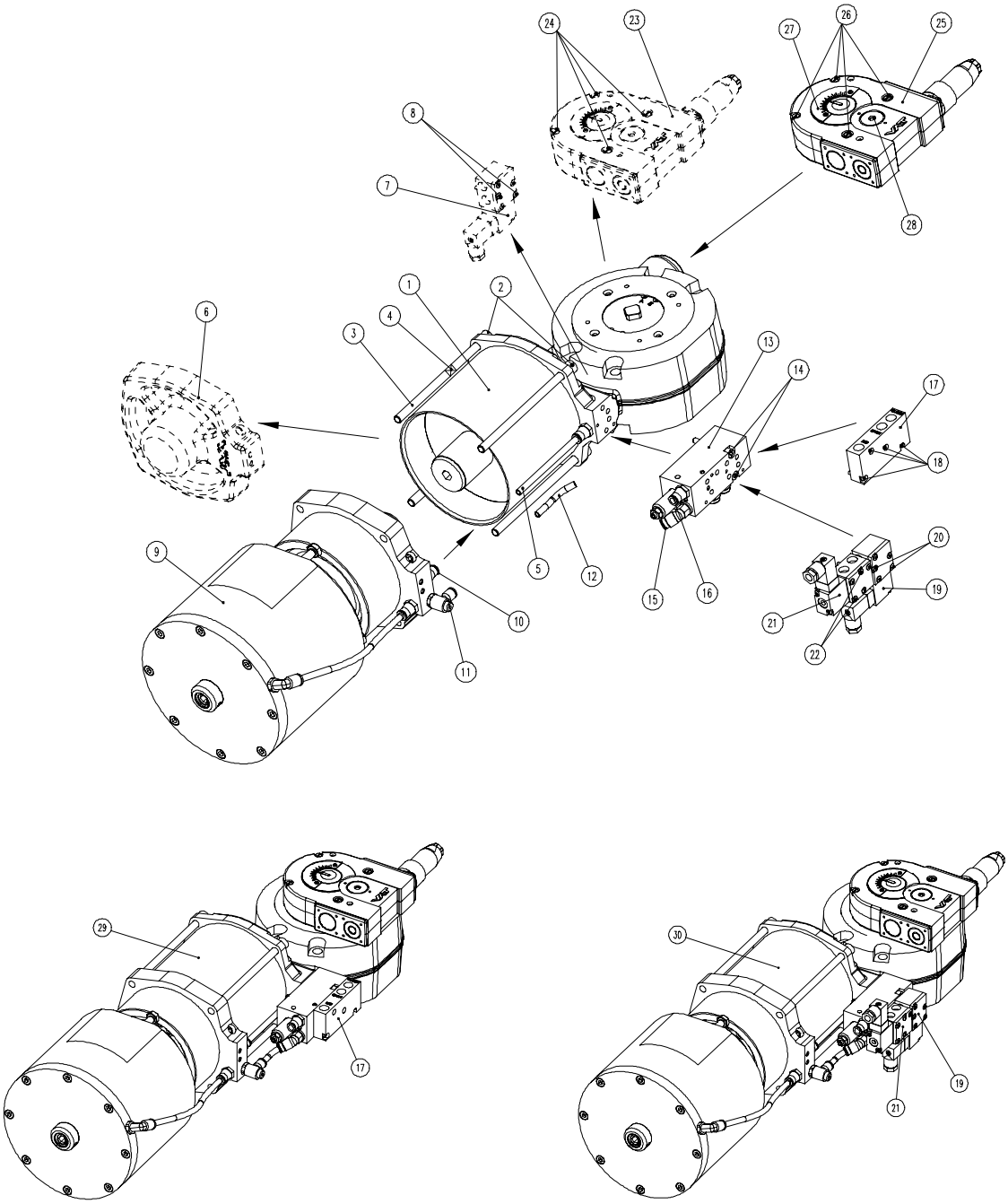
6 Drawing


42/1/33
42
42/7
42/6
42/4
42/5
61/11
MA= 30 Nm
26
43
61/10
MA= 128 Nm
61/9
MA= 30 Nm
19
61/4
2/1
61/1
61/2
2/2
1/1
thread M8 for eye-bolt support
61/8
61/13
1/2
61/6
61/5
thread M8 for eye-bolt support
21
42/3
42/1
42/2
44

6.1 Mechanism assembly drawing



6.2 3-Pos actuator



7 Spare parts

(Items refer to the numbers on page 17 and 18)

Item	Description	DN 400	DN500	QTY required per valve
2/2	Bonnet seal	N-5100-386	N-5100-390	1
21/32	Gate seal or counter gate seal	N-5100-461	N-5100-469	1
26	Actuator module	239607	239605	1
19	Rotary feed through module	323482	263036	1
	QTY 28 Lubricated Locking balls	245973	245974	1
	3-Pos actuator retrofit kit for standard valve without solenoid	308068	308070	1
	3-Pos actuator retrofit kit for standard valve with solenoid	308066	308069	1

8 Warranty

Each product sold by VAT Vakuumventile AG (VAT) is warranted to be free from the manufacturing defects that adversely affect the normal functioning thereof during the warranty period stated in VAT's «Terms of Sale» immediately following delivery thereof by VAT, provided that the same is properly operated under conditions of normal use and that regular, periodic maintenance and service is performed or replacements made, in accordance with the instructions provided by VAT. The foregoing warranty shall not apply to any product or component that has been repaired or altered by anyone other than an authorized VAT representative or that has been subject to improper installation or abuse, misuse, negligence or accident. VAT shall not be liable for any damage, loss, or expense, whether consequential, special, incidental, direct or otherwise, caused by, arising out of or connected with the manufacture, delivery (including any delay in or failure to deliver), packaging, storage or use of any product sold or delivered by VAT shall fail to conform to the foregoing warranty or to the description thereof contained herein, the purchaser thereof, as its exclusive remedy, shall upon prompt notice to VAT of any such defect or failure and upon the return of the product, part or component in question to VAT at its factory, with transportation charges prepaid, and upon VAT's inspection confirming the existence of any defect inconsistent with said warranty or any such failure, be entitled to have such defect or failure cured at VAT's factory and at no charge therefor, by replacement or repair of said product, as VAT may elect. VAT MAKES NO WARRANTY OR REPRESENTATION OF ANY KIND, EXPRESS OR IMPLIED, (INCLUDING NO WARRANTY OR MERCHANTABILITY), EXCEPT FOR THE FOREGOING WARRANTY AND THE WARRANTY THAT EACH PRODUCT SHALL CONFORM TO THE DESCRIPTION THEREOF CONTAINED HEREIN, and no warranty shall be implied by law.

Furthermore, the «Terms of sale» at the back of the price list are applicable.