541N SERIES

Technical Manual

Erie™
Water Treatment Controls

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Introduction

The 541N Series are electronic 2- or 4-cycle regeneration control valves for softening of drinking and feed water supplies. When the drain solenoid is activated, the valve is automatically transferred to the regeneration position; together with the optional additional solenoid valve(s) integrated in the back cap of the control valve body, this simple and reliable system guarantees years of trouble-free service. The microprocessor controlled programmer with NOVRAM®, offers unrivalled programming simplicity for use in demand initiated with days override systems. 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 541N18 and 541N19 control valves require a conventional float-controlled brine valve with aircheck to control the brine refill. The 541N94 and 541N99 require only an aircheck; a conventional float-controlled brine valve system can be used as a double security. 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).

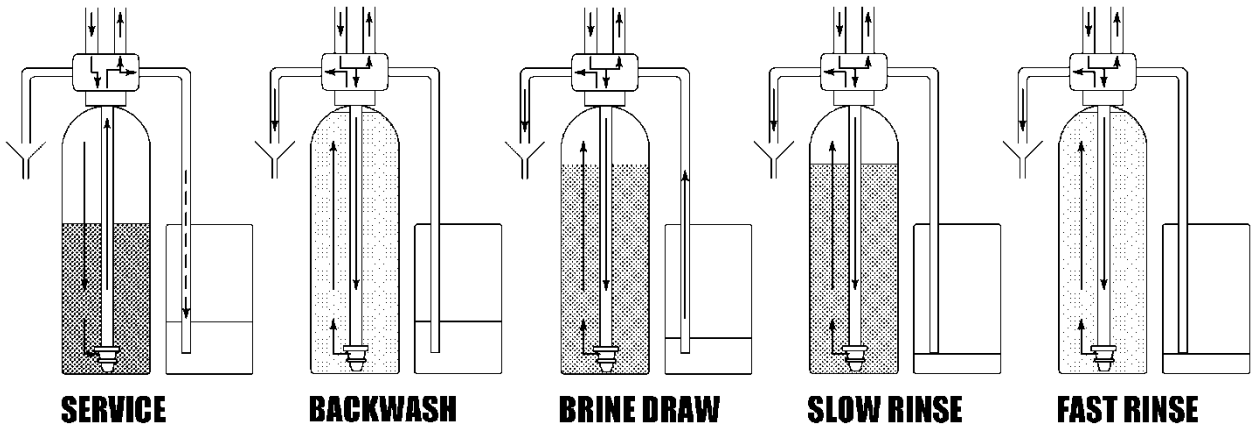
2. **BACKWASH (541N18/N94):**
   Water flows down through the riser tube and up through the resin bed to drain; the resin bed is fully expanded and all foreign materials are thoroughly washed from the resin, allowing a good brine cycle to occur.

3. **BRINE DRAW:**
   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 draw cycle is terminated when the air check is shut.

4. **SLOW RINSE:**
   Slow rinse continues for the remainder of the 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.

5. **FAST RINSE (541N18/N94):**
   Water flows down through the riser tube and up through the resin bed to drain, ensuring that all traces of brine are washed out. The resin bed is now ready for the next service cycle.

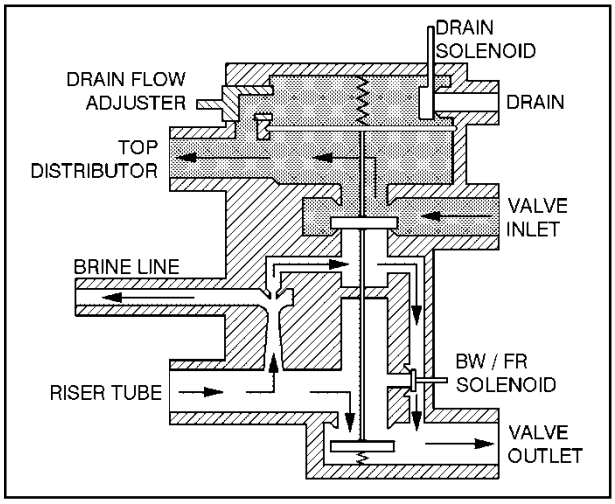
6. **REFILL (541N94/N99):**
   With the valve back in the service position, soft water flows to the brine tank at a fixed flow of 1 L/min, and this for a programmable duration.



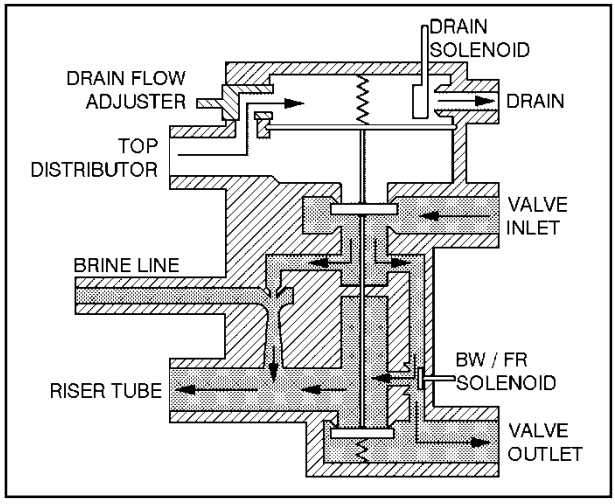
Technical Specifications

• Valve body material	Glass filled Noryl®
• Connections	
- inlet/outlet	Brass adapters BSP, 3/4" male/female, 1" male
- drain line	1/2" NPT with hose barb 13 mm
- brine line	Compression fitting 3/8" polytube
- tank	2 1/2" - 8 NPSM
- riser tube	1,050" / 26,7 mm
• Mixing valve	Optional
• Flow rates (valve with riser)	
- service	$K_v = 4,1$ / $C_v = 4,8$
- backwash (541N18/N94)	$K_v = 0,7$ / $C_v = 0,8$
- fast rinse (541N18/N94)	$K_v = 0,7$ / $C_v = 0,8$
• Application	Softener 6" - 12"
• Operating pressure	1,4 - 8,3 bar / 20 - 120 psi
• Operating temperature	2 - 48 °C / 35 - 120 °F
• Electrical rating	24V - 50 Hz, max. 966 mA (541N18/N94) 24V - 50 Hz, max. 676 mA (541N99) 24V - 50 Hz, max. 326 mA (541N19)
• Regeneration	4 cycles, counter-current brining (541N18/N94) 2 cycles, counter-current brining (541N19/N99)
• Controller	Electronic with µ-processor and NOVRAM®
- software	EAZY
- regeneration initiation	Demand with days override or manual
- regeneration mode	Delayed, immediate or delayed with immediate override
- time of regeneration	Adjustable
- days override	Adjustable: OFF, 1 - 30 days
- water hardness	Adjustable: 1 - 99 °f / °d / °Clarck
- reserve capacity	Self-calculating or adjustable (0-70% of total cap.)
- backwash (541N18/N94)	Adjustable: 0 - 20 min
- brine draw/slow rinse	Adjustable: 0 - 180 min
- fast rinse (541N18/N94)	Adjustable: 0 - 20 min
- refill (541N94/N99)	Adjustable: 0 - 65 min (@ 1 L/min)
• Flow meter accuracy	1,4 - 115 L/min: ±10%

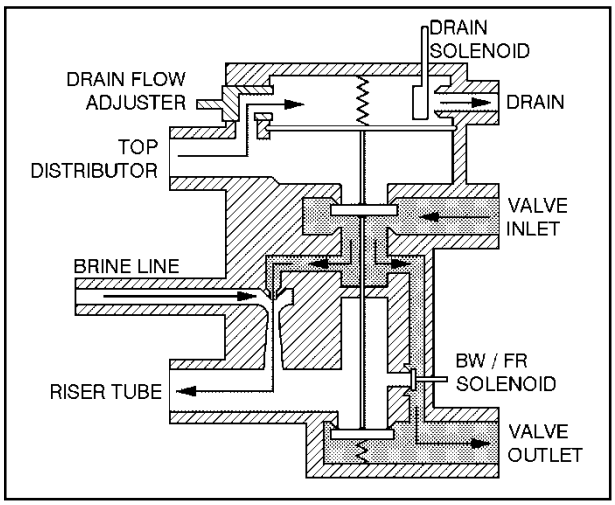
Flow Diagrams (541N18/N19)



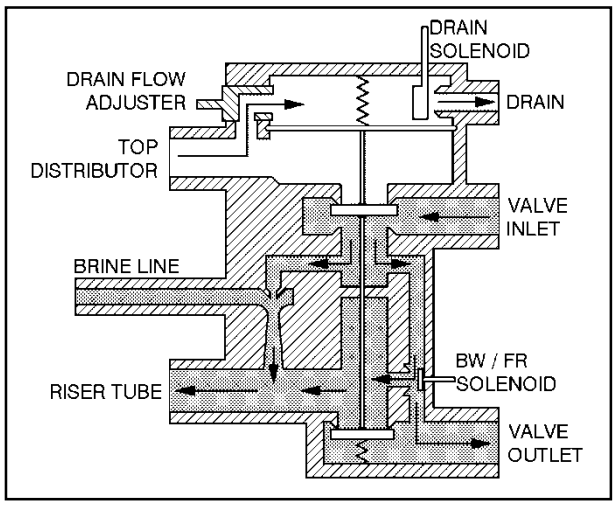
SERVICE



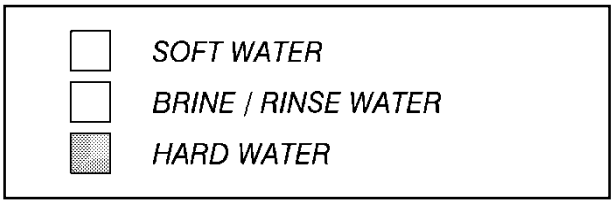
BACKWASH (541N18)



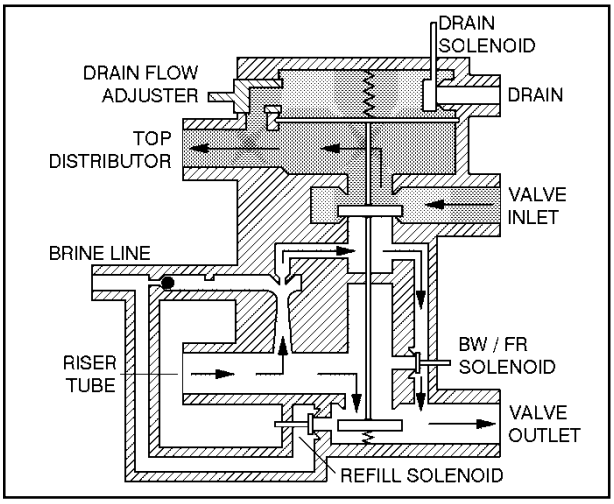
BRINE DRAW / SLOW RINSE



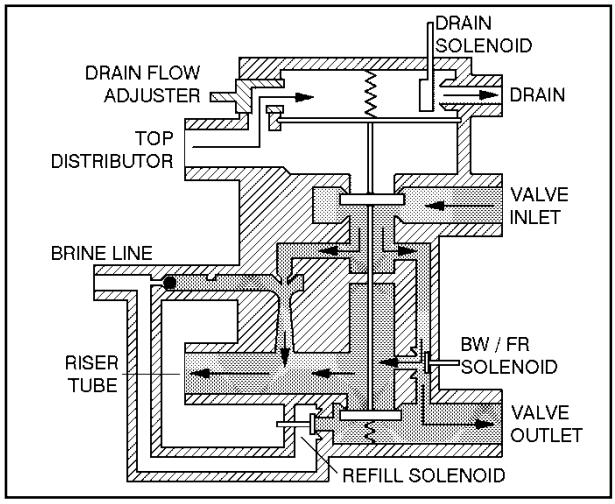
FAST RINSE (541N18)



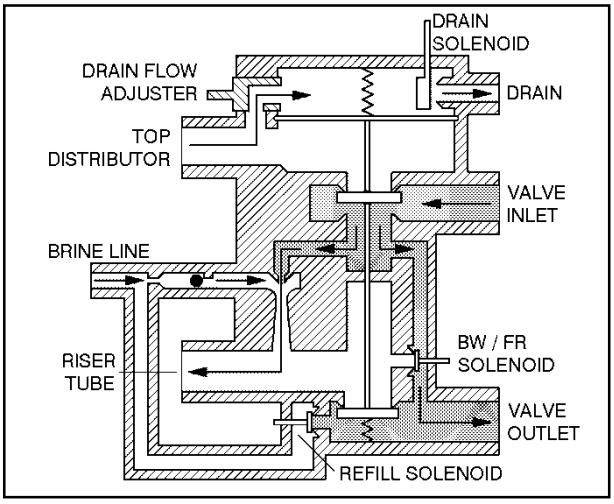
Flow Diagrams (541N94/541N99)



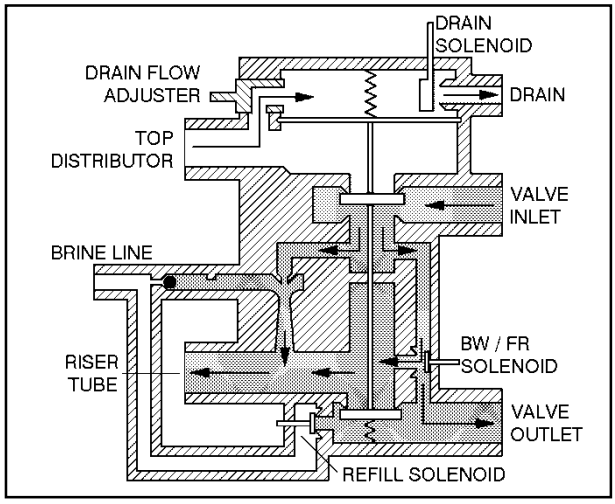
SERVICE



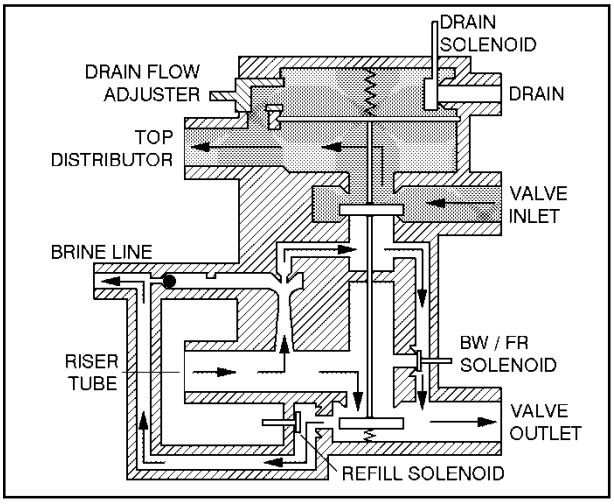
BACKWASH (541N94)



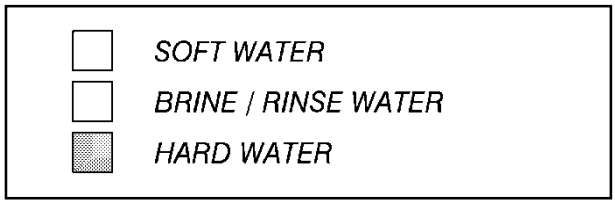
BRINE DRAW / SLOW RINSE



FAST RINSE (541N94)



BRINE REFILL



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 inlet pressure.

Inlet	Inj. 9		Inj. 8		Inj. 5		Inj. 4		Inj. 3		Inj. 2		Inj. 1	
press.	Brine	Rinse	Brine	Rinse	Brine	Rinse	Brine	Rinse	Brine	Rinse	Brine	Rinse	Brine	Rinse
bar	l/min	l/min	l/min	l/min	l/min	l/min	l/min	l/min	l/min	l/min	l/min	l/min	l/min	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	Injector
Liter	Nr.
< 8	9
8 – 15	8
15 – 20	5
20 – 30	4
30 – 40	3
40 – 50	2
> 50	1

Drain flow control (optional)

The drain flow control determines the resin bed expansion during backwash (541N18 and 541N94 only), independent of the inlet pressure. The optimal bed expansion is generally obtained at a backwash flow of 1,8 L/min per dm^2 of resin bed surface. In case of the 541 valve, it also helps to keep the piston in the regeneration position when the operating pressure is extremely low (< 1,5 bar).

∅ 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 the control 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 resin 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 unit.
- Installation must only be undertaken by a person competent in plumbing.
- All plumbing and electrical 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 elbows on 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 solenoid on the control 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**: the 541N18 and 541N19 control valves require a conventional float-controlled brine valve with aircheck to control the brine refill. The 541N94 and 541N99 require only an aircheck; a conventional float-controlled brine valve system can be used as a double security. 3/8" polytube must be used to connect the brine system to the control valve's brine elbow.
4. **Transformer**: make sure the power source carries the same rating as the transformer; plug transformers output lead (with plug ø 2,5 mm x 5,5 mm) into socket at the timers power lead and plug transformer into socket; the connection can be secured by means of the wire clip.

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 unit; close the tap.
4. Program the control valve according to the specific installation (refer to "Programming" on pg. 10).
5. Fill the brine tank with water, higher then the air-check level.
6. Press the ***scroll*** button until the display shows:

```
Regen in 10 sec
```

7. Leave the control valve in this position; the countdown timer will countdown to 0 sec and start a regeneration.
8. The drain solenoid will be activated and the display will show:

```
Rgn:XX  Cyc1:YY
```

9. Check the correct functioning of the control valve in the different regeneration cycles; the control valve can be advanced to the next regeneration cycle manually by pressing the ***scroll*** button.

	541N18	**541N19**	**541N94**	**541N99**	**Action**
Backwash	Cycle 1	/	Cycle 1	/	purge air from system
Brine draw/slow rinse	Cycle 2	Cycle 1	Cycle 2	Cycle 1	draw water from the brine tank until the air check closes
Fast rinse	Cycle 3	/	Cycle 3	/	check drain line for flow
Brine refill	/	/	Cycle 4	Cycle 2	allow water to run to brine tank for the entire cycle time

10. Add salt to the brine tank.

For 541N18/541N19 only:

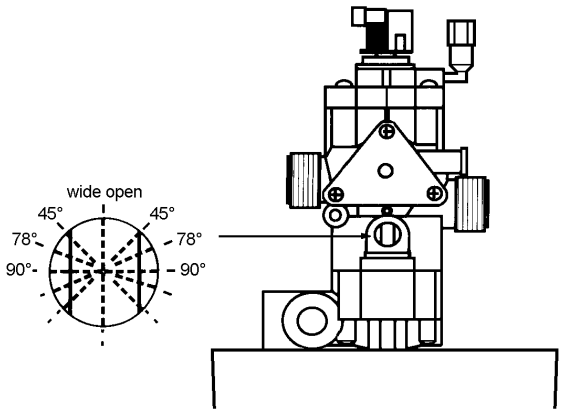
11. As soon as the control valve is back in the service position, place unit in bypass.
12. Add the appropriate amount of water to the brine tank.
13. Set float of brine valve to the level of the water in the brine tank.
14. Shift bypass valve back to the service position.

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. This way the water consumption during backwash and fast rinse can be tuned for the system's size. The optimal bed expansion during backwash, is generally obtained at a backwash flow of 1,8 L/min per dm^2 of resin bed surface (depending on the type of resin). To adjust:

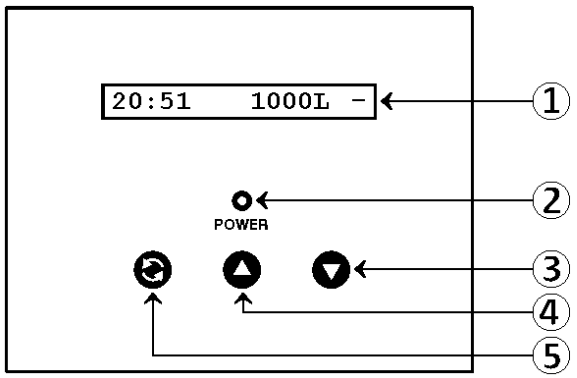
1. Place the unit in backwash position.
2. Check the flow to drain.
3. Adjust the flow to drain by turning the drain flow adjuster either to the right or to the left, until the desired drain flow is obtained.

Also, 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.

Electronic Control Panel



① **display**

② **POWER led**: lights up when electrical power is applied

③ **DOWN button**: to decrease the value of the parameter

④ **UP button**: to increase the value of the parameter

⑤ **SCROLL button**: to advance to the next parameter

Power-up

After power-up, the display will show the installed software version for 5 seconds, f.e.:

```
EZDSDg EZ
```

Afterwards it will automatically revert back to the service display.

The POWER led will light up.

Power failure

In the event of a power failure, the program will remain stored in the NOVRAM® during an undefined period, while an incorporated SuperCap (capacitor) will maintain the correct time of day during a period of several hours; consequently, in case of prolonged power failure, the time of day might not be maintained; if this happens, the time of day indication will *flash* when the power supply is re-established, indicating that the time of day needs to be set.

When the power failure occurs during the execution of an automatic regeneration, the control valve will immediately return to the service position; when the power supply is re-established, the control valve will stay in the service position for 60 sec. and restart a complete regeneration from the beginning.

Timer failure

In the event of a timer failure, the display will show the message:

```
Service Required
```

In such case, entering one of the programming levels can possibly solve the problem. However if the problem persists, professional service is required.

Service mode

In **service mode** the display shows the time of day, the remaining capacity and the water usage indicator:

```
20:51    1000L -
```

Every day the control valve automatically recalculates the reserve capacity, as a progressing average. Permanently it compares the remaining capacity with the calculated reserve capacity; as soon as the remaining capacity equals the calculated reserve capacity, the display will show the time of day and the indication "REGEN", indicating that a delayed regeneration will be started at the pre-programmed time of regeneration:

```
20:51     REGEN-
```

In case the resin bed is fully exhausted (remaining capacity equals zero) before a delayed regeneration can take place, the unit will regenerate immediately.

Regeneration mode

In **regeneration mode** the display shows the total remaining regeneration time, the actual regeneration cycle and the remaining cycle time:

```
Rgn: 67 Cyc2: 45
```

total remaining regen. time — actual regen. cycle — remaining cycle time

The control valve can be **reset to service mode** at any time by pressing the ***scroll*** button, as such manually advancing it through the regeneration cycles.

Checking the flow meter

In case of water usage, the remaining capacity counter in the service display will count back per unit, i.e. per litre; furthermore the water usage indicator will revolve. This way the correct functioning of the water meter can be verified.

Manual regeneration

It is possible to manually initiate a rgeneration.

1. Press the ***scroll*** button repeatedly until the display shows:

```
Regen in 10 sec
```

- If the control valve is left in this position, the countdown timer will countdown to 0 sec and *start a regeneration.*
- To cancel this mode, press the ***scroll*** button before the countdown timer has reached 0 sec; the control valve will return to the service mode.

Programming

!!! ATTENTION

- During programming, it is necessary to enter the desired change within 60 sec. Otherwise the microprocessor will automatically break off the programming and return to the service mode, *while all possibly entered changes to the program are lost*. If this occurs, it will be necessary to re-initiate the programming process.
- All programming parameters are grouped into different user-specific levels (End-User / Parameter Set / Diagnostics). The end-user level is accessible freely; in order to access one of the other specific levels, the proper access code, i.e. key sequence, needs to be entered.
- In the programming modes, a *flashing* indication implicates that this parameter can be adjusted by pressing the ***up*** button or ***down*** button; in this technical manual this is indicated by means of an *italic* font.

Programming instructions - End-User level

Before entering the programming mode, make sure that the control valve is in the service mode.

1. Press the ***scroll*** button; the display will show:

   `Language:English`

   - Press the ***up*** button or ***down*** button to set *the language*.

2. Press the ***scroll*** button again; the display will show:

   `Set time: 20:51`

   - Press the ***up*** button or ***down*** button to set *the time of day*.

3. Press the ***scroll*** button again; the display will show:

   `Set hardn.: XX°f`

   - Press the ***up*** button or ***down*** button to set *the water hardness of the incoming untreated water*.

Programming instructions - Parameter Set level

In the Parameter Set level the basic configuration parameters of the unit can be programmed, depending on the specific configuration of the unit.

Before entering the programming mode, make sure that the control valve is in the service mode.

1. Press the ***scroll*** button and hold it for 5 sec until the display shows:

   `System Check`

2. Within 10 sec, press the ***up*** button; the display will show:

   `HardUnit: °f`

   - Press the ***up*** button or ***down*** button to set *the units of hardness*.

3. Press the ***scroll*** button again; the display will show:

   `ExCap:5.2°f M3/L`

   - Press the ***up*** button or ***down*** button to set *the exchange capacity per litre of resin*.

4. Press the ***scroll*** button again; the display will show:

   `Resin: 20 liters`

   - Press the ***up*** button or ***down*** button to set *the volume of resin*.

5. Press the ***scroll*** button again; the display will show:

   `Override: 4 days`

   - Press the ***up*** button or ***down*** button to set *the number of days between regenerations*.

6. Press the ***scroll*** button again; the display will show:

   `Cycle 1: 5 min`

   - Press the ***up*** button or ***down*** button to set *the length of the regeneration cycle*.

	541N18	541N19	541N94	541N99	Setting range
Backwash	Cycle 1	/	Cycle 1	/	0-20 min
Brine draw/slow rinse	Cycle 2	Cycle 1	Cycle 2	Cycle 1	0-180 min
Fast rinse	Cycle 3	/	Cycle 3	/	0-20 min
Brine refill @ 1 L/min	/	/	Cycle 4	Cycle 2	0-65 min

7. Press the ***scroll*** button again; the display will show:

   `MTR:SNAP SENSOR`

   - Press the ***up*** button or ***down*** button to set *the model of flow meter used*:
     - **SNAP SENSOR**: model with snap-on flow meter sensor.
     - **SCREW SENSOR**: model with sensor fixed by means of screw.

8. Press the ***scroll*** button again; the display will show:

Regen:*Dlyd/Immd*

- Press the ***up*** button or ***down*** button to set *the regeneration mode*:
  - **Dlyd/Immd**: when the remaining capacity equals the reserve capacity, a *delayed regeneration* is started; however when the remaining capacity equals 0 before the programmed time of regeneration is reached, an *immediate regeneration* is started.
  - **Immediate**: when the remaining capacity equals 0, an *immediate regeneration* is started.
  - **Delayed**: when the remaining capacity equals the reserve capacity, a *delayed regeneration* is started.

9. Press the ***scroll*** button again; the display will show (only when the regeneration mode was set to 'Delayed' or 'Dlyd/Immd'):

Regen @ *2:00*

- Press the ***up*** button or ***down*** button to *set the time of regeneration*.

10. Press the ***scroll*** button again; the display will show (only when the regeneration mode was set to 'Delayed' or 'Dlyd/Immd'):

Rsrv *Variable*

- Press the ***up*** button or ***down*** button to set *the reserve capacity*:
  - **Variable**: the reserve capacity is calculated automatically, based on the registered daily water usage.
  - **Fxd**: press the ***scroll*** button again and press the ***up*** button or ***down*** button to set *the reserve capacity to a fixed amount*.

11. Press the ***scroll*** button again; the display will show:

Exit

- Press the ***up*** button or ***down*** button to save the program to the NOVRAM® and exit the programming level.

Diagnostics level

Besides of all programming parameters, a series of operating parameters can be consulted in the diagnostics level; particularly during a service intervention, these parameters can be helpful to identify the cause of a problem.

1. **Accessing the Diagnostics level:**
   - Make sure that the control valve is in the service mode.
   - Press the ***scroll*** button and hold it for 5 sec until the display shows:

     `System Check`
   - Within 10 sec, press the ***down*** button; the display will show:

     `Regen XXdays ago`
   - You are now in the Diagnostics level; use the ***scroll*** button to advance through the different diagnostics parameters.

2. **Exiting the Diagnostics level:**
   - If no button is pressed within a time frame of 5 minutes, the microprocessor will exit the diagnostics level end return to the service mode.
   - Press the ***scroll*** button until the display shows:

     `Exit`
   - Press the ***up*** button or ***down*** button to exit the Diagnostics level.

3. **Available diagnostic parameters:**
   - **Regen X days ago**: display shows number of days since last regeneration of the unit.
   - **In Srvc**: displays show how many days the unit has been in service.
   - **# of Regens**: display shows the number of regenerations that have taken place since installation.
   - **TotVol**: display shows the total water usage through the unit since installation.
   - **LastRgn@**: display shows the water usage at the moment of the last regeneration.
   - **InstFlow**: display shows the instantaneous flow rate.
   - **AvgVol**: display shows the average daily water usage.
   - **Capacity**: display shows the calculated volume of softened water between regenerations.
   - **Hardness**: display shows the setting of the water hardness.
   - **Rsrv**: display shows the setting of the reserve capacity.
   - **Regen @**: display shows the setting of the time of regeneration.
   - **Override**: display shows the setting of the number of days between regenerations.
   - **Cycle X**: display shows the setting of the length of the corresponding regeneration cycle.
   - **Units**: display shows that control is programmed for Metric units.
   - **MTR**: display shows the setting of the water meter.
   - **Capacity**: display shows that control is programmed for hardness setting.
   - **Regen**: display shows the setting of the regeneration mode.
   - **Valve Type**: display shows the valve type setting.
   - **MP Resets**: display shows the number of resets of the microprocessor (*for factory purpose only*).
   - **Memory Reset**: display shows the number of corrupt memory start-ups (*for factory purpose only*).
   - **EZ**: display shows the software version (*for factory purpose only*).
   - **CapToUse:** display shows the remaining capacity.

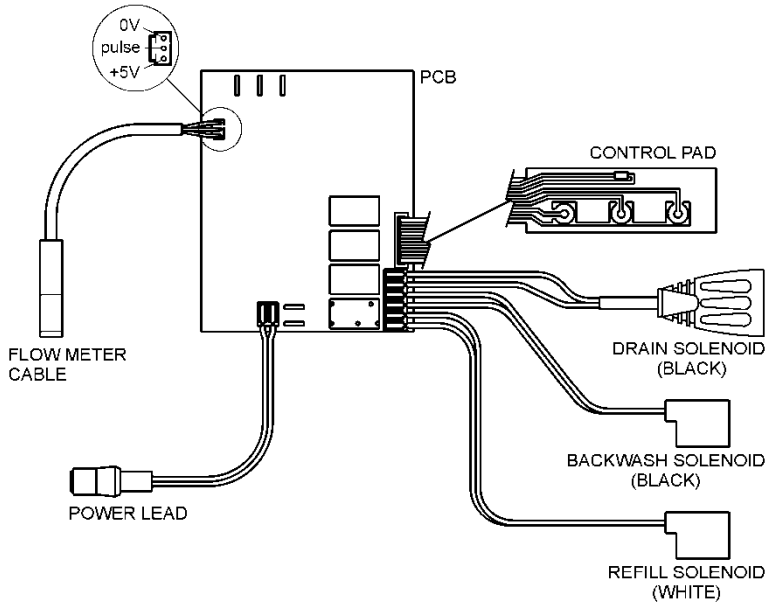
Parts Replacement

!!! BEFORE SERVICING:

- **MAKE SURE THE CONTROL VALVE IS IN SERVICE POSITION**
- **DISCONNECT ALL ELECTRICAL POWER TO THE UNIT**
- **BYPASS OR DISCONNECT THE WATER SUPPLY**
- **RELIEVE THE WATER PRESSURE**

Printed Circuit Board

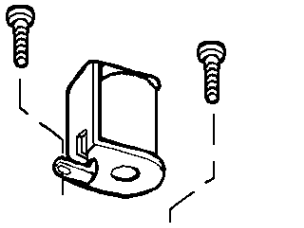
1. Disconnect all connectors from the solenoid(s), outlet elbow and transformer.
2. Loosen the 2 timer housing screws and remove the timer housing from the bracket.
3. Remove the front panel from the timer housing.
4. Disconnect all connectors from the PCB.
5. Remove the flat cable of the 3-button control pad from the push-in connection on the PCB.
6. Remove the screws holding the PCB in place.
7. Push aside the clip holding the PCB in place and remove the PCB.
8. Reverse the procedure for reassembly; refer to wiring diagram for proper lead connections.



Drain solenoid

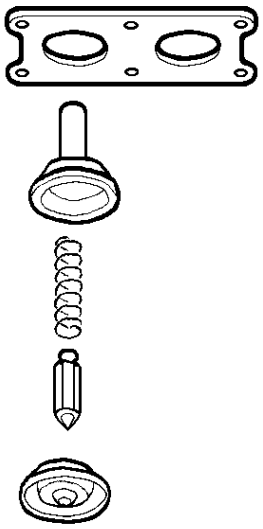
1. Disconnect the connector from the drain solenoid.
2. Disconnect the drain hose from the drain solenoid.
3. Unscrew the drain solenoid from the drain port.
4. Reverse the procedure for reassembly.

Backwash/refill solenoid



1. Disconnect the connector from the solenoid.
2. Remove the screw holding the solenoid in place and lift away the solenoid.
3. Reverse the procedure for reassembly.

Backwash/refill solenoid diaphragm

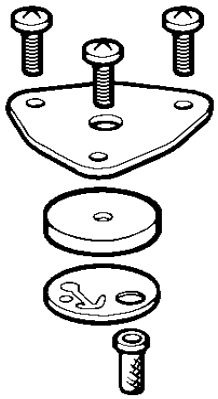


1. Disconnect the connector from the solenoid(s).
2. Remove the screw(s) holding the solenoid(s) in place and lift away the solenoid(s).
3. Remove the remaining screws holding down the retainer.
4. Place a hand under the retainer and remove the retainer; the guide(s), the solenoid plunger(s) and the plunger spring(s) will fall into your hand.
5. Verify that the solenoid plunger moves smoothly against the plunger spring inside of the guide; clean or replace if necessary.
6. Separate the solenoid diaphragm(s) from the valve body.
7. Clean out the diaphragm cavity in the valve body.
8. Check the diaphragm for rips or tears; the diaphragm should have 1 hole in the centre and 2 smaller holes off centre.
9. Reverse the procedure for reassembly.

Valve head

1. Disconnect all connectors from the solenoid(s), flow meter and transformer.
2. Loosen the 2 timer housing screws and remove the timer housing from the bracket.
3. Remove the drain hose from the drain solenoid.
4. Remove the 4 valve head screws and pull away the valve head assembly.
5. 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:

- 541N18/N19: the brine elbow.
- 541N94/N99: the back cap.

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.

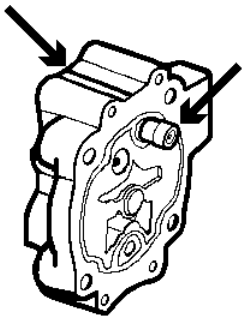
To access the restrictor for cleaning purposes:

– **541N18/N19**

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.

– **541N94/N99:**

1. Remove the brine line from the brine elbow.
2. Disconnect the connector from the backwash/refill solenoid.
3. Remove the 4 screws from the back cap.
4. Place a hand under the back cap and remove the back cap; the check disk spring and check ball might fall into your hand.
5. Check restrictor for dirt or clogging; clean if necessary by blowing air through restrictor.
6. Install the check disc on the body stem assembly and the check disc spring onto the centre post of the check disc.
7. Install the check ball in the refill cavity of the valve body.
8. Make sure the back cap gasket is securely installed in the back cap grooves.
9. 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.
10. Install the 4 screws and tighten them.
11. Install the connector to the backwash/refill solenoid.
12. Install the brine line to the brine elbow.



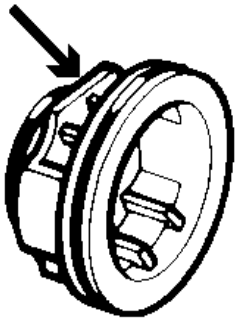
Incorporated drain flow control (optional)

1. Remove the valve head; refer to Parts Replacement “Valve head”.
2. Locate the drain flow control in the drain channel of the valve head.
3. Pull out the drain flow control.
4. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.

Main diaphragm

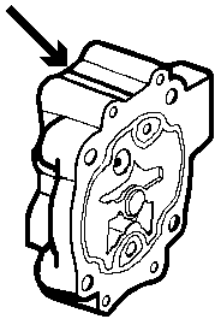
1. Remove the valve head; refer to Parts Replacement “Valve head”.
2. Remove the screw and washer from the centre of the main diaphragm.
3. Remove the main diaphragm from the body stem assembly.
4. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.

Body stem assembly



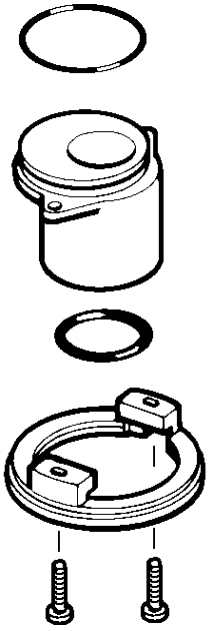
1. Remove the valve head; refer to Parts Replacement “Valve head”.
2. Pull forward the main diaphragm; put 2 fingers behind the membrane and pull out the body stem assembly.
3. Inspect the centre check disc rubber seal for wear; clean or replace if necessary.
4. Lubricate the O-rings of the seat insert.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

Check disc



1. 541N94/N99 only: remove the brine line from the brine elbow.
2. Disconnect the connector from the backwash/refill solenoid.
3. Remove the 4 screws from the back cap.
4. Place a hand under the back cap and remove the back cap; the check disk spring and check ball (541N94/N99 only) might fall into your hand.
5. Remove the check disc from the body stem assembly.
6. Inspect the check disc rubber seal for wear; clean or replace if necessary.
7. Install the check disc on the body stem assembly and the check disc spring onto the centre post of the check disc.
8. 541N94/N99 only: install the check ball in the refill cavity of the valve body.
9. Make sure the back cap gasket is securely installed in the back cap grooves.
10. 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.
11. Install the 4 screws and tighten them.
12. Install the connector to the backwash/refill solenoid.
13. Install the brine line to the brine elbow.

Riser insert



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

Flow meter turbine

1. Disconnect the flow meter connector from the outlet elbow.
2. Unscrew the outlet from the outlet elbow on the control valve.
3. Unscrew the outlet elbow from the control valve.
4. Pull out the hub from the outlet elbow.
5. Remove the impeller.
6. Reverse the procedure for reassembly.

Troubleshooting

Hard (untreated) water to service

Cause	Solution
1. Open or defective bypass	1. Close or verify bypass
2. Valve in regeneration	2. Wait until regeneration finishes or advance regeneration to end
3. Loss of resin	3. Refer to problem “Loss of resin”
4. Mixing valve open	4. Reduce mixing valve opening
5. Change in raw water hardness	5. Adjust programming accordingly
6. Unit fails to regenerate	6. Refer to problem “Unit fails to regenerate”
7. Valve fails to draw brine	7. Refer to problem “Valve fails to draw brine”
8. Decreasing exchange capacity of resin	8. Clean or replace resin bed
9. No salt in brine tank	9. Add salt
10. Leak at riser tube	10. Verify that riser tube is seated correctly and is not cracked

Unit fails to regenerate

Cause	Solution
1. Faulty electrical supply	1. Verify electrical service (fuse, transformer,...)
2. Defective flow meter	2. Clean and/or replace flow meter
3. Defective PCB	3. Replace PCB
4. Defective drain solenoid	4. Replace drain solenoid
5. Body stem assembly switches continuously	5. 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 and or brine restrictor	3. Clean injector and or brine restrictor
4. Backwash solenoid plunger stuck in open position	4. Clean or replace plunger and solenoid diaphragm
5. Plugged injector filter	5. Clean injector filter
6. Restricted drain line	6. Verify drain line for kinks or restrictions
7. Restricted brine line	7. Verify brine line for kinks or restrictions
8. Leak in brine line	8. Verify brine line and connections for air leakage
9. Not enough water in brine tank	9. Refer to problem “Valve fails to refill brine tank”

Excessive water in brine tank

Cause	Solution
1. Valve fails to draw brine	1. Refer to problem "Valve fails to draw brine"
2. Improper brine refill time setting	2. Verify that brine refill time corresponds to the proper salt level and amount of resin
3. Missing brine refill flow control	3. Verify that flow control is installed and properly sized
4. Leak from valve to brine tank	4. Clean or replace plunger and solenoid diaphragm of refill solenoid
5. Improper setting of float	5. Verify float setting of brine valve
6. Defective brine valve	6. Verify or replace brine valve

Valve fails to refill brine tank

Cause	Solution
1. Improper brine refill time setting	1. Verify that refill time corresponds to salt level and amount of resin
2. Plugged refill flow control	2. Clean flow control

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. Verify program

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 outlet manifold	2. Remove and clean outlet
3. Plugged lower and/or upper distributor	3. Verify that distributors are free of debris
4. Crushed lower and/or upper distributor	4. Replace distributor(s)

Drain flows continuously

Cause	Solution
1. Drain solenoid stuck in open position	1. Clean drain solenoid
2. Defective PCB	2. Replace PCB

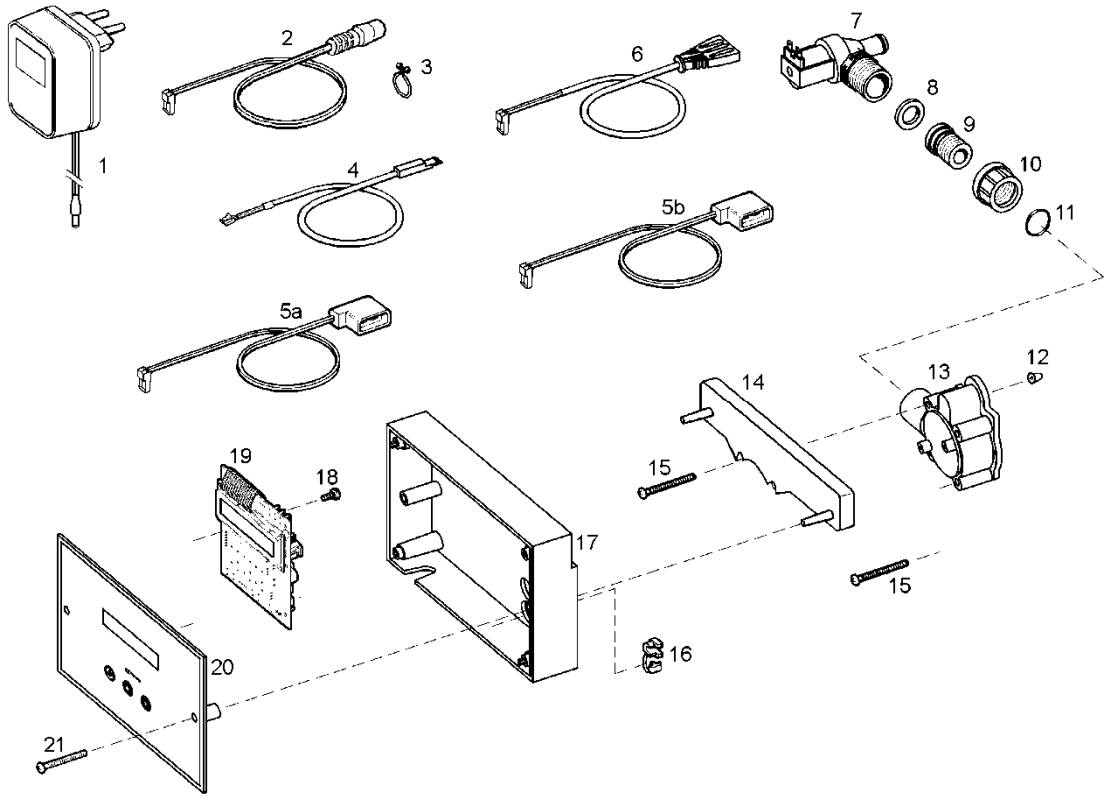
Annual Maintenance

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

1. Clean out injector and injector filter.
2. Clean out backwash and refill solenoid diaphragm.
3. Verify correct functioning of flow meter; clean out flow meter if necessary.
4. Verify programming of timer; re-program timer if necessary.
5. Verify correct execution of program.
6. Measure the residual hardness; adjust mixing valve if necessary.
7. Verify min. and max. water pressure; install pressure reducer if necessary.

Exploded Views & Part Numbers

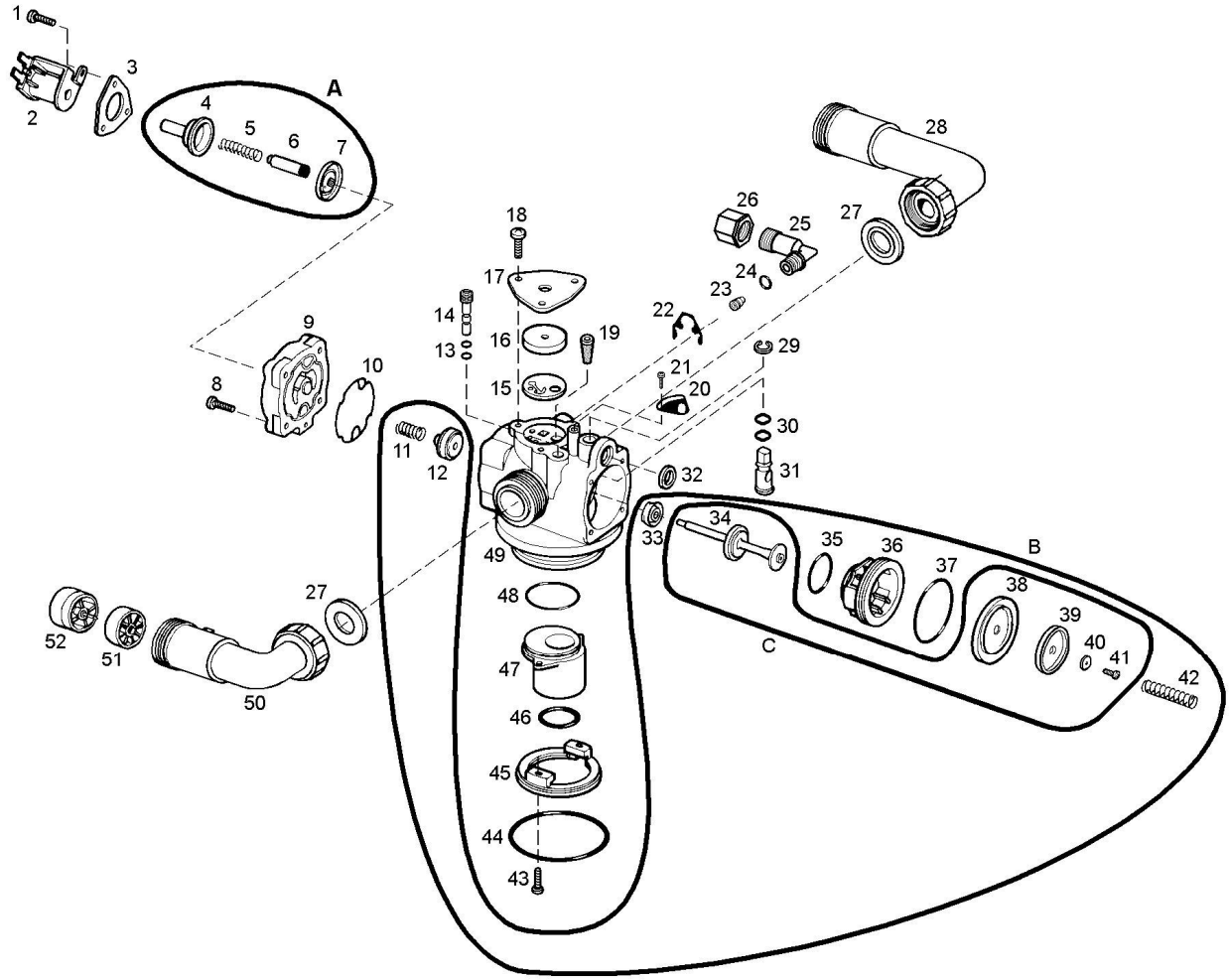
Electronic timer



ITEM	PART NUMBER	DESCRIPTION
1	28/298/11	Transfo 230/24V - 50 Hz, 24VA, EuroT plug
	28/298/18	Transfo 230/24V - 50 Hz, 24VA, UK plug
2	70971	Power lead with plug
3	72263	Wire clip
4	72519	Flow meter cable
5a	71681	Cable, backwash solenoid, black (541N18/N94)
5b	71682	Cable, refill solenoid, white (541N94/N99)
6	72561	Cable, drain solenoid
7	74023	Drain solenoid
8	74019	Gasket, drain solenoid
9	74016	Drain line adaptor
10	74018	Nut, drain solenoid
11	185/115/1	O-ring, drain line adaptor
12	541/300/*	Drain flow control (optional)
13	72216	Valve head
14	72682	Bracket, timer housing
15	15/87	Screw, valve head (4x)
16	28/8/28	Strain relief
17	74026	Timer housing 541N18/N19/N99
	74027	Timer housing 541N94
18	15/102	Screw, PCB (2x)
19	72532	Printed Circuit Board 541N18
	72533	Printed Circuit Board 541N19
	72534	Printed Circuit Board 541N94
	72535	Printed Circuit Board 541N99
20	74040	Front panel
21	72683	Screw, timer housing (2x)

* Size: refer to “Sizing Table”

Valve body 541N18

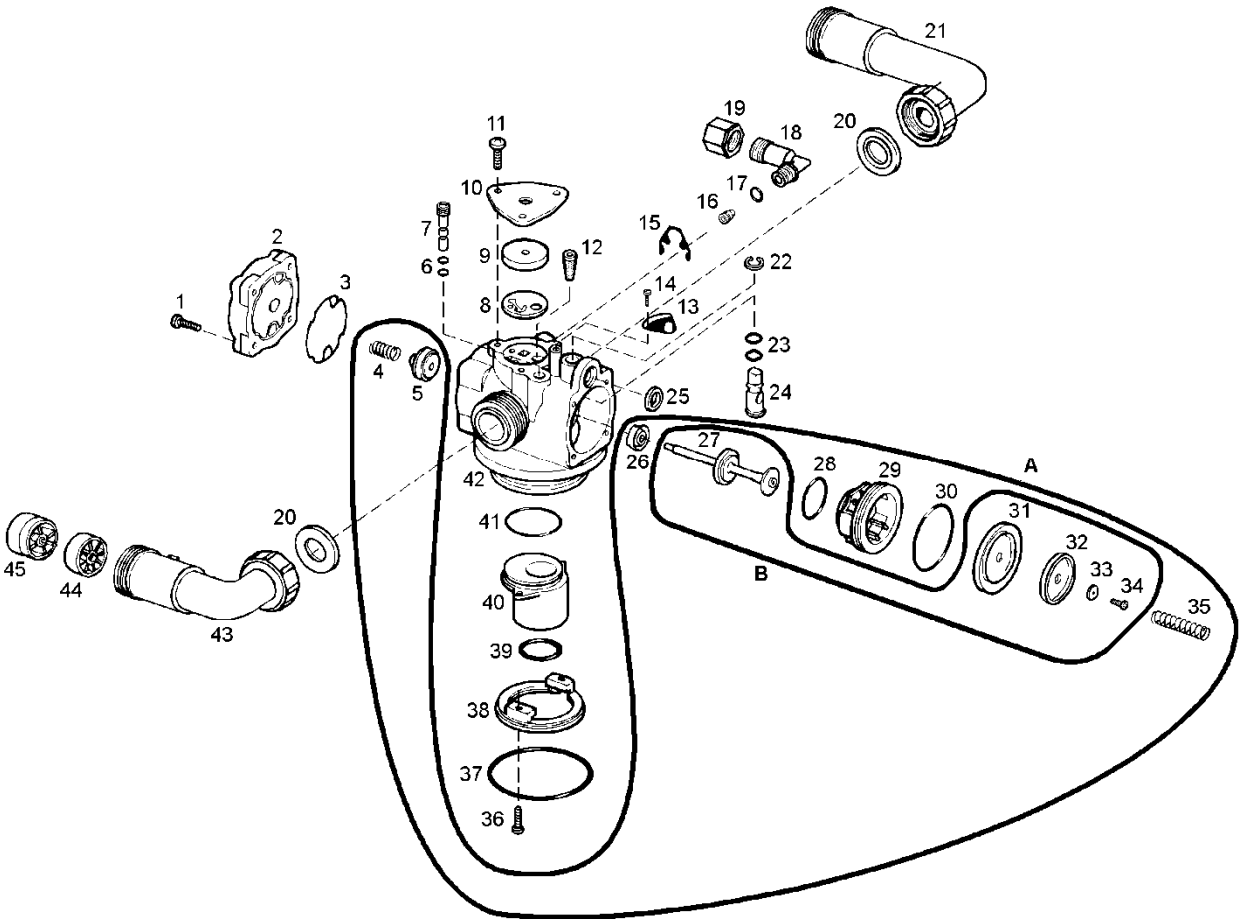


ITEM	PART NUMBER	DESCRIPTION
1	15/91	Screw, solenoid (3x)
2	413/134/24	Solenoid

ITEM	PART NUMBER	DESCRIPTION
3	413/60	Retainer, solenoid
4	413/58	Guide, solenoid
5	413/62	Spring, solenoid plunger
6	74099	Plunger, solenoid
7	74098	Diaphragm, solenoid
8	15/222	Screw, back cap (4x)
9	541/208/2	Back cap
10	541/206	Gasket, back cap
11	541/239	Spring, check disc
12	541/246	Check disc
13	185/005/1	O-ring, mixing valve (2x)
14	541/940/6/1	Mixing valve (optional)
15	541/325	Gasket, injector
16	428/*	Injector
17	541/221	Cover plate, injector
18	15/89	Screw, cover plate (3x)
19	72604	Filter, injector
20	72609	Locking plate, drain flow adjuster
21	15/76	Screw, locking plate
22	541/254	Spring clip
23	74015 74022	Brine draw restrictor 0,8mm (with injector 9 only) Brine draw restrictor 1,0mm (with injector 8 only)
24	186/118	O-ring, brine elbow
25	568/336/0	Brine elbow
26	21/90	Nut, brine elbow
27	72467	Union gasket (2x)
28	72542	Elbow, inlet
29	19/19	Clip, drain flow adjuster
30	186/134	O-ring, drain flow adjuster (2x)
31	541/238	Drain flow adjuster
32	529/244	O-ring, drain port
33	467/216	Seal, body stem
34	72605	Body stem
35	185/024/1	O-ring, seat insert (small)
36	541/204	Seat insert
37	185/029/1	O-ring, seat insert (large)
38	72602	Main diaphragm
39	72507	Retainer, main diaphragm
40	72245	Washer, main diaphragm
41	72552	Screw, main diaphragm
42	516/221	Spring, main diaphragm
43	15/90	Screw, adapter ring (2x)
44	185/67/4	O-ring, tank
45	541/232	Adapter ring
46	185/214/1	O-ring, riser tube
47	541/218	Riser insert 1,050”
48	185/029/1	O-ring, riser insert
49	541/257/1 541/257/1/R	Valve body (incl. 467/216) Valve body (incl. 467/216) for mixing valve
50	72543	Elbow, outlet
51	72544	Impeller
52	72545	Hub, Impeller
A	RK/413	Repair kit solenoid diaphragm
B	RK/541/244	Repair kit body stem and seat
C	72611	Repair kit body stem

* Size: refer to “Sizing Table”

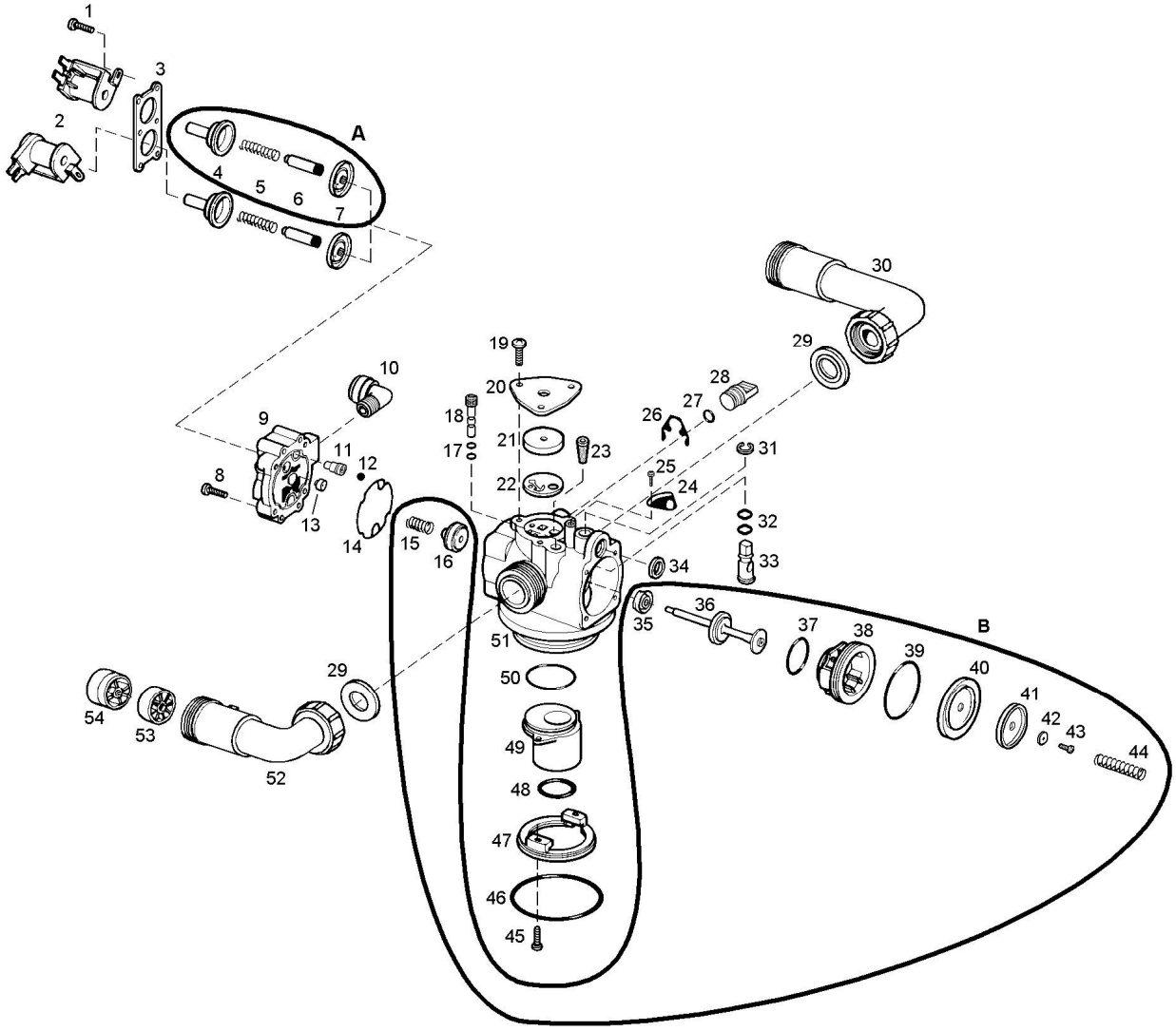
Valve body 541N19



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 74022	Brine draw restrictor 0,8mm (with injector 9 only) Brine draw restrictor 1,0mm (with injector 8 only)
17	186/118	O-ring, brine plug
18	568/336/0	Brine elbow
19	21/90	Nut, brine elbow
20	72467	Union gasket (2x)
21	72542	Elbow, inlet
22	19/19	Clip, drain flow adjuster
23	186/134	O-ring, drain flow adjuster (2x)
24	541/238	Drain flow adjuster
25	529/244	O-ring, drain port
26	467/216	Seal, body stem
27	72605	Body stem
28	185/024/1	O-ring, seat insert (small)
29	541/204	Seat insert
30	185/029/1	O-ring, seat insert (large)
31	72602	Main diaphragm
32	72507	Retainer, main diaphragm
33	72245	Washer, main diaphragm
34	72552	Screw, main diaphragm
35	516/221	Spring, main diaphragm
36	15/90	Screw, adapter ring (2x)
37	185/67/4	O-ring, tank
38	541/232	Adapter ring
39	185/214/1	O-ring, riser tube
40	541/218	Riser insert 1,050”
41	185/029/1	O-ring, riser insert
42	541/257/1 541/257/1/R	Valve body (incl. 467/216) Valve body (incl. 467/216) for mixing valve
43	72543	Elbow, outlet
44	72544	Impeller
45	72545	Hub, Impeller
A	RK/541/244	Repair kit body stem and seat
B	72611	Repair kit body stem

* Size: refer to “Sizing Table”

Valve body 541N94

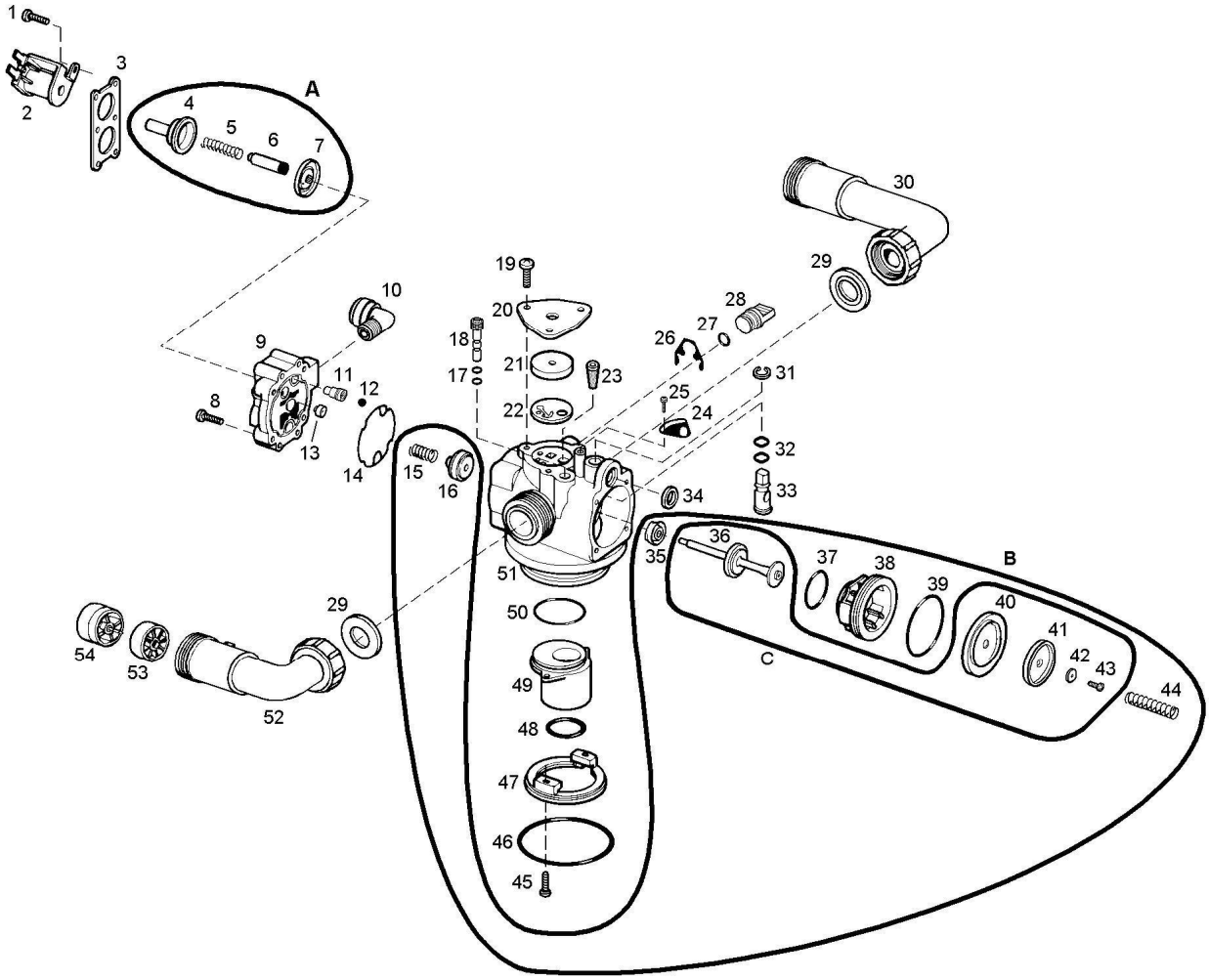


ITEM	PART NUMBER	DESCRIPTION
1	15/90	Screw, solenoid (6x)
2	413/134/24	Solenoid
3	541/229	Retainer, solenoid
4	413/58	Guide, solenoid
5	413/62	Spring, solenoid plunger

ITEM	PART NUMBER	DESCRIPTION
6	74099	Plunger, solenoid
7	74098	Diaphragm, solenoid
8	15/222	Screw, back cap (4x)
9	541/274/2/E	Back cap
10	DM/A6ME4	Brine elbow
11	74015	Brine draw restrictor 0,8mm (with injector 9 only)
	74022	Brine draw restrictor 1,0mm (with injector 8 only)
12	541/275	Check ball
13	568/385/2/A	Refill flow control A (1 L/min)
14	541/206	Gasket, back cap
15	541/239	Spring, check disc
16	541/246	Check disc
17	185/005/1	O-ring, mixing valve (2x)
18	541/940/6/1	Mixing valve (optional)
19	15/89	Screw, cover plate (3x)
20	541/221	Cover plate, injector
21	428/*	Injector
22	541/325	Gasket, injector
23	72604	Filter, injector
24	72609	Locking plate, drain flow adjuster
25	15/76	Screw, locking plate
26	541/254	Spring clip
27	186/118	O-ring, brine plug
28	541/273	Brine plug
29	72467	Union gasket (2x)
30	72542	Elbow, inlet
31	19/19	Clip, drain flow adjuster
32	186/134	O-ring, drain flow adjuster (2x)
33	541/238	Drain flow adjuster
34	529/244	O-ring, drain port
35	467/216	Seal, body stem
36	72605	Body stem
37	185/024/1	O-ring, seat insert (small)
38	541/204	Seat insert
39	185/029/1	O-ring, seat insert (large)
40	72602	Main diaphragm
41	72507	Retainer, main diaphragm
42	72245	Washer, main diaphragm
43	72552	Screw, main diaphragm
44	516/221	Spring, main diaphragm
45	15/90	Screw, adapter ring (2x)
46	185/67/4	O-ring, tank
47	541/232	Adapter ring
48	185/214/1	O-ring, riser tube
49	541/218	Riser insert 1,050”
50	185/029/1	O-ring, riser insert
51	541/257/1	Valve body (incl. 467/216)
	541/257/1/R	Valve body (incl. 467/216) for mixing valve
52	72543	Elbow, outlet
53	72544	Impeller
54	72545	Hub, Impeller
A	RK/413	Repair kit solenoid diaphragm
B	RK/541/244	Repair kit body stem and seat
C	72611	Repair kit body stem

* Size: refer to “Sizing Table”

Valve body 541N99



ITEM	PART NUMBER	DESCRIPTION
1	15/90	Screw, solenoid (4x)
2	413/134/24	Solenoid
3	541/229	Retainer, solenoid
4	413/58	Guide, solenoid
5	413/62	Spring, solenoid plunger

ITEM	PART NUMBER	DESCRIPTION
6	74099	Plunger, solenoid
7	74098	Diaphragm, solenoid
8	15/222	Screw, back cap (4x)
9	541/286/2/E	Back cap
10	DM/A6ME4	Brine elbow
11	74015	Brine draw restrictor 0,8mm (with injector 9 only)
	74022	Brine draw restrictor 1,0mm (with injector 8 only)
12	541/275	Check ball
13	568/385/2/A	Refill flow control A (1 L/min)
14	541/206	Gasket, back cap
15	541/239	Spring, check disc
16	541/246	Check disc
17	185/005/1	O-ring, mixing valve (2x)
18	541/940/6/1	Mixing valve (optional)
19	15/89	Screw, cover plate (3x)
20	541/221	Cover plate, injector
21	428/*	Injector
22	541/325	Gasket, injector
23	72604	Filter, injector
24	72609	Locking plate, drain flow adjuster
25	15/76	Screw, locking plate
26	541/254	Spring clip
27	186/118	O-ring, brine plug
28	541/273	Brine plug
29	72467	Union gasket (2x)
30	72542	Elbow, inlet
31	19/19	Clip, drain flow adjuster
32	186/134	O-ring, drain flow adjuster (2x)
33	541/238	Drain flow adjuster
34	529/244	O-ring, drain port
35	467/216	Seal, body stem
36	72605	Body stem
37	185/024/1	O-ring, seat insert (small)
38	541/204	Seat insert
39	185/029/1	O-ring, seat insert (large)
40	72602	Main diaphragm
41	72507	Retainer, main diaphragm
42	72245	Washer, main diaphragm
43	72552	Screw, main diaphragm
44	516/221	Spring, main diaphragm
45	15/90	Screw, adapter ring (2x)
46	185/67/4	O-ring, tank
47	541/232	Adapter ring
48	185/214/1	O-ring, riser tube
49	541/218	Riser insert 1,050”
50	185/029/1	O-ring, riser insert
51	541/257/1	Valve body (incl. 467/216)
	541/257/1/R	Valve body (incl. 467/216) for mixing valve
52	72543	Elbow, outlet
53	72544	Impeller
54	72545	Hub, Impeller
A	RK/413	Repair kit solenoid diaphragm
B	RK/541/244	Repair kit body stem and seat
C	72611	Repair kit body stem

* Size: refer to “Sizing Table”

Order Specifications 541N18

541N18/*VID(/R)*

***V** = Voltage*: **L** = transfo 230/24VAC, 24VA, EuroT plug
R = transfo 230/24VAC, 24VA, UK plug
J = no transfo

***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*

Order Specifications 541N19

541N19/*VID(/R)*

***V** = Voltage*: **L** = transfo 230/24VAC, 24VA, EuroT plug
R = transfo 230/24VAC, 24VA, UK plug
J = no transfo

***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*

Order Specifications 541N94

541N94/*VID(/R)*

***V** = Voltage*: **L** = transfo 230/24VAC, 24VA, EuroT plug
R = transfo 230/24VAC, 24VA, UK plug
J = no transfo

***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*

Order Specifications 541N99

541N99/*VID(/R)*

***V** = Voltage*: **L** = transfo 230/24VAC, 24VA, EuroT plug
R = transfo 230/24VAC, 24VA, UK plug
J = no transfo

***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*