

# 541N SERIES

## Technical Manual



**Water Treatment Controls**

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# Introduction

The 541N Series are electronic 3- or 5-cycle 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 (541N18/541N94 only):**

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:**

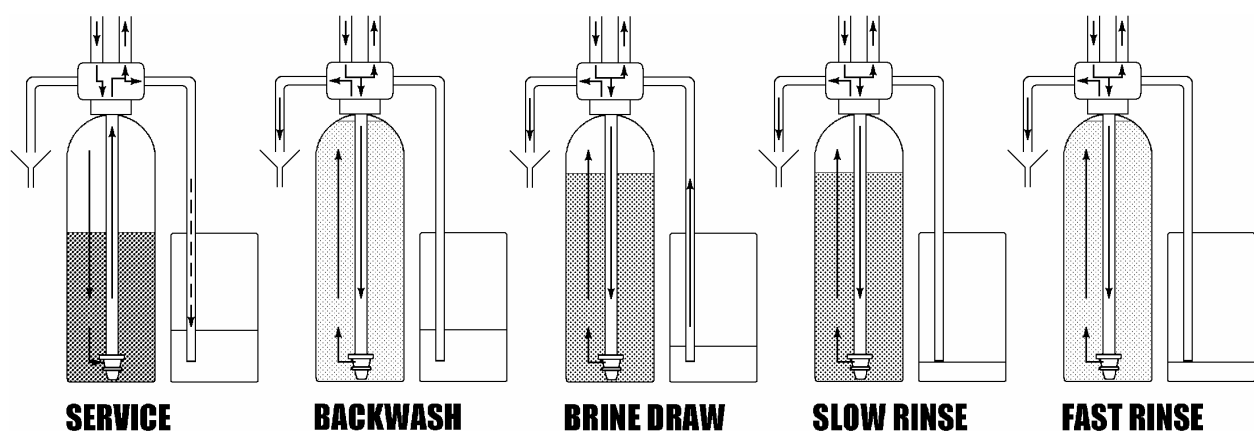
Slow rinse continues for the remainder of the cycle; the injectors motive water flows down through the riser tube and slowly up through the resin bed to drain, slowly washing the brine from the resin tank.

## **5. FAST RINSE (541N18/541N94 only):**

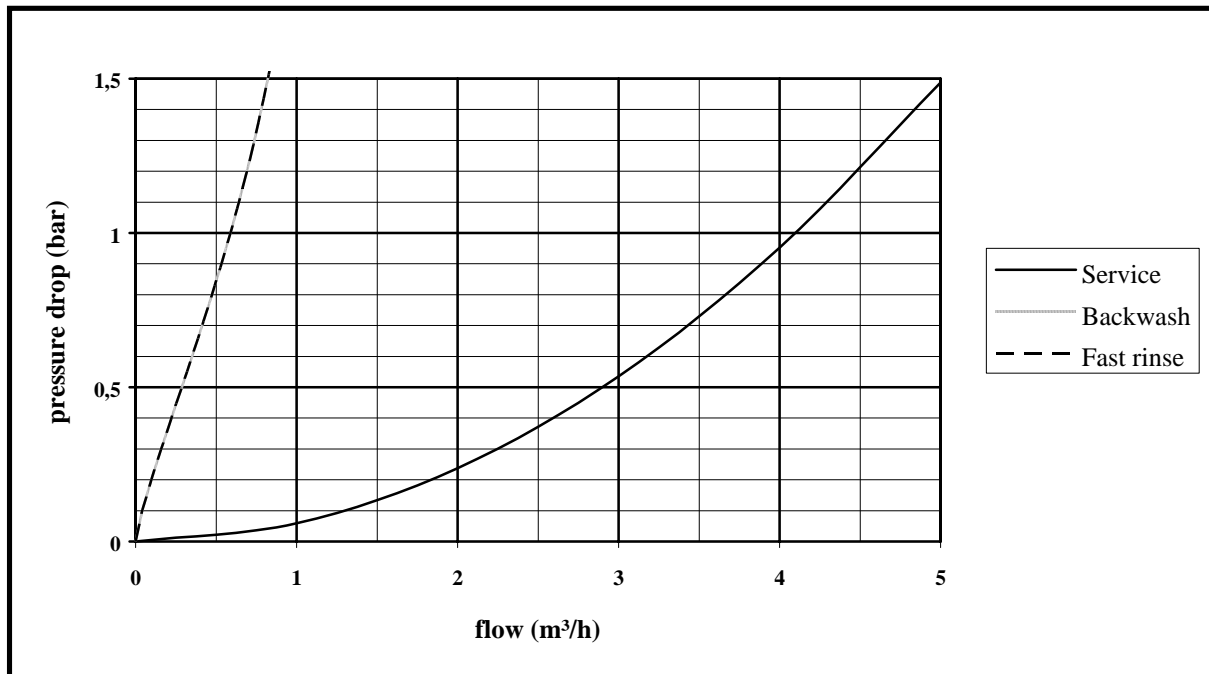
Water flows down through the riser tube and up through the resin bed to drain, ensuring that all traces of brine are washed out. The resin bed is now ready for the next service cycle.

## **6. BRINE REFILL (541N94/541N99 only):**

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.

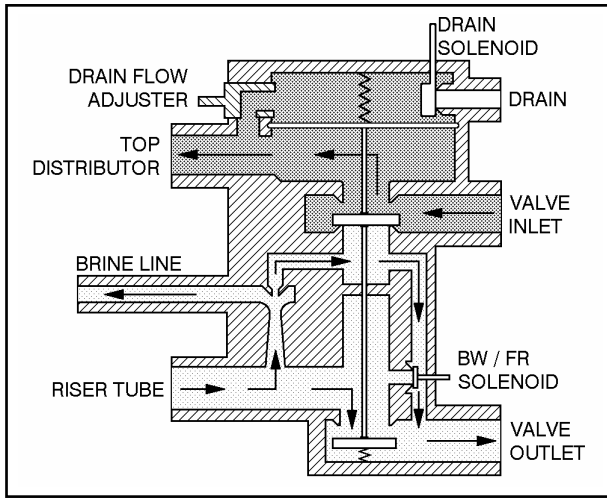


# Technical Specifications

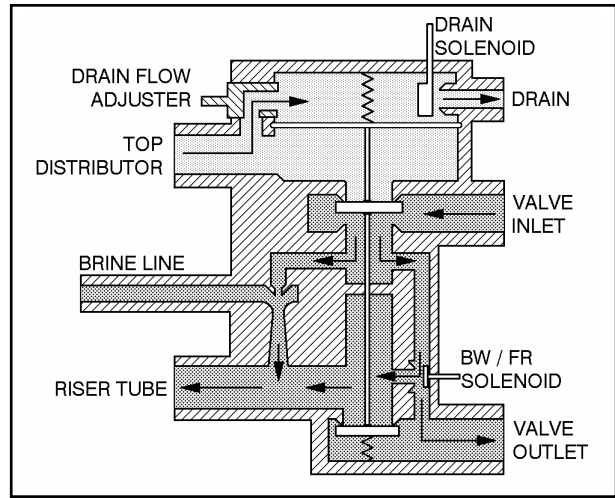


<ul style="list-style-type: none"> <li>Valve body material</li> <li>Connections                             <ul style="list-style-type: none"> <li>- inlet/outlet (optional)</li> <li>- drain line</li> <li>- brine line</li> <li>- tank</li> </ul> </li> <li>Riser tube</li> <li>Mixing valve</li> </ul>	Glass filled Noryl®  Brass adapters: 3/4" BSP male/female 1" BSP male Hose barb for 12 mm hose 3/8" tube 2 1/2" - 8 NPS 1,050" Optional
<ul style="list-style-type: none"> <li>Operating pressure</li> <li>Hydrostatic test pressure</li> <li>Electrical rating</li> <li>Temperature</li> </ul>	Min. 1,4 - max. 8,3 bar 20 bar 24V - 50 Hz, transfo available Min. 2 °C - max. 48 °C
<ul style="list-style-type: none"> <li>Flow (m³/h) = <math>K_v \times \sqrt{\Delta p(\text{bar})}</math> <ul style="list-style-type: none"> <li>- service: <math>K_v</math></li> <li>- backwash: <math>K_v</math></li> <li>- fast rinse: <math>K_v</math></li> </ul> </li> </ul>	4,1 0,7 0,7
<ul style="list-style-type: none"> <li>Softener applications</li> </ul>	Min. 6" (152 mm) – max. 13" (305 mm)
<ul style="list-style-type: none"> <li>Cycles</li> <li>Controller                             <ul style="list-style-type: none"> <li>- regeneration initiation</li> <li>- regeneration type</li> <li>- days override</li> <li>- water hardness</li> <li>- reserve capacity</li> <li>- backwash (541N18/541N94 only)</li> <li>- brine draw/slow rinse</li> <li>- fast rinse (541N18/541N94 only)</li> <li>- brine refill (541N94/541N99 only)</li> </ul> </li> <li>Flow meter accuracy</li> </ul>	3 or 5 cycles, counter-current regeneration Electronic with $\mu$ -processor and NOVRAM® Demand with days override or manual Delayed with immediate override Adj.: OFF, 1-30 days Adj.: 1-99 °F / °D / °Clarck Variable Adj.: 0-20 min Adj.: 0-120 min Adj.: 0-20 min Adj.: 0-65 min Min. 1,4 L/min – max. 115 L/min: $\pm 10\%$

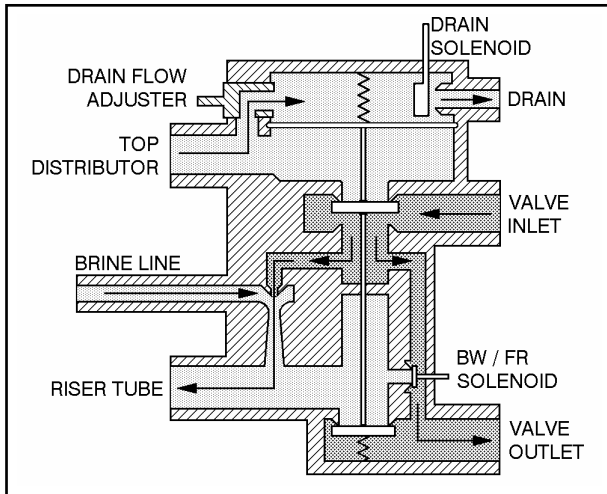
# Flow Diagrams (541N18/541N19 only)



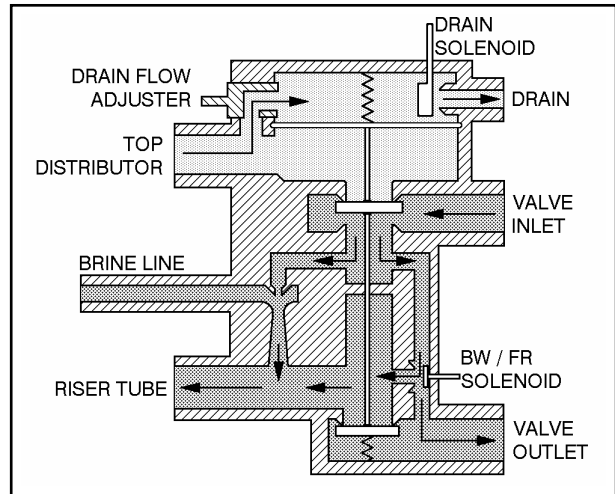
**SERVICE**



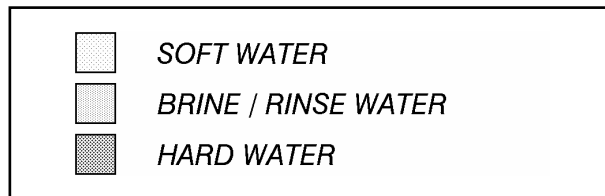
**BACKWASH (541N18 only)**



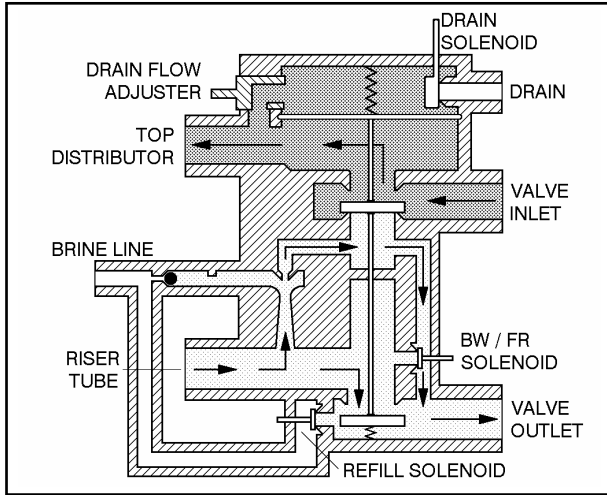
**BRINE DRAW / SLOW RINSE**



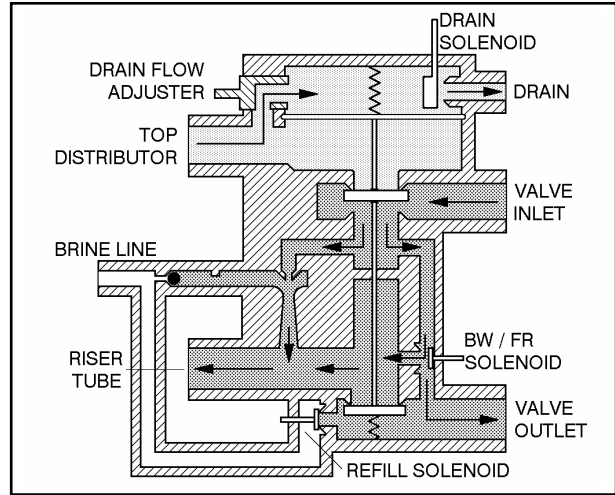
**FAST RINSE (541N18 only)**



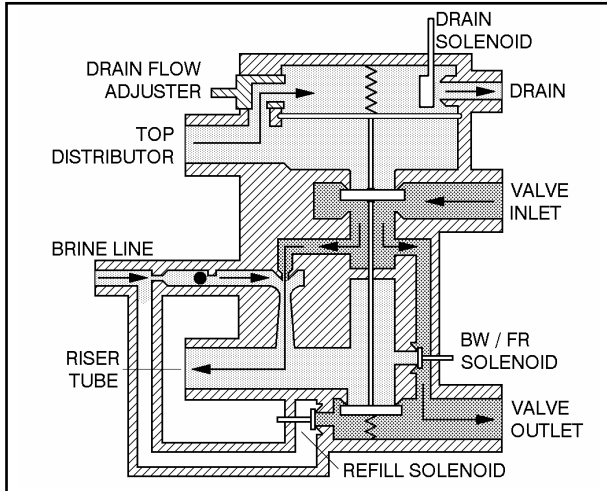
# Flow Diagrams (541N94/541N99 only)



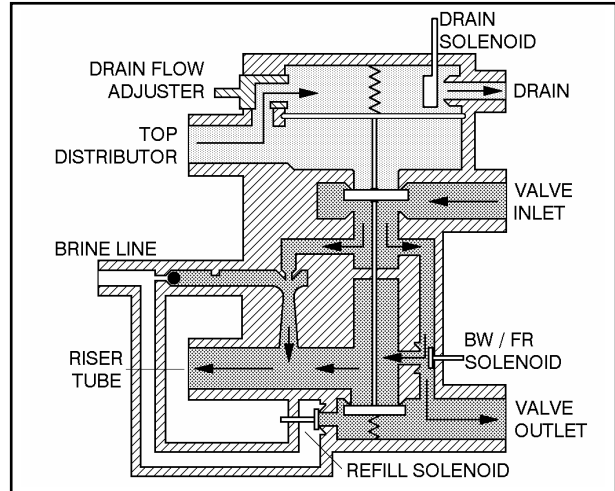
**SERVICE**



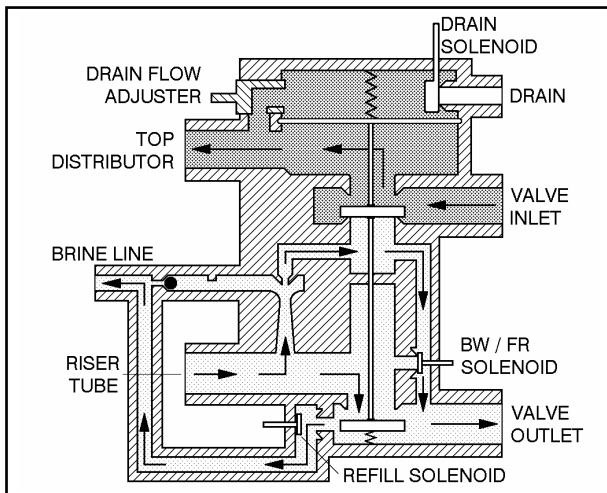
**BACKWASH (541N94 only)**



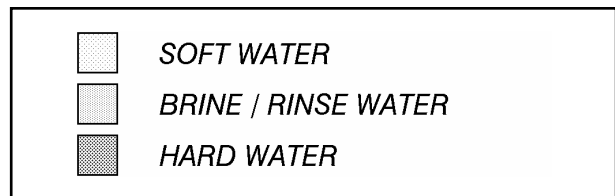
**BRINE DRAW / SLOW RINSE**



**FAST RINSE (541N94 only)**



**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 press. bar	Inj. 9		Inj. 8		Inj. 5		Inj. 4		Inj. 3		Inj. 2		Inj. 1	
	Brine l/min	Rinse l/min	Brine l/min	Rinse l/min	Brine l/min	Rinse l/min	Brine l/min	Rinse l/min	Brine l/min	Rinse l/min	Brine l/min	Rinse l/min	Brine l/min	Rinse 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)

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<sup>2</sup> 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).

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 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 transformer's output lead (with plug  $\varnothing$  2,5 mm x 5,5 mm) into socket at the timer's 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. Push 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 pushing the *scroll*  button.

	<b>541N18</b>	<b>541N19</b>	<b>541N94</b>	<b>541N99</b>	<b>Action</b>
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

For 541N18/541N19 only:

10. As soon as the control valve is back in the service position, place unit in bypass.
11. Add the appropriate amount of water to the brine tank.
12. Add salt 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)

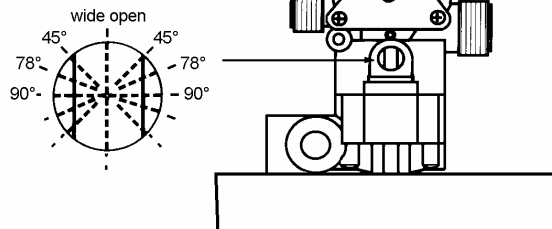
To adjust the residual hardness, the incorporated mixing valve must be regulated in function of the hardness of the incoming water and the desired residual hardness; the scale on the mixing valve has no absolute indication, but serves only as a reference point:

- 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 removing 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 mind that closing the drain flow adjuster too much, will result in bad suction of the injector.

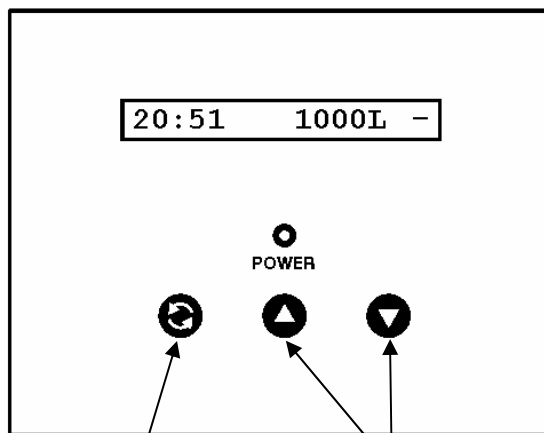


# The Electronic Timer

## Basic features

### Control pad

The electronic timer uses a Printed Circuit Board (PCB), equipped with a microprocessor and NOVRAM®. All programming is done by use of the 3-button control pad with LCD-display.

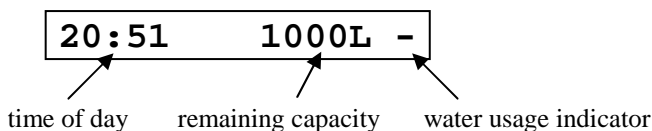


*scroll button*  
to advance  
to the next  
parameter

*up / down buttons*  
to adjust the  
value of the  
parameter

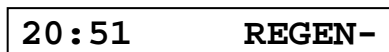
### Service mode

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



In case of water usage, the remaining capacity counter 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.

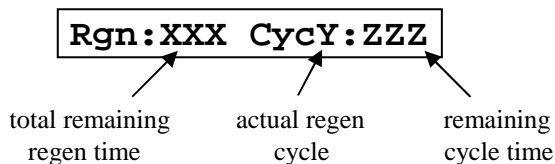
Every day the control valve automatically recalculates the reserve capacity, as a progressing average. Permanently it compares the remaining capacity with the calculated reserve capacity; as soon as the remaining capacity equals the calculated reserve capacity, the display will show the time of day and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



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 total remaining regen time and it's remaining cycle time:



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

### **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, when the power supply is re-established, be *flashing*, indicating that the time of day needs to be set; refer to “Programming instructions for the End-User level” to set the correct time of day.

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.

## 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 pushing the **up** ▲ button or **down** ▼ button; in this technical manual this is indicated by means of an *italic font*.

### Programming instructions for the End-User level

The basic configuration of the unit has been pre-programmed; the End-User level allows the end-user to rapidly program the operating parameters, according to his own specific situation.

- Make sure that the control valve is in the service mode.
- Push the **scroll** ⌂ button; the display will show:

**Language: *English***

- Push the **up** ▲ button or **down** ▼ button to *set the language*.
- Push the **scroll** ⌂ button again; the display will show:

**Set time: 20:51**

- Push the **up** ▲ button or **down** ▼ button to *set the time of day*.
- Push the **scroll** ⌂ button again; the display will show:

**Set hardn.: XX°F**


- Push the **up** ▲ button or **down** ▼ button to *set the water hardness of the incoming untreated water*.
- Push the **scroll** ⌂ button again; the display will show:

**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, push the **scroll** ⌂ button before the countdown timer has reached 0 sec; the control valve will return to the service mode.

## Programming instructions for the 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.

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




**System Check**

- Within 10 sec, push the *up*  button; the display will show:



**HardUnit: °F**


- Push the *up*  button or *down*  button to *set the units of hardness*.
- Push the *scroll*  button again; the display will show:

**ExCap: 5.2°F M3/L**



- Push the *up*  button or *down*  button to *set the exchange capacity per litre of resin*.
- Push the *scroll*  button again; the display will show:


**Resin: 20 liters**

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

- Push the *scroll*  button again; the display will show:

**Override: 4 days**


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

- Push the *scroll*  button again; the display will show:




**Cycle 1: XX min**

- Push 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/slow rinse	Cycle 2	Cycle 1	Cycle 2	Cycle 1	0-120 min
Fast rinse	Cycle 3	/	Cycle 3	/	0-20 min
Brine refill	/	/	Cycle 4	Cycle 2	0-65 min

- Push the *scroll*  button again; the display will show:

**MTR: SNAP SENSOR**


- Push the *up*  button or *down*  button to *set the model of flow meter used*:
  1. SNAP SENSOR: model with snap-on flow meter sensor;
  2. SCREW SENSOR: model with sensor fixed by means of screw.
- Push the *scroll*  button again; the display will show:

**Regen @ 2:00**



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

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- Push the *scroll*  button again; the display will show:

**Exit**


- Push the *up*  button or *down*  button to save the program to the NOVRAM® and exit the Parameter Set 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.
- Push the *scroll*  button and hold it for 5 sec until the display shows:


**System Check**

- Within 10 sec, push the *down*  button; the display will show:

**Regen Xdays 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 pushed within a time frame of 5 minutes, the microprocessor will exit the diagnostics level and return to the service mode.
- Push the *scroll*  button until the display shows:

**Exit**

- Push 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.
- **LastRg@:** 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 that control is programmed for variable reserve.
- **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.
- **Flow Meter Type:** display shows that control is programmed for standard meter.
- **Capacity:** display shows that control is programmed for hardness setting.
- **Regen:** display shows that control is programmed for delayed regeneration with immediate override.
- **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*).
- **EE writes:** display shows the number of Eprom writes (*for factory purpose only*).

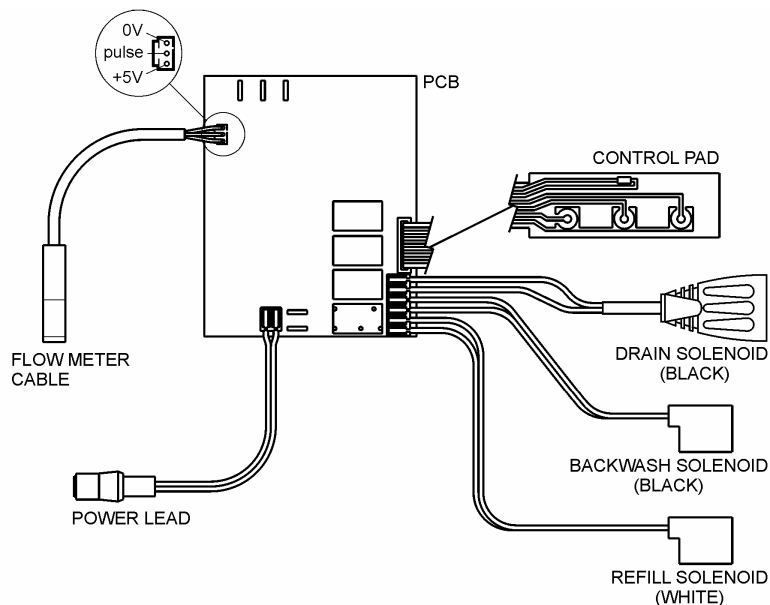
# Parts Replacement

## **!!! 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 plate from the timer housing.
4. Disconnect all connectors from the PC.
5. Remove the flat cable of the 3-button control pad from the push-in connection on the PCB.
6. Remove the screw 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.

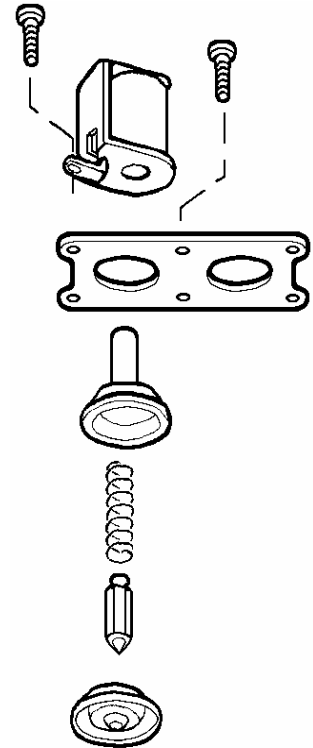


## Drain solenoid

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**

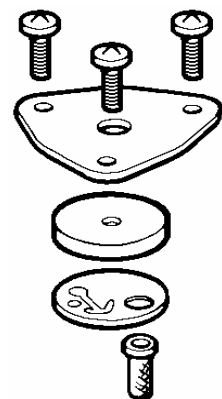
1. Disconnect the connector from the solenoid(s).
2. Remove the screw(s) holding the solenoid(s) in place and lift away the solenoid(s).
3. Remove the remaining screws holding down the retainer.
4. Place a hand under the retainer and remove the retainer; the guide(s), the solenoid plunger(s) and the 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 flow restrictor

For injectors 8 and 9, an additional 'restrictor' is used that is located in:

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

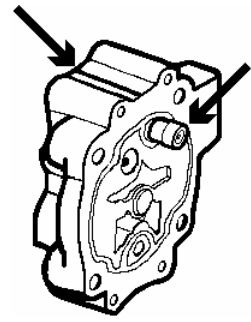
To access the restrictor for cleaning purposes:

– **541N18/541N19**

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.

– **541N94/541N99:**

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



### Incorporated drain flow control (optional)

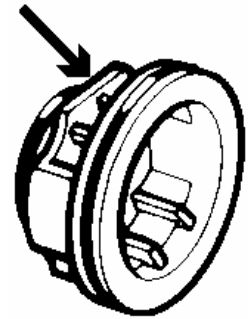
1. Remove the valve head; refer to Parts Replacement "Valve head".
2. Locate the drain flow control in the drain channel of the valve head.
3. Pull out the drain flow control.
4. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.

### Main diaphragm

1. Remove the valve head assembly; refer to Parts Replacement "Valve head".
2. Remove the clip from the centre of the main diaphragm.
3. Lift away 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.

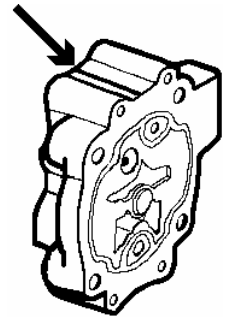
## **Body stem assembly**

1. Remove the valve head; refer to Parts Replacement “Valve head”.
2. Remove the clip from the centre of the main diaphragm.
3. Pull the diaphragm away from the body stem assembly.
4. Remove the seat insert.
5. Pull out the body stem assembly.
6. Inspect the centre check disc rubber seal for wear; clean or replace if necessary.
7. Install the body stem assembly.
8. Lubricate the O-rings of the seat insert.
9. Install the seat insert with 1 of the 2 flats facing towards the top of the valve body.
10. Reverse the procedure for reassembly; make sure the drain port O-ring is securely installed in the valve body groove.
11. It is now necessary to verify the position of the rear check disc; refer to Parts Replacement “Check disc”.



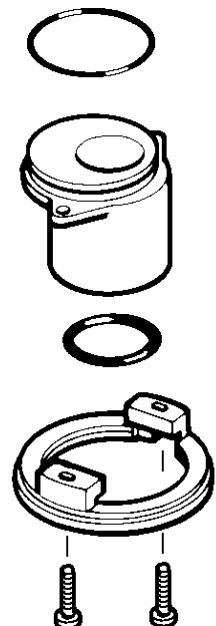
## **Check disc**

1. Remove the brine line from the brine elbow.
2. Disconnect the connector from the 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 (541N94/541N99 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. 541N94/541N99 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 refill solenoid.
13. Install the brine line to the brine elbow.



## **Riser insert**

1. Disconnect the 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.



**Flow meter turbine**

1. Disconnect the flow meter cable 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 the hub from the outlet of the outlet elbow.
5. Remove the impeller.
6. Reverse the procedure for reassembly.



# **Troubleshooting**

## **Hard (untreated) water to service**

<b>Cause</b>	<b>Solution</b>
1. Open or defective bypass	1. Close or verify bypass
2. Loss of resin	2. Refer to problem "Loss of resin"
3. Valve in regeneration	3. Wait until regeneration finishes or advance regeneration to end
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. Decreasing exchange capacity of resin	7. Clean or replace resin bed
8. No salt in brine tank	8. Add salt
9. Leak at riser tube	9. Verify that riser tube is seated correctly and is not cracked

## **Unit fails to regenerate**

<b>Cause</b>	<b>Solution</b>
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**

<b>Cause</b>	<b>Solution</b>
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**

<b>Cause</b>	<b>Solution</b>
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**

<b>Cause</b>	<b>Solution</b>
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**

<b>Cause</b>	<b>Solution</b>
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**

<b>Cause</b>	<b>Solution</b>
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 through drain line**

<b>Cause</b>	<b>Solution</b>
1. Excessive backwash/fast rinse flow	1. Adjust drain flow adjuster
2. Lower and/or upper distributor damaged	2. Replace distributor(s)
3. Leak between riser tube and upper distributor	3. Verify that riser tube is seated correctly and is not cracked

## **Loss of water pressure**

<b>Cause</b>	<b>Solution</b>
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**

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

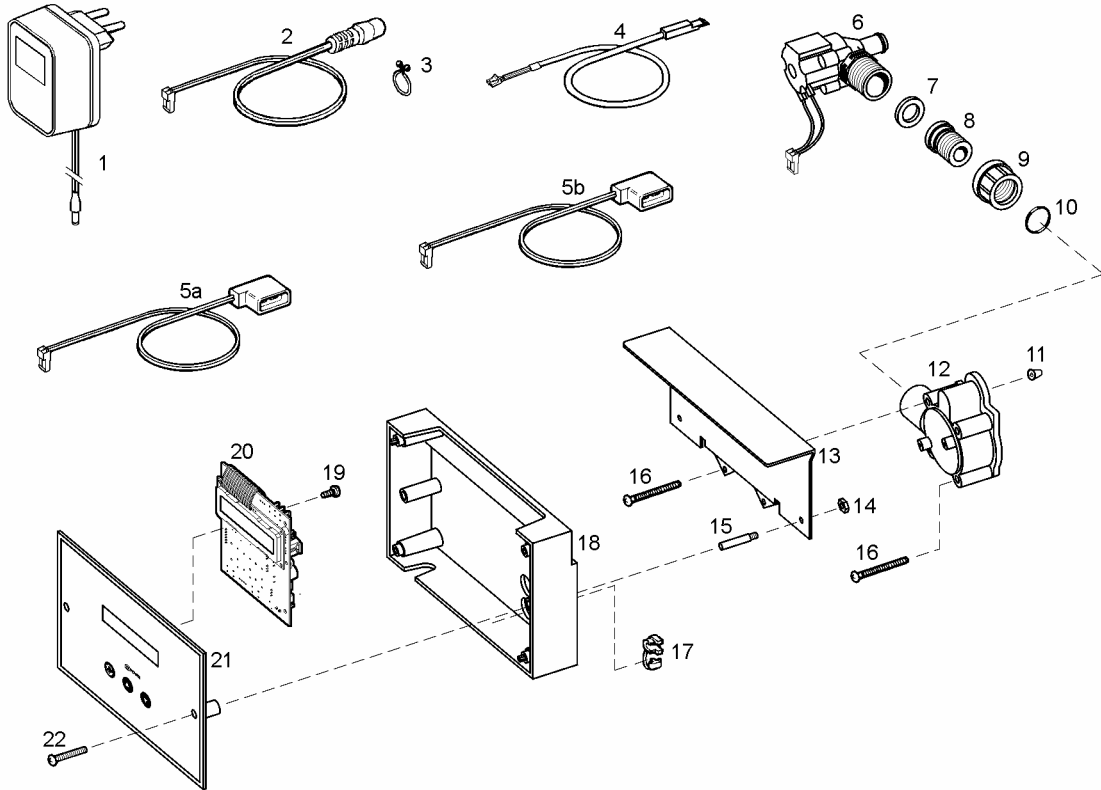
# Annual Maintenance

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

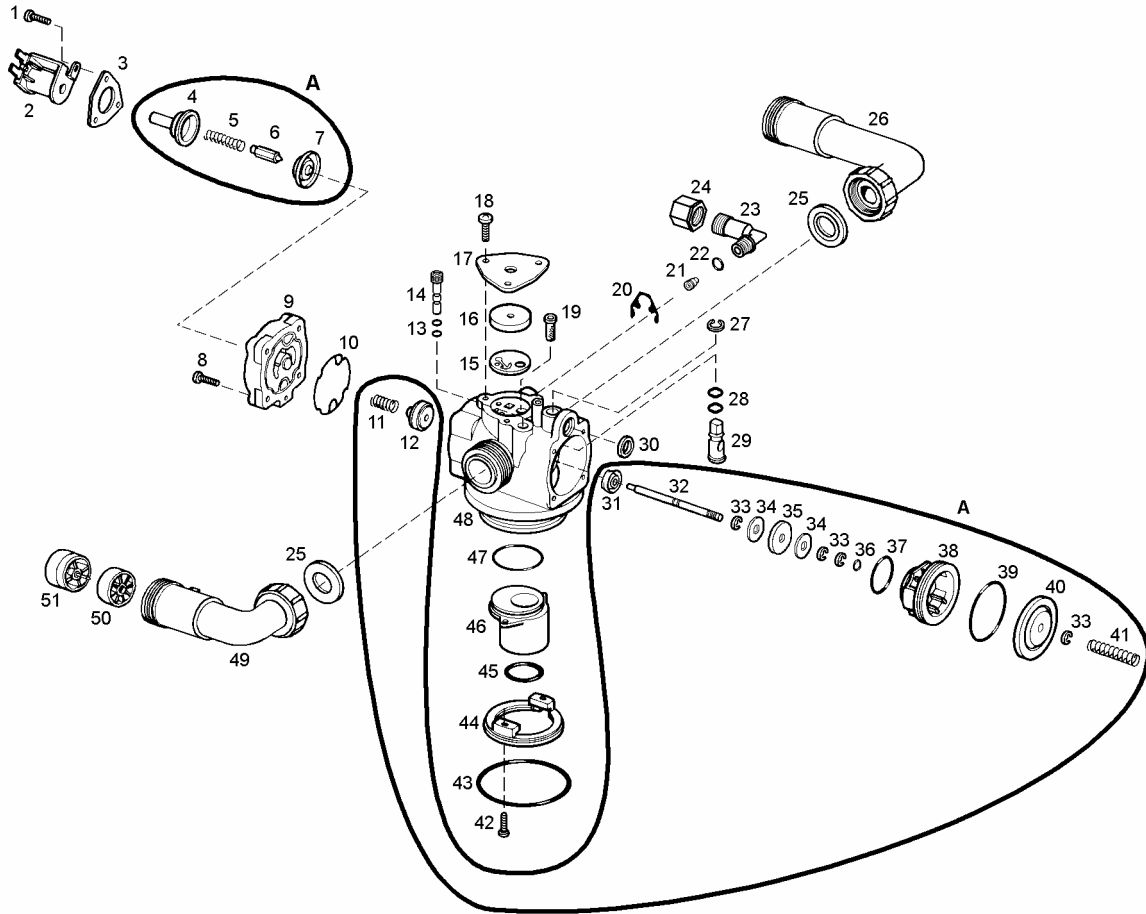


## 541N SERIES

ITEM	PART NUMBER	DESCRIPTION
<b>1</b>	28/297/11	Transfo 230/24V - 50 Hz, 10VA, EuroT plug
	28/297/18	Transfo 230/24V - 50 Hz, 10VA, UK plug
	28/298/11	Transfo 230/24V - 50 Hz, 20VA, EuroT plug
	28/298/18	Transfo 230/24V - 50 Hz, 20VA, UK plug
<b>2</b>	70971	Power lead with plug
<b>3</b>	72263	Wire clip
<b>4</b>	72519	Flow meter cable
<b>5a</b>	71681	Cable, backwash solenoid (black)
<b>5b</b>	71682	Cable, refill solenoid (white)
<b>6</b>	74029	Drain solenoid
<b>7</b>	74019	Gasket, drain solenoid
<b>8</b>	74016	Drain line adaptor
<b>9</b>	74018	Nut, drain solenoid
<b>10</b>	185/115/1	O-ring, drain line adaptor
<b>11</b>	541/300/*	Drain flow control (optional)
<b>12</b>	72216	Valve head
<b>13</b>	72481	Bracket, timer housing
<b>14</b>	12682	Nut, extension post (2x)
<b>15</b>	72482	Extension post
<b>16</b>	15/87	Screw, valve head (4x)
<b>17</b>	28/8/28	Strain relief
<b>18</b>	74025	Timer housing 541N19
	74026	Timer housing 541N18/541N99
	74027	Timer housing 541N94
<b>19</b>	15/102	Screw, PCB
<b>20</b>	72532	Printed Circuit Board 541N18
	72533	Printed Circuit Board 541N19
	72534	Printed Circuit Board 541N94
	72535	Printed Circuit Board 541N99
<b>21</b>	74040	Timer cover
<b>22</b>	72490	Screw, timer housing

\* Size: refer to "Sizing Table"

**Valve body 541N18**

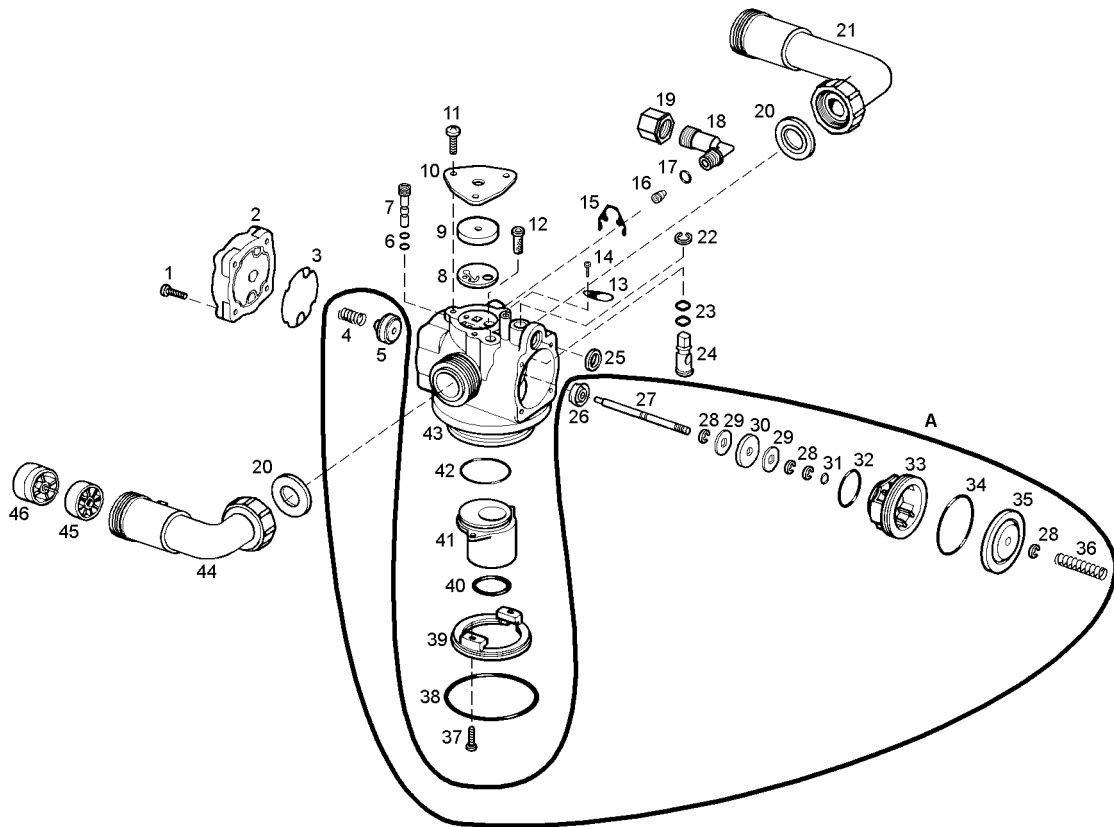


## 541N SERIES

ITEM	PART NUMBER	DESCRIPTION
1	15/90	Screw, solenoid (4x)
2	413/134/24	Solenoid
3	413/60	Retainer, solenoid
4	413/58	Guide, solenoid
5	413/62	Spring, solenoid plunger
6	413/61	Plunger, solenoid
7	413/59	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	413/13	Filter, injector
20	541/254	Spring clip
21	74015	Brine flow restrictor 0,8mm (with injector 9 only)
	74022	Brine flow restrictor 1,0mm (with injector 8 only)
22	186/118	O-ring, brine elbow
23	568/336/0	Brine elbow
24	21/90	Nut, brine elbow
25	72467	Union gasket (2x)
26	72542	Elbow, inlet
27	19/19	Clip, drain flow adjuster
28	186/134	O-ring, drain flow adjuster (2x)
29	541/238	Drain flow adjuster
30	529/244	O-ring, drain port
31	467/216	Seal, body stem
32	541/210	Body stem
33	19/3	Clip, body stem (4x)
34	541/217	Washer (2x)
35	541/216	Valve disc
36	185/005/1	O-ring, 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	541/256	Main diaphragm
41	516/221	Spring, main diaphragm
42	15/90	Screw, adapter ring (2x)
43	185/67/4	O-ring, tank
44	541/232	Adapter ring
45	185/214/1	O-ring, riser tube
46	541/218	Riser insert 1,050"
47	185/029/1	O-ring, riser insert
48	541/257/1	Valve body (incl. 467/216)
	541/257/1/R	Valve body (incl. 467/216) for mixing valve
49	72543	Elbow, outlet
50	72544	Impeller
51	72545	Hub, Impeller
A	RK/413	Repair kit solenoid diaphragm
B	RK/541/244	Repair kit body stem

\* Size: refer to "Sizing Table"

**Valve body 541N19**



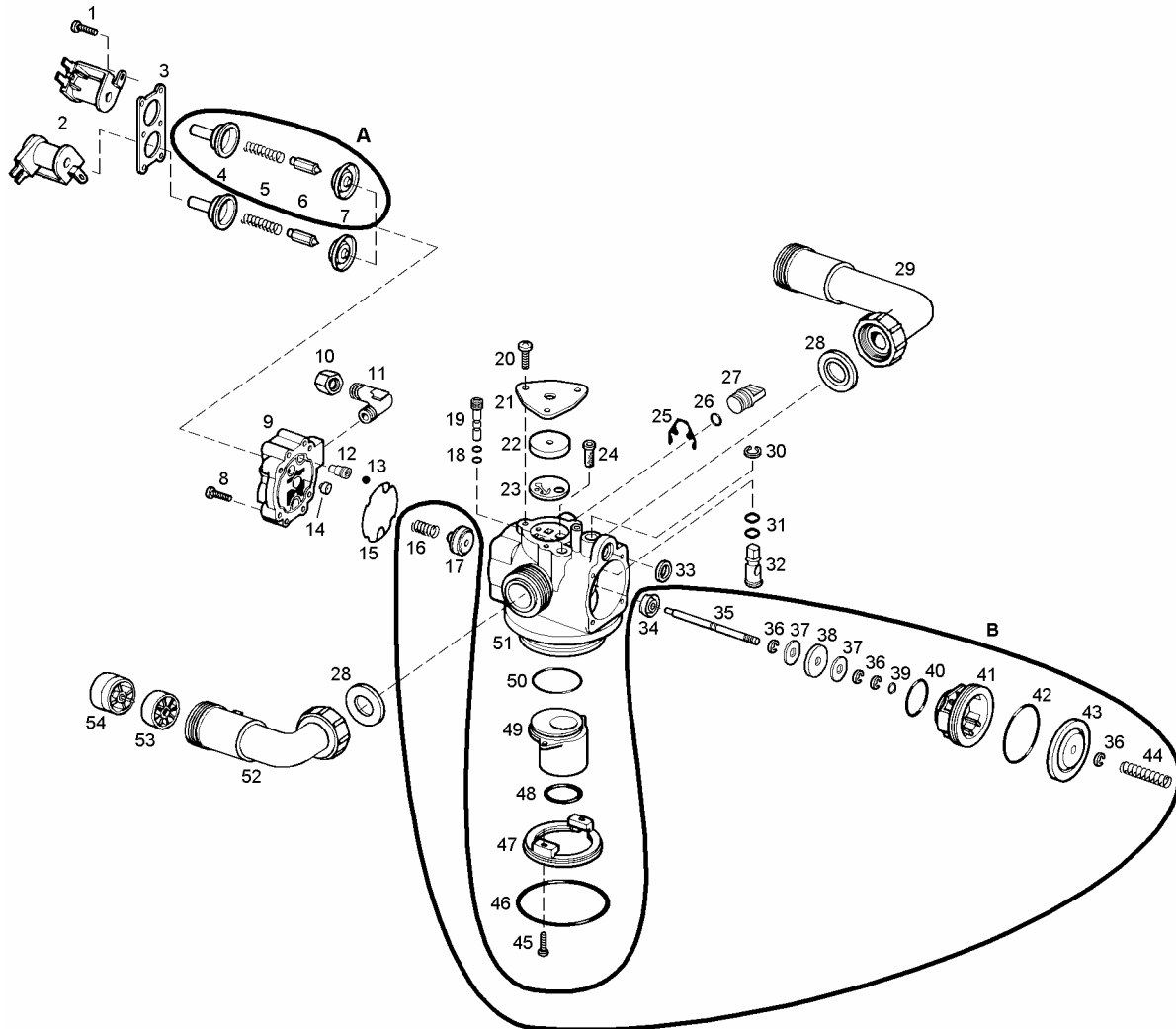


## 541N SERIES

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	413/13	Filter, injector
13	541/293	Locking plate, drain flow adjust.
14	15/76	Screw, locking plate
15	541/254	Spring clip
16	74015	Brine flow restrictor 0,8mm (with injector 9 only)
	74022	Brine flow 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	541/210	Body stem
28	19/3	Clip, body stem (4x)
29	541/217	Washer (2x)
30	541/216	Valve disc
31	185/005/1	O-ring, body stem
32	185/024/1	O-ring, seat insert (small)
33	541/204	Seat insert
34	185/029/1	O-ring, seat insert (large)
35	541/256	Main diaphragm
36	516/221	Spring, main diaphragm
37	15/90	Screw, adapter ring (2x)
38	185/67/4	O-ring, tank
39	541/232	Adapter ring
40	185/214/1	O-ring, riser tube
41	541/218	Riser insert 1,050"
42	185/029/1	O-ring, riser insert
43	541/257/1	Valve body (incl. 467/216)
	541/257/1/R	Valve body (incl. 467/216) for mixing valve
44	72543	Elbow, outlet
45	72544	Impeller
46	72545	Hub, Impeller
A	RK/413	Repair kit solenoid diaphragm
B	RK/541/244	Repair kit body stem

\* Size: refer to "Sizing Table"

**Valve body 541N94**



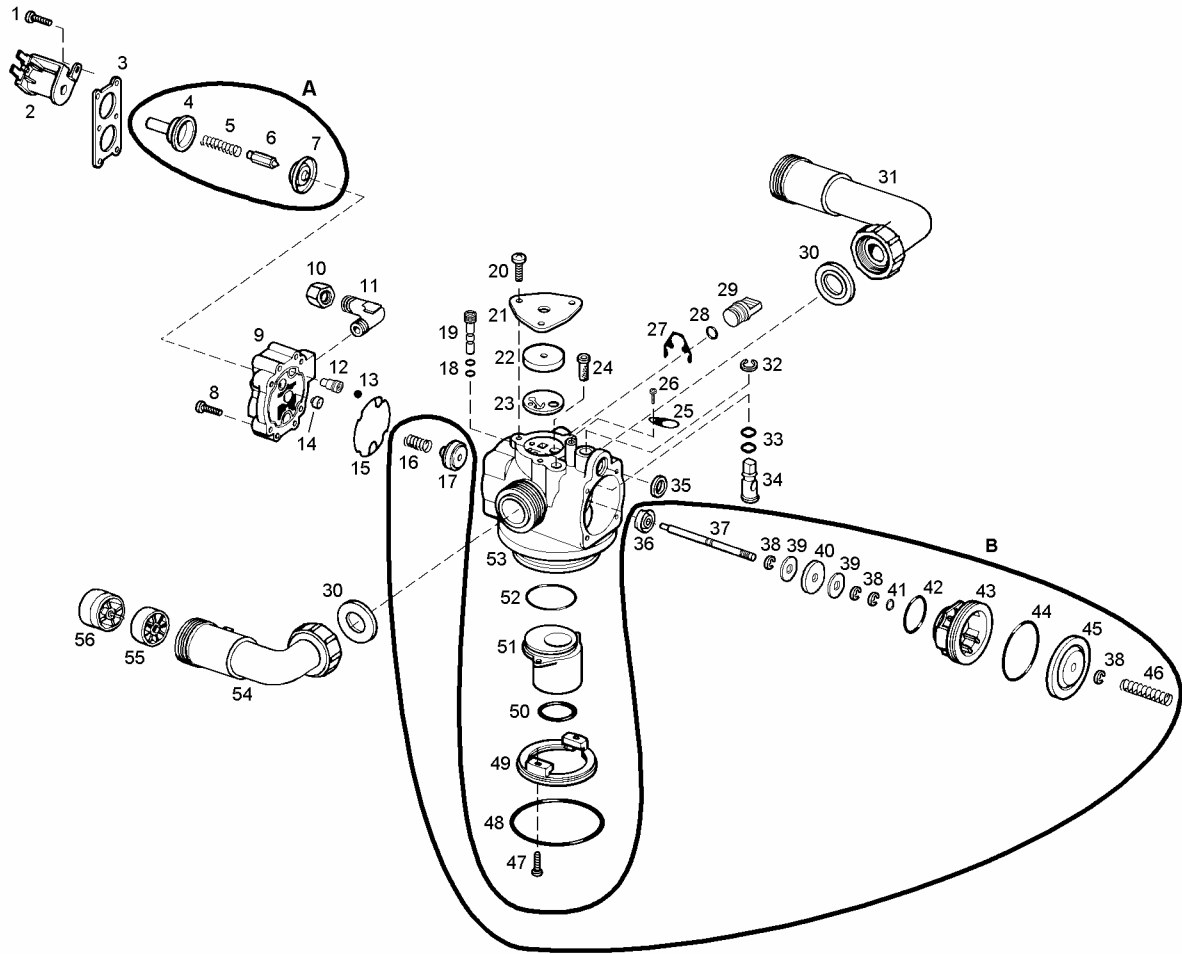
ITEM	PART NUMBER	DESCRIPTION
1	15/90	Screw, solenoid (6x)
2	413/134/24	Solenoid
3	541/229	Retainer, solenoid

## 541N SERIES

ITEM	PART NUMBER	DESCRIPTION
4	413/58	Guide, solenoid
5	413/62	Spring, solenoid plunger
6	413/61	Plunger, solenoid
7	413/59	Diaphragm, solenoid
8	15/222	Screw, back cap (4x)
9	541/274/2/E	Back cap
10	21/88	Nut, brine elbow
11	21/35	Brine elbow
12	74015	Brine flow restrictor 0,8mm (with injector 9 only)
	74022	Brine flow restrictor 1,0mm (with injector 8 only)
13	541/275	Check ball
14	568/385/2/A	Refill flow control A (1 L/min)
15	541/206	Gasket, back cap
16	541/239	Spring, check disc
17	541/246	Check disc
18	185/005/1	O-ring, mixing valve (2x)
19	541/940/6/1	Mixing valve (optional)
20	15/89	Screw, cover plate (3x)
21	541/221	Cover plate, injector
22	428/*	Injector
23	541/325	Gasket, injector
24	413/13	Filter, injector
25	541/254	Spring clip
26	186/118	O-ring, brine plug
27	541/273	Brine plug
28	72467	Union gasket (2x)
29	72542	Elbow, inlet
30	19/19	Clip, drain flow adjuster
31	186/134	O-ring, drain flow adjuster (2x)
32	541/238	Drain flow adjuster
33	529/244	O-ring, drain port
34	467/216	Seal, body stem
35	541/210	Body stem
36	19/3	Clip, body stem (4x)
37	541/217	Washer (2x)
38	541/216	Valve disc
39	185/005/1	O-ring, body stem
40	185/024/1	O-ring, seat insert (small)
41	541/204	Seat insert
42	185/029/1	O-ring, seat insert (large)
43	541/256	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

\* 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

## 541N SERIES

ITEM	PART NUMBER	DESCRIPTION
6	413/61	Plunger, solenoid
7	413/59	Diaphragm, solenoid
8	15/222	Screw, back cap (4x)
9	541/286/2/E	Back cap
10	21/88	Nut, brine elbow
11	21/35	Brine elbow
12	74015	Brine flow restrictor 0,8mm (with injector 9 only)
	74022	Brine flow restrictor 1,0mm (with injector 8 only)
13	541/275	Check ball
14	568/385/2/A	Refill flow control A (1 L/min)
15	541/206	Gasket, back cap
16	541/239	Spring, check disc
17	541/246	Check disc
18	185/005/1	O-ring, mixing valve (2x)
19	541/940/6/1	Mixing valve (optional)
20	15/89	Screw, cover plate (3x)
21	541/221	Cover plate, injector
22	428/*	Injector
23	541/325	Gasket, injector
24	413/13	Filter, injector
25	541/293	Locking plate, drain flow adjust.
26	15/76	Screw, locking plate
27	541/254	Spring clip
28	186/118	O-ring, brine plug
29	541/273	Brine plug
30	72467	Union gasket (2x)
31	72542	Elbow, inlet
32	19/19	Clip, drain flow adjuster
33	186/134	O-ring, drain flow adjuster (2x)
34	541/238	Drain flow adjuster
35	529/244	O-ring, drain port
36	467/216	Seal, body stem
37	541/210	Body stem
38	19/3	Clip, body stem (4x)
39	541/217	Washer (2x)
40	541/216	Valve disc
41	185/005/1	O-ring, body stem
42	185/024/1	O-ring, seat insert (small)
43	541/204	Seat insert
44	185/029/1	O-ring, seat insert (large)
45	541/256	Main diaphragm
46	516/221	Spring, main diaphragm
47	15/90	Screw, adapter ring (2x)
48	185/67/4	O-ring, tank
49	541/232	Adapter ring
50	185/214/1	O-ring, riser tube
51	541/218	Riser insert 1,050"
52	185/029/1	O-ring, riser insert
53	541/257/1	Valve body (incl. 467/216)
	541/257/1/R	Valve body (incl. 467/216) for mixing valve
54	72543	Elbow, outlet
55	72544	Impeller
56	72545	Hub, Impeller
A	RK/413	Repair kit solenoid diaphragm
B	RK/541/244	Repair kit body stem

\* Size: refer to "Sizing Table"

# **Order Specifications 541N18**

## **541N18/VID(/R)**

**V = Voltage:**   **L** = transfo 230/24VAC, 20VA, EuroT plug  
                      **R** = transfo 230/24VAC, 20VA, 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)
<b>U</b>	1,2	(4,5)
<b>E</b>	1,6	(6,1)
<b>F</b>	1,8	(6,8)
<b>G</b>	2,0	(7,6)
<b>H</b>	2,2	(8,3)
<b>J</b>	2,6	(9,8)
<b>T</b>	3,0	(11,4)
<b>K</b>	3,5	(13,2)

**/R = Incorporated mixing valve**

# **Order Specifications 541N19**

## **541N19/VID(/R)**

**V = Voltage:**   **L** = transfo 230/24VAC, 10VA, EuroT plug  
                      **R** = transfo 230/24VAC, 10VA, 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)
<b>U</b>	1,2	(4,5)
<b>E</b>	1,6	(6,1)
<b>F</b>	1,8	(6,8)
<b>G</b>	2,0	(7,6)
<b>H</b>	2,2	(8,3)
<b>J</b>	2,6	(9,8)
<b>T</b>	3,0	(11,4)
<b>K</b>	3,5	(13,2)

**/R = Incorporated mixing valve**

# **Order Specifications 541N94**

## **541N94/VID(/R)**

**V = Voltage:**   **L** = transfo 230/24VAC, 20VA, EuroT plug  
                      **R** = transfo 230/24VAC, 20VA, 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)
<b>U</b>	1,2	(4,5)
<b>E</b>	1,6	(6,1)
<b>F</b>	1,8	(6,8)
<b>G</b>	2,0	(7,6)
<b>H</b>	2,2	(8,3)
<b>J</b>	2,6	(9,8)
<b>T</b>	3,0	(11,4)
<b>K</b>	3,5	(13,2)

**/R = Incorporated mixing valve**



# **Order Specifications 541N99**

## **541N99/VID(/R)**

**V = Voltage:**   **L** = transfo 230/24VAC, 10VA, EuroT plug  
                      **R** = transfo 230/24VAC, 10VA, 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)
<b>U</b>	1,2	(4,5)
<b>E</b>	1,6	(6,1)
<b>F</b>	1,8	(6,8)
<b>G</b>	2,0	(7,6)
<b>H</b>	2,2	(8,3)
<b>J</b>	2,6	(9,8)
<b>T</b>	3,0	(11,4)
<b>K</b>	3,5	(13,2)

**/R = Incorporated mixing valve**



