

541D20 SERIES

Technical Manual



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Introduction

The 541D20 is a mechanical 2-cycle control valve for softening of drinking and feed water supplies. When the drain paddle is opened, the valve is automatically transferred to the regeneration position; with its few moving parts, this simple and reliable system guarantees years of trouble-free service. The semi-automatic twist timer must be manually initiated by simply turning the knob to the desired brine/slow rinse cycle time; the regeneration will take place and afterwards the valve will automatically return to the service position. The valve is designed for hard water bypass during regeneration. A built in adjustable blending device for mixing hard and soft water to suit the particular needs of each installation is an optional feature. The valve requires a conventional float-controlled brine valve with aircheck to control the brine refill. The following sequence is followed:

1. SERVICE:

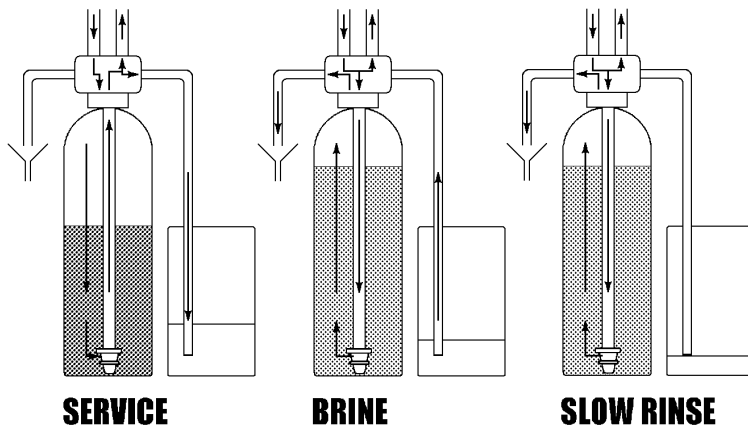
Untreated water flows down through the resin bed and up through the riser tube; the water is conditioned when passing through the resin. The throughput is dependent on the maximum permissible pressure drop for the complete water softener and the maximum permissible specific load of the resin (generally taken as 40 litres soft water per hour per litre resin).

2. BRINE:

Salt brine, drawn from the brine tank by the injector, flows down through the riser tube and slowly up through the resin bed to drain; the resin is being regenerated when the salt brine passes through. The brine cycle is terminated when the air check is shut.

3. SLOW RINSE:

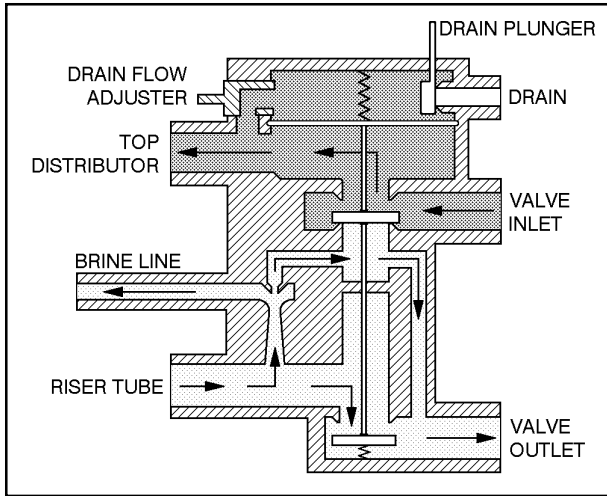
Slow rinse continues for the remainder of the brine cycle; the injectors motive water flows down through the riser tube and slowly up through the resin bed to drain, slowly washing the brine from the resin tank.



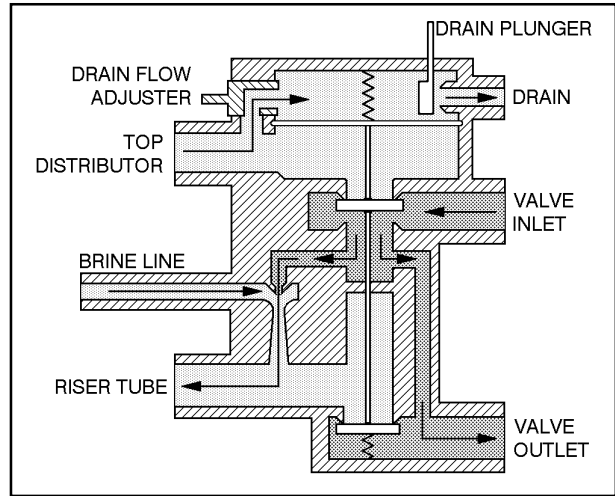
Technical Specifications

<ul style="list-style-type: none">• Valve body material• Connections<ul style="list-style-type: none">- inlet/outlet- drain line- brine line- tank- riser tube• Mixing valve	Glass filled Noryl® Brass adapters BSP, 3/4" male/female, 1" male 1/2" NPT with hose barb 13 mm Compression fitting 3/8" polytube 2 1/2" - 8 NPSM 1,050" / 26,7 mm Optional
<ul style="list-style-type: none">• Flow rates (valve with riser)<ul style="list-style-type: none">- service	$K_v = 4,1 / C_v = 4,8$
<ul style="list-style-type: none">• Application	Softener 6" - 12"
<ul style="list-style-type: none">• Operating pressure• Operating temperature• Electrical rating	1,4 - 8,3 bar / 20 - 120 psi 2 - 48 °C / 35 - 120 °F Non-electric
<ul style="list-style-type: none">• Regeneration• Controller<ul style="list-style-type: none">- regeneration initiation- brine draw/slow rinse- refill	2 cycles, counter-current brining Semi-automatic Manual Adjustable: 0 - 120 min Float valve controlled

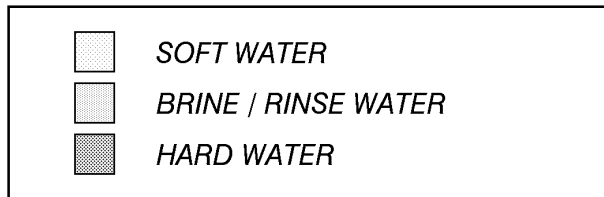
Flow Diagrams



SERVICE



BRINE / SLOW RINSE



Injector & Flow Control Selection

Injector

The injector determines the brine concentration (ratio between brine suction and rinse water) and the brine flow through the resin bed, thus the contact time between brine and resin. Injector performances vary significantly with operating pressure.

Inlet press bar	Inj. 9		Inj. 8		Inj. 5		Inj. 4		Inj. 3		Inj. 2		Inj. 1	
	Brine l/min	Rins l/min	Brine l/min	Rins l/min	Brine l/min	Rins l/min	Brine l/min	Rins l/min	Brine l/min	Rins l/min	Brine l/min	Rins l/min	Brine l/min	Rins l/min
1,38	0,15	0,68	0,23	0,68	0,38	0,68	1,14	1,14	1,14	1,51	1,14	2,27	1,14	2,65
2,76	0,26	0,95	0,42	0,95	0,76	0,95	1,51	1,51	1,89	1,89	1,89	3,03	1,89	3,79
4,14	0,30	1,10	0,45	1,10	1,14	1,10	1,89	1,51	2,27	2,27	2,27	3,03	2,27	4,92
5,52	0,30	1,25	0,45	1,25	1,32	1,25	2,08	2,46	2,27	2,84	2,46	3,97	2,46	5,49
6,90	0,30	1,40	0,45	1,40	1,51	1,40	2,08	2,65	2,27	3,03	2,65	4,16	2,65	6,06

!!! The following table is only an indication and is valid for an inlet pressure of 3 bar, a bed height of 30" and a salt consumption of 120-150 gr/l resin.

Resin volume Liter	Injector Nr.
< 8	9
8 – 15	8
15 – 20	5
20 – 30	4
30 – 40	3
40 – 50	2
> 50	1

Drain flow control (optional)

In case of the 541 valve, the drain flow control helps to keep the piston in the regeneration position when the operating pressure is extremely low (< 1,5 bar).

Ø Tank		Drain F.C.		
inch	mm	Nr.	Gal/min	(L/min)
6	152	U	1,2	(4,5)
7	178	U	1,2	(4,5)
8	203	E	1,6	(6,1)
9	229	G	2,0	(7,6)
10	254	J	2,6	(9,8)
12	305	K	3,5	(13,2)

Installation

Assembly

For proper assembly of valve and resin tank, proceed as follows:

1. Rinse the resin tank well before use.
2. Attach the lower distributor to the riser tube using PVC-glue or a stainless steel pin.
3. Lower the riser tube into the tank so that it touches the bottom.
4. Cut the riser tube 13 mm (= 1/2") below the top of the tank threads and chamfer the tube to prepare for insertion into the control valve.
5. Temporary plug the top of the riser tube to prevent resin from entering the tube and fill the tank with resin for max. 3/4.
6. Make sure the O-ring in the riser insert of the control valve is in the correct position; screw the upper distributor onto the control valve.
7. Lubricate the threads, the top of the riser tube and the tank O-ring of the control valve.
8. Lower the control valve straight down onto the riser tube and screw it onto the tank.

Installation

!!! ATTENTION

- For proper functioning of the unit, incoming water pressure should be between a minimum of 1,4 bar during regeneration and a maximum of 8,3 bar in service; if necessary, a pressure reducer must be installed ahead of the system.
- For proper functioning of the timer, the dial should be installed in a vertical plane, with a maximum deviation of 5° positive or negative.
- Installation must only be undertaken by a person competent in plumbing.
- All plumbing connections must be done in accordance with local codes.
- Do not install the unit too close to a water heater (min. 3 m of piping between outlet of unit and inlet of heater); water heaters can sometimes transmit heat back down the cold pipe into the control valve; always install a check valve at the outlet of the unit.
- If the control valve is not equipped with a bypass, a three valve bypass system must be installed to enable bypassing during servicing.

For proper installation of the unit, proceed as follows:

1. **Inlet/outlet**: connect the inlet and outlet to the control valve; when facing the front of the valve, the inlet is at the right and the outlet at the left side.
2. **Drain line**: connect a hose to the drain line fitting on the valve and secure it; insert the drain hose into a standpipe, with siphon if required; make sure the drain hose is:
 - as short as possible,
 - not elevated too much,
 - free of kinks,as this will all create undesired counter-pressure.
3. **Brine line**: a conventional float-controlled brine valve system with aircheck is required for proper brining during regeneration; 3/8" polytube must be used to connect the brine system to the valve; do not overtighten the nut.

Installation check-out

When installation has been completed, the unit is ready to be placed into service. Proceed as follows, while checking the unit for any leakages:

1. Place unit in bypass and turn on main water supply; open a cold water tap nearby and allow water to run for a few minutes until all foreign material that may have resulted from the installation is washed out; close the tap.
2. Slowly shift the bypass valve to the service position and secure it; allow water to completely fill the resin tank.
3. Carefully open a cold water tap and allow water to run for at least 2 minutes to set the resin bed and purge air from the system; close the tap.
4. Fill the brine tank with water, higher than the air-check level.
5. Turn the timer knob clockwise past 30 min, to open the drain paddle; the valve is now transferred to the brine/slow rinse position.
6. Allow the valve to draw water from the brine tank until the aircheck closes.
7. Place unit in bypass.
8. Add the appropriate amount of water to the brine tank.
9. Add salt to the brine tank.
10. Set float of brine valve to the level of the water in the brine tank.
11. Shift bypass valve back to the service position.
12. Turn the timer knob back counter clockwise to the OFF position, to close the drain paddle; the valve is now transferred back to the service position.

Mixing valve (optional)

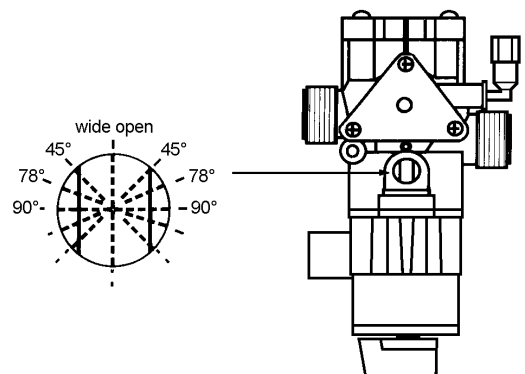
To adjust the residual hardness, the incorporated mixing valve must be regulated in function of the hardness of the incoming water and the desired residual hardness; the scale on the mixing valve has no absolute indication, but serves only as a reference point:

- To increase the residual hardness: turn screw counter clockwise.
- To decrease the residual hardness: turn screw clockwise.

Drain flow adjuster

!!! ATTENTION

When the valve is equipped with an incorporated drain flow control (optional), the drain flow adjuster is assembled and locked in the wide open position! By releasing the locking screw of the locking plate, the drain flow adjuster can still be used, but note that the maximum flow to drain is limited by the incorporated drain flow control (optional).



With the drain flow adjuster it is possible to adjust the water flow to drain during regeneration. The so created counter pressure helps to keep the piston of the valve in the regeneration position when the operating pressure is extremely low (< 1,5 bar). To adjust:

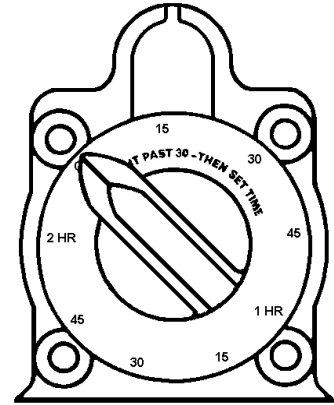
1. Place the unit in brine/slow rinse position.
2. Turn the drain flow adjuster either to the right or to the left until the piston remains stable in the regeneration position.

Do note that closing the drain flow adjuster too much, will result in bad suction of the injector.

The Semi-automatic Timer

Setting

The semi-automatic timer must be manually initiated; by turning the timer knob clockwise past 30 min, the drain paddle is opened and the valve is transferred to the brine/slow rinse position; the length of this cycle can then be set between 0 and 120 min. At any time the regeneration can be cancelled by turning the timer knob back counter clockwise to the OFF position



Fast functioning check

When You want to check if the system is operating correctly, proceed as follows:

1. Open water supply to valve.
2. Turn the timer knob clockwise past 30 min, to open the drain paddle; the valve is now transferred to the brine/slow rinse position.
3. Check brine draw by listening or feeling for suction.
4. Turn the timer knob back counter clockwise to the OFF position, to close the drain paddle; the valve is now transferred back to the service position.

Parts Replacement

!!! BEFORE SERVICING:

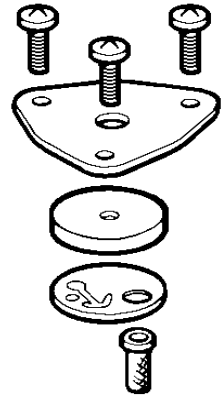
- **MAKE SURE THE CONTROL VALVE IS IN SERVICE POSITION**
- **BYPASS OR DISCONNECT THE WATER SUPPLY**
- **RELIEF THE WATER PRESSURE**

Timer head assembly

1. Remove the drain hose from the drain line fitting.
2. Remove the 4 timer head screws and pull away the timer head assembly.
3. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.

Injector

1. Remove the 3 screws holding the injector cover plate in place.
2. Lift off the injector cover plate.
3. Remove the injector and injector gasket.
4. Remove the injector filter and check for dirt or clogging.
5. Install the injector filter.
6. Install a new injector gasket; mind the alignment over the alignment post.
7. Install the injector; mind the alignment over the alignment post.
8. Install the injector cover plate.
9. Install the 3 injector cover plate screws and tighten them evenly.



Brine draw restrictor

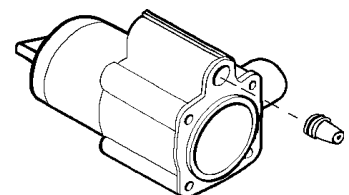
For injectors 8 and 9, an additional 'restrictor' is used that is located in the brine elbow. The restrictor is tightly pressed in, to ensure a leakage free seal. Do NOT remove the restrictor to prevent damage of restrictor and/or seal.

To access the restrictor for cleaning purposes:

1. Remove the brine line from the brine elbow.
2. Remove the clip that secures the brine elbow.
3. Check restrictor for dirt or clogging; clean if necessary by blowing air through restrictor.
4. Install the brine elbow and secure it with the clip.
5. Install the brine line to the brine elbow.

Incorporated drain flow control (optional)

1. Remove the drain hose from the drain line fitting.
2. Remove the 4 timer head screws and pull away the timer head assembly.
3. Locate the drain flow control in the drain channel of the timer head.
4. Pull out the drain flow control.
5. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.

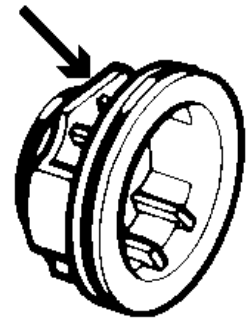


Main diaphragm

1. Remove the drain hose from the drain line fitting.
2. Remove the 4 timer head screws and pull away the timer head assembly.
3. Remove the screw and washer from the centre of the main diaphragm.
4. Remove the main diaphragm from the body stem assembly.
5. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.

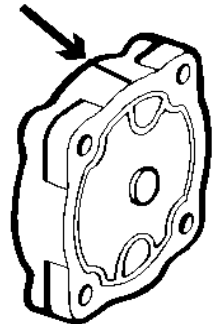
Body stem assembly

1. Remove the drain hose from the drain line fitting.
2. Remove the 4 timer head screws and pull away the timer head assembly.
3. Pull forward the main diaphragm; put 2 fingers behind the membrane and pull out the body stem assembly.
4. Inspect the centre check disc rubber seal for wear; clean or replace if necessary.
5. Lubricate the O-rings of the seat insert.
6. Install the body stem assembly.
7. Install the seat insert with 1 of the 2 flats facing towards the top of the valve body.
8. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.



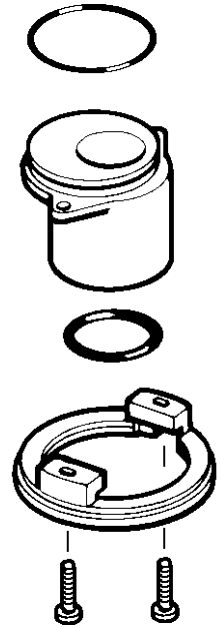
Check disc

1. Remove the 4 screws from the back cap.
2. Place a hand under the back cap and remove the back cap; the check disk spring might fall into Your hand.
3. Remove the check disc from the body stem assembly.
4. Inspect the check disc rubber seal for wear; clean or replace if necessary.
5. Install the check disc on the body stem assembly and the check disc spring onto the centre post of the check disc.
6. Make sure the back cap gasket is securely installed in the back cap grooves.
7. Align the mark on top of the back cap with the mark on the valve body and install the back cap with the open end of the check disk spring onto the centre post of the back cap.
8. Install the 4 screws and tighten them.



Riser insert

1. Remove the inlet and outlet from the control valve.
2. Remove the drain hose from the drain line fitting and the brine line from the brine line fitting.
3. Remove the control valve from the resin tank.
4. Unscrew the upper distributor from the control valve.
5. Remove the 2 screws holding the adapter ring and riser insert in place.
6. Lift away the adapter ring.
7. Pull the riser insert out of the valve body.
8. Check the O-ring on the riser insert; clean or replace if necessary; lubricate lightly.
9. Install the riser insert; press it in firmly.
10. Install the adapter ring and tighten the 2 screws.
11. Make sure the O-ring in the riser insert of the control valve is in the correct position; screw the upper distributor onto the control valve.
12. Lubricate the threads, the top of the riser tube and the tank O-ring of the control valve.
13. Lower the control valve straight down onto the riser tube and screw it onto the tank.
14. Install the drain hose to the drain line fitting and the brine line to the brine line fitting.
15. Install the inlet and outlet to the control valve.



Troubleshooting

Hard (untreated) water to service

Cause	Solution
1. Open or defective bypass	1. Close or verify bypass
2. Excessive water usage	2. Regenerate unit now
3. Valve in regeneration	3. /
4. Loss of resin	4. Refer to problem "Loss of resin"
5. Mixing valve open	5. Reduce mixing valve opening
6. Change in raw water hardness	6. Regenerate unit more frequently
7. Unit fails to regenerate	7. Refer to problem "Unit fails to regenerate"
8. Valve fails to draw brine	8. Refer to problem "Valve fails to draw brine"
9. Decreasing exchange capacity of resin	9. Clean or replace resin bed
10. No salt in brine tank	10. Add salt
11. Leak at riser tube	11. Verify that riser tube is seated correctly and is not cracked

Unit fails to regenerate

Cause	Solution
1. Drain paddle does not go open	1. Turn timer knob to at least 30 min Replace timer head assembly
2. Body stem assembly switches continuously	2. Check minimum operating pressure; refer to Installation "Drain flow adjuster"

Valve fails to draw brine

Cause	Solution
1. Low operating pressure	1. Verify operating pressure; must exceed 1,4 bar
2. Drain flow adjuster too much closed	2. Open drain flow adjuster slowly until unit draws brine
3. Plugged injector	3. Clean injector
4. Plugged injector filter	4. Clean injector filter
5. Restricted drain line	5. Verify drain line for kinks or restrictions
6. Restricted brine line	6. Verify brine line for kinks or restrictions
7. Leak in brine line	7. Verify brine line and connections for air leakage
8. Not enough water in brine tank	8. Verify functioning and float setting of brine valve

Excessive water in brine tank

Cause	Solution
1. Improper setting of float	1. Verify float setting of brine valve
2. Defective brine valve	2. Verify or replace brine valve

Unit uses too much salt

Cause	Solution
1. Excessive water in brine tank	1. Refer to problem "Excessive water in brine tank"
2. Unit regenerates too frequently	2. Adjust regeneration frequency

Salt water to service

Cause	Solution
1. Excessive water in brine tank	1. Refer to problem "Excessive water in brine tank"
2. Injector undersized	2. Verify injector selection
3. Improper brine/slow rinse time setting	3. Verify that brine/slow rinse time corresponds to the proper salt level and amount of resin

Loss of resin

Cause	Solution
1. Lower and/or upper distributor damaged	1. Replace distributor(s)
2. Leak between riser tube and upper distributor	2. Verify that riser tube is seated correctly and is not cracked

Loss of water pressure

Cause	Solution
1. Mineral or iron build-up in resin tank	1. Clean resin bed and control valve; increase regeneration frequency
2. Plugged lower and/or upper distributor	2. Verify that distributors are free of debris
3. Crushed lower and/or upper distributor	3. Replace distributor(s)

Drain flows continuously

Cause	Solution
1. Defective timer head	1. Replace timer head assembly

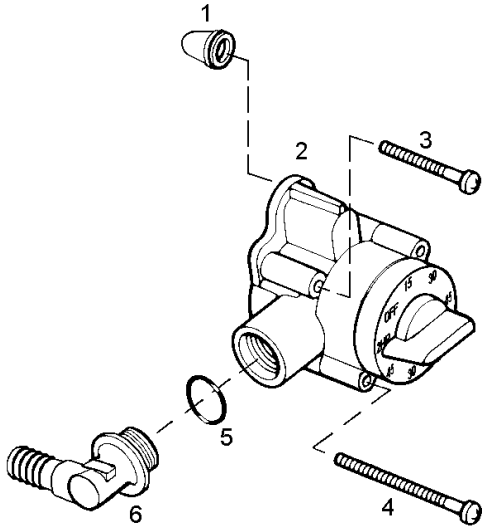
Annual Maintenance

To assure the correct functioning of the control valve, the following items must be checked annually:

1. Clean out injector and injector filter.
2. Verify correct execution of setting (refer to “Fast functioning check” on pg. 7).
3. Measure the residual hardness; adjust mixing valve if necessary.
4. Verify min. and max. water pressure; install pressure reducer if necessary.

Exploded View & Part Numbers

Semi-automatic timer

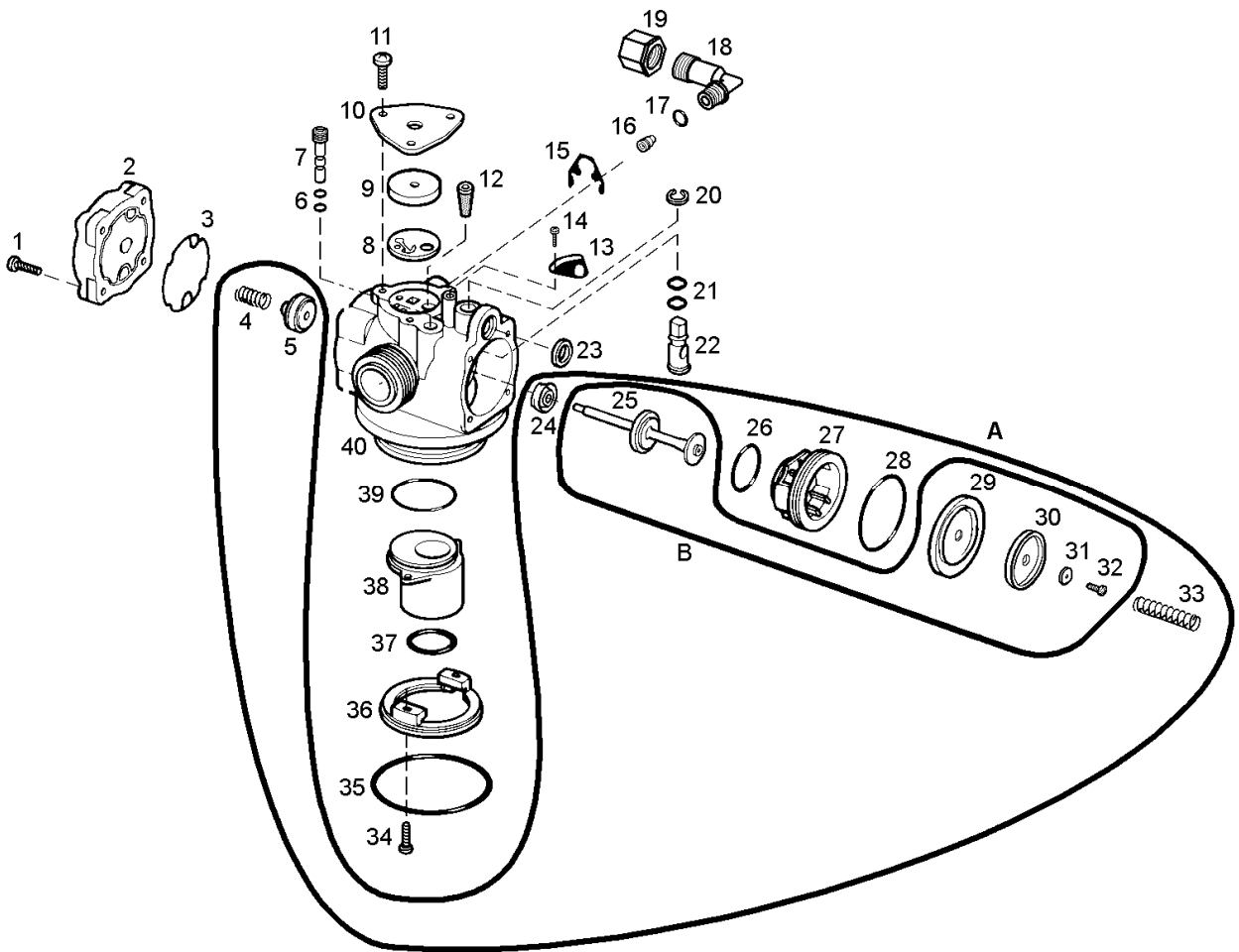


541D20 SERIES

ITEM	PART NUMBER	DESCRIPTION
1	541/300/*	Drain flow control (optional)
2	72313	Timer head assembly
3	15/87	Screw (short), timer head (2x)
4	72308	Screw (long), timer head (2x)
5	185/115/1	O-ring, drain elbow
6	H1026/1	Drain elbow

* Size: refer to "Sizing Table"

Valve body



541D20 SERIES

ITEM	PART NUMBER	DESCRIPTION
1	15/222	Screw, back cap (4x)
2	541/207	Back cap
3	541/206	Gasket, back cap
4	541/239	Spring, check disc
5	541/246	Check disc
6	185/005/1	O-ring, mixing valve (2x)
7	541/940/6/1	Mixing valve (optional)
8	541/325	Gasket, injector
9	428/*	Injector
10	541/221	Cover plate, injector
11	15/89	Screw, cover plate (3x)
12	72604	Filter, injector
13	72609	Locking plate, drain flow adjuster
14	15/76	Screw, locking plate
15	541/254	Spring clip
16	74015	Brine draw restrictor 0,8mm (with injector 9 only)
	74022	Brine draw restrictor 1,0mm (with injector 8 only)
17	186/118	O-ring, brine elbow
18	568/336/0	Brine elbow
19	21/90	Nut, brine elbow
20	19/19	Clip, drain flow adjuster
21	186/134	O-ring, drain flow adjuster (2x)
22	541/238	Drain flow adjuster
23	529/244	O-ring, drain port
24	467/216	Seal, body stem
25	72605	Body stem
26	185/024/1	O-ring, seat insert (small)
27	541/204	Seat insert
28	185/029/1	O-ring, seat insert (large)
29	72602	Main diaphragm
30	72507	Retainer, main diaphragm
31	72245	Washer, main diaphragm
32	72552	Screw, main diaphragm
33	516/221	Spring, main diaphragm
34	15/90	Screw, adapter ring (2x)
35	185/67/4	O-ring, tank
36	541/232	Adapter ring
37	185/214/1	O-ring, riser tube
38	541/218	Riser insert 1,050"
39	185/029/1	O-ring, riser insert
40	541/257/1	Valve body (incl. 467/216)
	541/257/1/R	Valve body (incl. 467/216) for mixing valve
A	RK/541/244	Repair kit body stem and seat
B	72611	Repair kit body stem

* Size: refer to "Sizing Table"

Order Specifications

541D20/ID(/R)

I = Injector: 9, 8, 5, 4, 3, 2, 1

D = Incorporated drain flow control:

0 = no flow control, only drain flow adjuster

Nr.	Gal/min	(L/min)
U	1,2	(4,5)
E	1,6	(6,1)
F	1,8	(6,8)
G	2,0	(7,6)
H	2,2	(8,3)
J	2,6	(9,8)
T	3,0	(11,4)
K	3,5	(13,2)

/R = Incorporated mixing valve

