

WATER SOFTENERS

CONTENTS

1. DESCRIPTION OF THE SOFTENING PROCESS	3
2. COMPONENTS AND TECHNICAL SPECIFICATIONS OF GEL WATER SOFTENERS	4
2.1 GEL WATER SOFTENERS MODELS	4
2.2 DECAL COMPONENTS	5
2.3 DECALUX COMPONENTS	6
2.4 DUPLEX COMPONENTS	6
2.5 SPARE PARTS	7
2.6 TECHNICAL SPECIFICATIONS	8
3. OPERATION	11
4. OPERATING CONDITIONS	14
5. PRELIMINARY DESIGN	14
5.1 EXAMPLES OF DESIGN	16
6. SAFETY WARNINGS	17
7. EMERGENCY SITUATIONS	18
8. INSTALLATION	18
8.1 INSTALLATION NOTES	18
8.2 INSTALLATION	19
9. START UP	23
10. PLANNED STOP AND PRESERVATION OF THE SYSTEM	28
10.1 PLANNED STOP	28
10.2 PRESERVATION	28
11. MAINTENANCE	28
11.1 ORDINARY MAINTENANCE	29
11.2 EXTRAORDINARY MAINTENANCE	29
11.2.1 CLEAN UP PROCEDURE OF CATIONIC RESINS POLLUTED BY IRON	29
12. TROUBLESHOOTING	30
13. ENCLOSURES	31
2.13.1 Service Report Form	31
2.13.2 Installation Check Form	32

1. DESCRIPTION OF THE SOFTENING PROCESS

When passing through the layers of the ground, water dissolves Calcium and Magnesium salts, making up the "hardness". This is the major cause of scale and damages to water systems, boilers, household appliances, taps and fittings.

Hardness is removed thanks to the cationic resins contained in water softeners, which retain Calcium and Magnesium, present in water in ionic form, and exchange them with sodium ions to be previously absorbed.

Accumulating ions of Calcium and Magnesium and releasing ions of Sodium, resins progressively lose the exchange capacity and must be therefore "regenerated" in contact with a solution of Sodium Chloride (common salt) known as brine. Regeneration can be programmed automatically by Time (Timer ET500) or by Volume/Time (Timer VT1000 - VT2000).

2. COMPONENTS AND TECHNICAL SPECIFICATIONS OF GEL WATER SOFTENERS

2.1 MODELS OF GEL WATER SOFTENERS

Gel water softeners are basically made up of a vessel for the resins, a tank for preparing and storing the brine necessary for regenerating the resins and a hydropneumatic valve controlled by a programming timer.

They may be classified into two groups:

Discontinuous operation

a. DECALUX = monoblock models from 5 l. to 60 l. of resin

Decalux water softeners are assembled in one single block where the brine tank, for resins regeneration, houses the vessel.

b. DECAL = twin-body models from 15 l. to 500 l. of resin

In Decal water softeners brine tank and vessel are separated.

Continuous operation

DUPLEX = twin-body models from 15 l. to 500 l. of resin

Duplex water softeners differ from the first group in the operating conditions.

Duplex are capable of guaranteeing softened water production 24 hours a day, as they are made up of two vessels supplied in parallel with alternate operation: one vessel in operation - the other one in stand-by. As soon as the vessel starts regenerating, the second vessel in stand-by starts operating by keeping softened water production constant.

DUPLEX structure is similar to DECAL: softener vessel and brine tank are separated and resins content from 15 to 500 litres.

Duplex softeners are fitted with two special timers VT2000 known as Master and Slave (identical), which synchronize the operation, stand-by and regeneration of the two vessels.

By starting both vessels at the same time, GEL Duplex softeners are capable of producing a peak flow rate higher than that of the single vessel.

The simultaneous operation of both vessels may be kept until the vessel in stand-by reaches 33% of its exchange capacity (see section 6 for definition of exchange capacity).

GEL softeners may be equipped with one of the following programming timers:

Timer ET 500 / ET 500 BIG

Timer VT 1000 / VT 1000 BIG

Timer VT 2000 / VT 2000 BIG

Timer VT 2000 Master / VT 2000 Slave

Timer VT 2000 Master BIG/ VT 2000 Slave BIG

Each timer may be supplied in standard or **AD** version. The **AD** version is fitted with a self-disinfection system for the resins and a salt alarm device indicating when salt is exhausted.

Timer VT 2000 may be supplied in the following types:

VT 2000 AD BPA for controlling automatic mixing valve

VT 2000 AD WS for controlling Water Sentinel anti flood system

VT 2000 AD BPW for controlling automatic mixing valve and Water Sentinel anti flood system

TIMERS AVAILABLE	
DECALUX	ET 500 / ET 500 AD VT 1000 / VT 1000 AD VT 2000 / VT 2000 AD
DECAL	ET 500 / ET 500 AD ET 500 BIG / ET 500 BIG AD VT 1000 / VT 1000 AD VT 1000 BIG / VT 1000 AD BIG VT 2000 / VT 2000 AD VT 2000 BIG / VT 2000 AD BIG
DUPLEX	VT 2000 Master/ Slave VT 2000 BIG Master / Slave VT 2000 AD Master / Slave VT 2000 AD BIG Master / Slave

MODELS			
VALVE	DECALUX	DECAL	DUPLEX
V 132	from 5 to 60	from 15 to 200	from 15 to 200
V 230		110 M 140 M 200 M 250 M	110+110 M 140+140 M 200+200 M 250+250 M
V 250		200 B 250 B 320 B 500 B	200+200 B 250+250 B 320+320 B 500+500 B

2.2 DECAL COMPONENTS

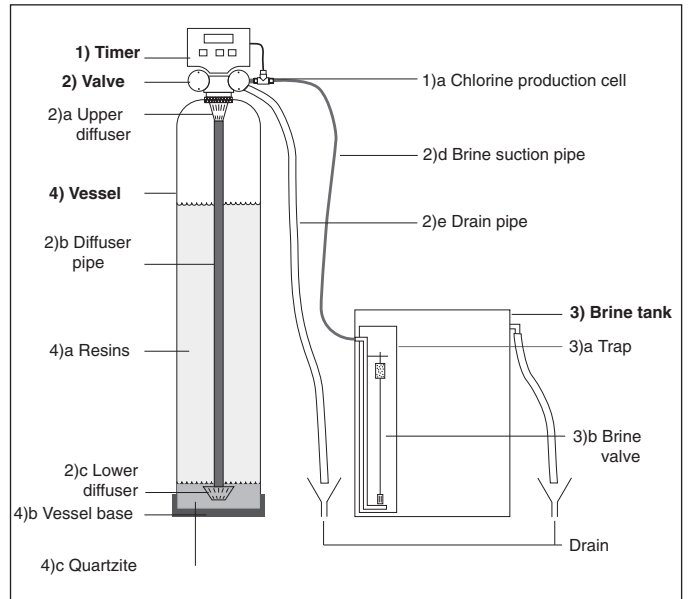


Fig. 2.1

DECAL water softeners are made up of:

1. programming timer, periodically starting resins regeneration
 - 1a. chlorine production cell for resins self-disinfection (AD models only)
2. hydropneumatic valve, directing water flow in operation and regeneration phases
 - 2a. upper diffuser, screwed to the valve
 - 2b. diffuser pipe for conveying treated water
 - 2c. lower diffuser, glued on the diffuser pipe
 - 2d. brine suction pipe
 - 2e. pipe for draining water during regeneration
3. brine tank
 - 3a. trap for brine valve
 - 3b. brine valve
4. vessel for containing resins made of polyethylene reinforced in glass fibre
 - 4a. cationic exchange resins
 - 4b. vessel base
 - 4c. quartzite 3-5 mm

Timer and hydropneumatic valve make up the head of the water softener.

2.3 DECALUX COMPONENTS

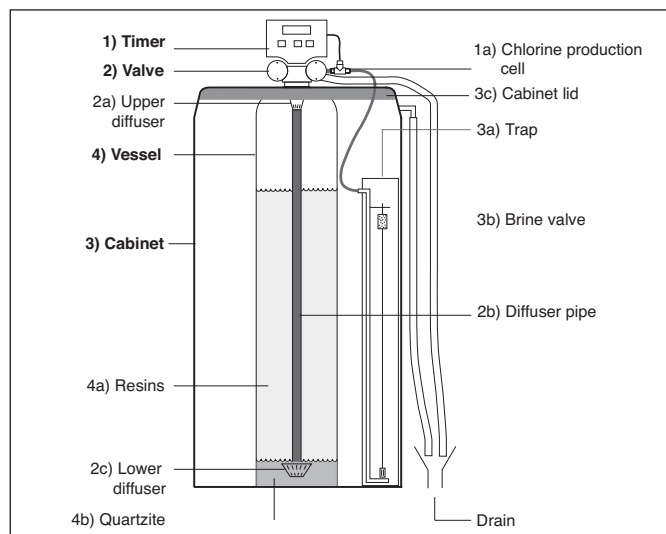


Fig. 2.2

DECALUX water softeners are made up of:

1. programming timer, periodically starting resins regeneration
 - 1a. chlorine production cell for resins self-disinfection (AD models only)
2. hydropneumatic valve, directing water flow in operation and regeneration phases
 - 2a. upper diffuser, screwed to the valve
 - 2b. diffuser pipe for conveying treated water
 - 2c. lower diffuser, glued on the diffuser pipe
3. cabinet, containing brine
 - 3a. trap for brine valve
 - 3b. brine valve
4. vessel for containing resins made of polyethylene reinforced in glass fibre
 - 4a. cationic exchange resins
 - 4b. vessel base
 - 4c. quartzite 3-5 mm

2.4 DUPLEX COMPONENTS

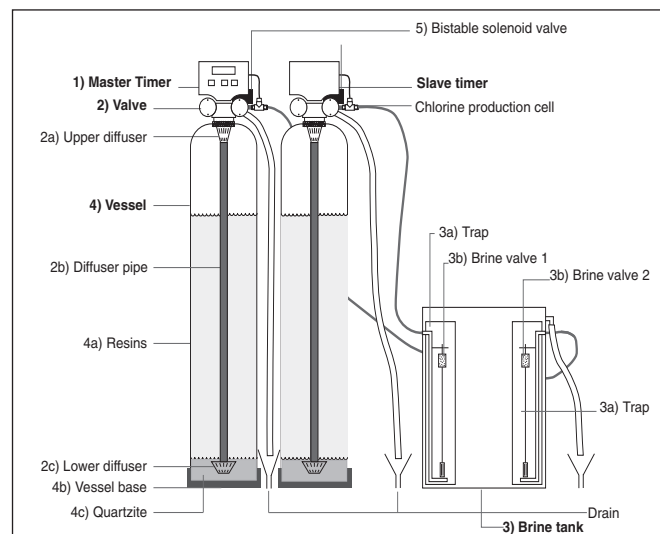


Fig. 2.3

DUPLEX water softeners are made up of:

1. programming timers (Master and Slave), periodically starting resins regeneration
 - 1a. chlorine production cells for resins self-disinfection (AD models only)
2. hydropneumatic valves, directing water flow in operation and regeneration phases
 - 2a. upper diffusers, screwed to the valves
 - 2b. diffuser pipes for conveying treated water
 - 2c. lower diffusers, glued on the diffuser pipes
3. brine tank, housing two brine valves
 - 3a. brine valves no. 1 and no. 2
4. vessels for containing resins made of polyethylene reinforced in glass fibre
 - 4a. cationic exchange resins
 - 4b. vessel base
 - 4c. quartzite 3-5 mm
5. bistable solenoid valves

2.5 SPARE PARTS

For enquiries on spare parts, please specify model and serial number of the water softener, item code and description of the spare part and number of pieces desired.

For information about spare parts please refer to the following sections:

Timers Section 12

ET500 / ET500 BIG
VT1000 / VT1000 BIG
VT2000 / VT2000 BIG
VT2000 Master / Slave
VT2000 Master BIG / Slave BIG

Valves Section 13

Time Valve 132
Volume Valve 132
Time Valve 230
Volume Valve 230
Time Valve 250
Volume Valve 250
Diffusers - Diffuser pipe

Brine tanks - Traps - Brine valves Section 14

Brine tanks
Brine valves

Vessels Section 15

Resins Section 16

Quartzite
Cationic resin

2.6 TECHNICAL SPECIFICATIONS

The tables below summarise the technical specifications of Water Softeners.

SOFTENERS FILLING TABLE					
DECALUX			DECAL - DUPLEX		
Model	Quartzite 3-5 mm Code 41070030 (Kg)	Cationic resin Code 41070020 (lt)	Models (each vessel)	Quartzite 3-5 mm Code 41070030 (Kg)	Cationic resin Code 41070020 (lt)
5	1	5	15	2	15
10	2	10	20	2	20
15	2	15	25	4	25
20	2	20	30	4	30
25	4	25	45	4	45
30	4	30	60	6,5	60
45	4	45	75	6,5	75
60	6,5	60	110	9	110
			110M	9	110
			140	11	140
			140M	11	140
			200	20	200
			200M	20	200
			200B	20	200
			250M	33	250
			250B	33	250
			320B	33	320
			500B	33	500

DECALUX																	
Item	Connections F.	Cyclic capacity (m ³ x1 ^{°f})	Flow rate potable use (h.l. >2)			Flow rate technical use (h.l. <0,5)			Flow rate technical use (h.l. >0,5)			Brine tanks (No. x l.)	Salt per regen. (Kg)	Regen. auton. (N.)	Regen. duration (min)	Weight (kg)	Dimensions LxHxZ (cm)
			operation (t<2,0) (m ³ /h)	ΔP	peak* (l/min)	operation (t 6,0) (m ³ /h)	ΔP	peak* (l/min)	operation (t 2,0) (m ³ /h)	ΔP	peak* (l/min)						
5	1 1/4"	30	0,30	<0,5	8	0,05	<0,5	1	0,15	<0,5	3	43	0,75	9	14	16	34x55x50
10	1 1/4"	60	0,60	<0,5	16	0,10	<0,5	2	0,30	<0,5	6	86	1,5	26	26	28	40x78x60
15	1 1/4"	90	0,90	<0,5	24	0,15	<0,5	3	0,45	<0,5	9	145	2,25	38	22	36	40x111x60
20	1 1/4"	120	1,20	<0,5	32	0,20	<0,5	4	0,60	<0,5	13	145	3,00	23	29	43	40x111x60
25	1 1/4"	150	1,50	<0,5	40	0,25	<0,5	5	0,75	<0,5	16	145	3,75	11	36	43	40x111x60
30	1 1/4"	180	1,80	<0,5	48	0,30	<0,5	6	0,90	<0,5	19	145	4,50	8	43	53	40x111x60
45	1 1/4"	270	2,25	<0,5	60	0,45	<0,5	8	1,35	<0,5	28	251	6,75	8	36	82	50x134x70
60	1 1/4"	360	3,00	<0,6	81	0,60	<0,5	11	1,80	<0,5	38	251	9,00	2	33	90	50x134x70

Table 2.1 - Technical specifications of DECALUX water softeners

Note: h.l. = hardness losses (°f); t = contact time between water and resins

DECAL																		
Item	Connections F.	Cyclic capacity (m ³ x1 [°] f)	Flow rate potable use (h.l. >2)			Flow rate technical use (h.l. <0,5)			Flow rate technical use (h.l. >0,5)			Brine tanks (l)	Salt per regen. (Kg)	Regen. auton. (N.)	Regen. duration (min)	Weight (kg)	Dimensions (cm)	
			operation (t<2,0) (m ³ /h)	ΔP	peak* (l/min)	operation (t 6,0) (m ³ /h)	ΔP	peak* (l/min)	operation (t 2,0) (m ³ /h)	ΔP	peak* (l/min)						Vessel LxH	Container ØxH
15	1 1/4"	90	0,90	<0,5	24	0,15	<0,5	3	0,45	<0,5	9	100	2,25	31	22	33	24x111	47x62
20	1 1/4"	120	1,20	<0,5	32	0,20	<0,5	4	0,60	<0,5	13	100	3,0	19	29	37	24x111	47x62
25	1 1/4"	150	1,50	<0,5	40	0,25	<0,5	5	0,75	<0,5	16	100	3,75	12	36	46	25x111	47x62
30	1 1/4"	180	1,80	<0,5	48	0,30	<0,5	6	0,90	<0,5	19	100	4,50	8	43	53	25x111	47x62
45	1 1/4"	270	2,25	<0,5	60	0,45	<0,5	8	1,35	<0,5	28	100	6,75	5	36	71	25x159	47x62
60	1 1/4"	360	3,00	<0,6	81	0,60	<0,5	11	1,80	<0,5	38	150	9,0	12	33	83	33x134	53x75
75	1 1/4"	450	3,75	<0,7	101	0,75	<0,5	14	2,25	<0,5	47	150	11,25	7	41	98	33x159	53x75
110	1 1/4"	660	4,40	<0,8	117	1,10	<0,5	20	3,30	<0,6	69	200	16,50	4	47	155	37x186	53x100
110/M	2"	660	4,40	<0,6	120	1,10	<0,5	20	3,30	<0,5	69	200	16,50	4	41	155	37x190	53x100
140	1 1/4"	840	5,60	<0,9	117	1,40	<0,5	26	4,20	<0,8	88	300	21,0	8	59	183	41x186	62x106
140/M	2"	840	5,60	<0,7	151	1,40	<0,5	26	4,20	<0,6	88	300	21,0	8	51	183	41x190	62x106
200	1 1/4"	1200	7,00	<1,2	117	2,00	<0,5	37	6,00	<1,0	125	520	30,0	10	84	280	56x183	78x111
200/M	2"	1200	7,00	<1,0	160	2,00	<0,5	37	6,00	<0,8	125	520	30,0	10	73	280	56x187	78x111
200/B	2"	1200	7,00	<0,8	188	2,00	<0,5	37	6,00	<0,6	125	520	30,0	10	66	280	56x197	78x111
250/M	2"	1500	8,75	<1,2	160	2,50	<0,5	46	7,50	<1,1	156	520	37,5	5	91	420	61x225	78x111
250/B	2"	1500	8,75	<0,9	235	2,50	<0,5	46	7,50	<0,6	156	520	37,5	5	34	420	61x235	78x111
320/B	2"	1920	9,60	<0,7	258	3,20	<0,5	59	9,60	<0,7	200	850	48,0	14	38	490	61x235	104x109
500/B	2"	3000	15,00	<0,9	350	5,00	<0,5	93	15,00	<0,9	313	850	75,0	5	53	653	77x237	104x109

Table 2.2 - Technical specifications of DECAL water softeners

DUPLEX																		
Items	Connections F.	Cyclic capacity (m ³ x1 [°] f)	Flow rate potable use (h.l. >2)			Flow rate technical use (h.l. <0,5)			Flow rate technical use (h.l. >0,5)			Brine tanks (l)	Salt per regen. (Kg)	Regen. auton. (N.)	Regen. duration (min)	Weight (kg)	Dimensions (cm)	
			operation (t<2,0) (m ³ /h)	ΔP	peak* (l/min)	operation (t 6,0) (m ³ /h)	ΔP	peak* (l/min)	operation (t 2,0) (m ³ /h)	ΔP	peak* (l/min)						Vessel LxH	Container ØxH
15	1"	90	0,90	<0,5	48	0,15	<0,5	6	0,45	<0,5	18	100	2,25	31	22	66	58x111	47x62
20	1"	120	1,20	<0,5	64	0,20	<0,5	8	0,60	<0,5	26	100	3,0	19	29	74	58x111	47x62
25	1"	150	1,50	<0,5	80	0,25	<0,5	10	0,75	<0,5	32	100	3,75	12	36	92	60x111	47x62
30	1"	180	1,80	<0,5	96	0,30	<0,5	12	0,90	<0,5	38	100	4,50	8	43	106	60x111	47x62
45	1"	270	2,25	<0,5	120	0,45	<0,5	16	1,35	<0,5	56	100	6,75	5	36	142	60x159	47x62
60	1"	360	3,00	<0,6	162	0,60	<0,5	22	1,80	<0,5	76	150	9,00	12	33	166	76x134	53x75
75	1"	450	3,75	<0,7	202	0,75	<0,5	28	2,25	<0,5	94	150	11,25	7	41	196	76x159	53x75
110	1"	660	4,40	<0,8	234	1,10	<0,5	40	3,30	<0,6	138	200	16,50	4	47	310	82x186	53x100
110 M	2"	660	4,40	<0,6	240	1,10	<0,5	40	3,30	<0,5	138	200	11,25	4	41	310	82x190	53x100
140	1"	840	5,60	<0,9	234	1,40	<0,5	52	4,20	<0,8	176	300	21,0	8	59	366	92x186	62x106
140 M	2"	840	5,60	<0,7	302	1,40	<0,5	52	4,20	<0,6	176	300	21,0	8	51	366	92x190	62x106
200	1"	1200	7,00	<1,2	234	2,00	<0,5	74	6,00	<1,0	250	520	30,0	10	84	560	140x183	78x111
200 M	2"	1200	7,00	<1,0	320	2,00	<0,5	74	6,00	<0,8	250	520	30,0	10	73	560	140x187	78x111
200 B	2"	1200	7,00	<0,8	376	2,00	<0,5	74	6,00	<0,6	250	520	30,0	10	66	560	140x197	78x111
250 M	2"	1500	8,75	<1,2	320	2,50	<0,5	92	7,50	<1,1	312	520	37,5	5	91	840	140x225	78x111
250 B	2"	1500	8,75	<0,9	470	2,50	<0,5	92	7,50	<0,6	312	520	37,5	5	34	840	140x235	78x111
320 B	2"	1920	9,60	<0,7	516	3,20	<0,5	118	9,60	<0,7	400	850	48,0	14	38	980	140x235	104x109
500 B	2"	3000	15,00	<0,9	700	5,00	<0,5	186	15,00	<0,9	626	850	75,0	5	53	1306	150x237	104x109

Table 2.3 - Technical specifications of DUPLEX water softeners

* Duplex water softener is capable of satisfying the peak flow rate shown in table for a limited time, by starting both vessels at the same time until 1/3 of the resin exchange capacity is reached.

The table below summarizes times and flow rates (at 4 bar) during regeneration phase.

Model (Litres of resin)	Times and flow rates during regeneration phases								Injector colour	Flow control no.
	PHASE 1		PHASE 2		PHASE 3		PHASE 4			
	Duration (min)	Flow rate (l/h)	Duration (min)	Flow rate (l/h)	Duration (min)	Flow rate (l/h)	Duration (min)	Flow rate (l/h)		
5	2	320	5	43	3	83	4	320	Brown	1
8	3	320	8	43	5	83	5	320	Brown	1
10	3	320	10	43	6	83	7	320	Brown	1
15	3	480	8	84	5	103	6	480	Blue	2
20	4	480	11	84	6	103	8	480	Blue	2
25	5	480	13	84	8	103	10	480	Blue	2
30	6	480	16	84	9	103	12	480	Blue	2
45	6	700	11	180	6	224	13	700	Red	3
60	6	950	9	282	5	353	13	950	Black	4
75	8	950	11	282	6	353	16	950	Black	4
110	7	1450	16	282	9	353	15	1450	Black	5
110M	7	1450	12	378	7	573	15	1450	Grey	5
140	9	1450	20	282	11	353	19	1450	Black	5
140M	9	1450	15	378	8	573	19	1450	Grey	5
140B	3	3800	26	280	16	570	6	3800	Blue/B	4 (x4)
200	13	1450	28	282	16	353	27	1450	Black	5
200M	13	1450	21	378	12	573	27	1450	Grey	5
200B	4	5800	35	280	20	570	7	5800	Blue/B	5 (x4)
250M	16	1450	26	378	15	573	34	1450	Grey	5
250B	4	5800	13	660	8	1170	9	5800	Black /B	5 (x4)
320B	4	9000	17	660	10	1170	7	9000	Black /B	Without flow control
500B	4	12000	26	660	15	1170	8	12000	Black /B	Without flow control holder

Table 2.4 - Times and flow rates during regeneration

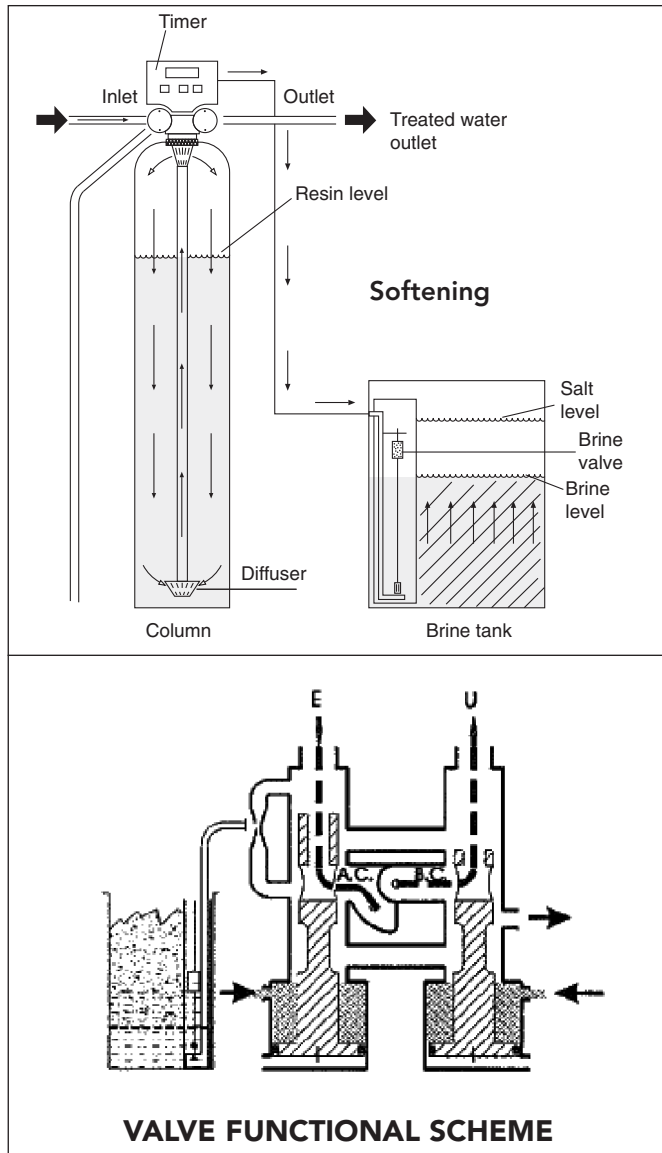
3. OPERATION

Water softening

Passing through the valve, water enters the column of the upper diffuser and passes through the cationic resin and the quartzite layer, then goes up inside the diffuser pipe and comes out from the valve with no hardness.

Figure 2.4 shows the working principle during service as well as the cross section view of the valve from above.

- water enters the valve from the inlet **E**;
- comes out from the upper diffuser passing through the small holes "A.C." of the valve;
- passes through the resins from the top to the bottom;
- passes through the lower diffuser;
- goes up through the diffuser pipe;
- enters the valve again through the central hole "B.C.";
- comes out from the outlet **U** of the valve.



Regeneration

In the course of time resins lose the exchange capacity and channelling creating inside them negatively affects the softener efficiency. To restore the resins performance, it is necessary to regenerate them so as to remove ions of Calcium and Magnesium they have retained and to recover the original Sodium charge for a new treatment cycle.

The softener regeneration, controlled by the timer, takes place in four different phases:

1. backwash
2. brine suction
3. slow rinse
4. fast rinse

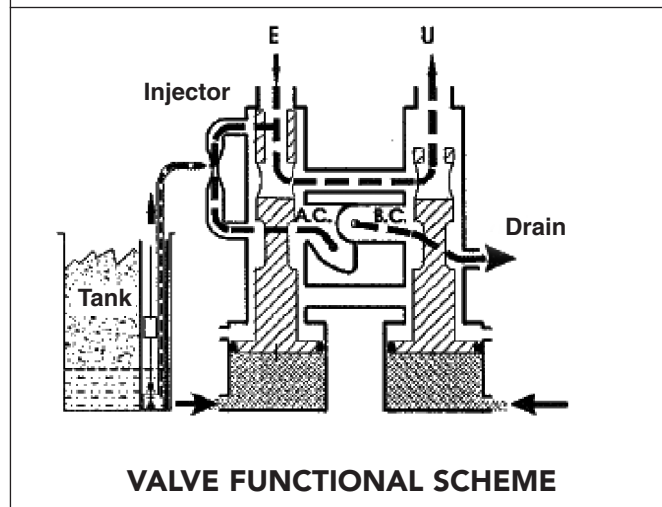
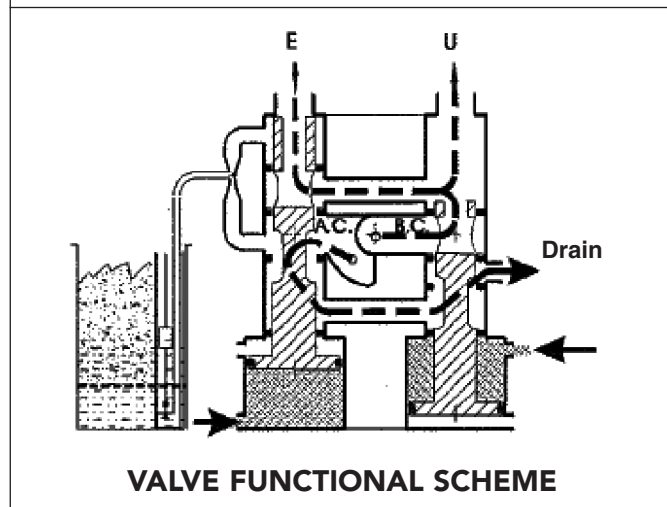
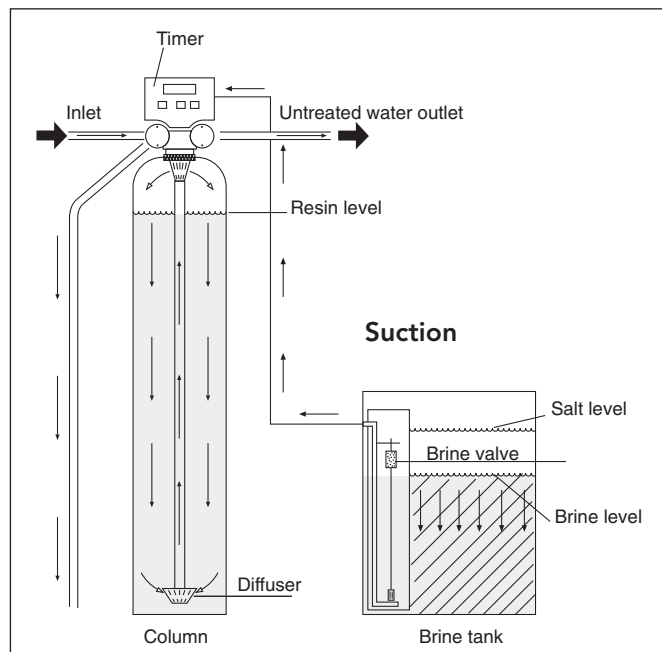
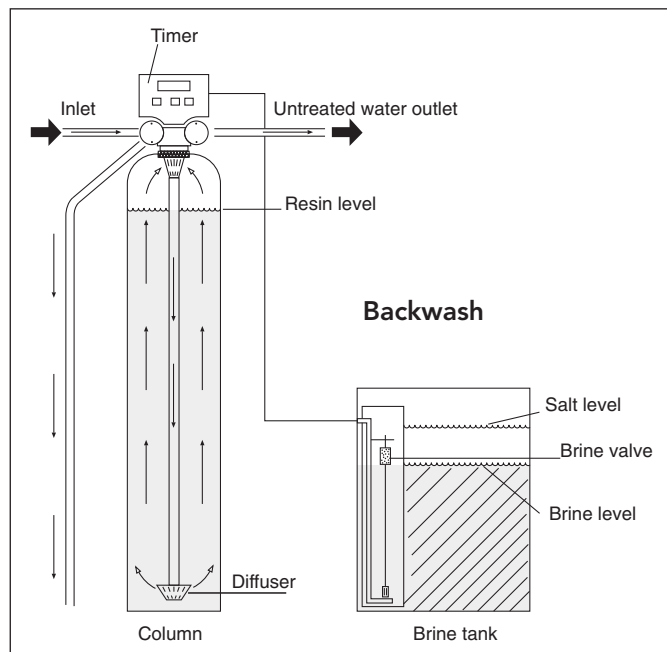
During regeneration phases the softener does not supply treated water.

Fig. 2.4

Regeneration phases

1. The first phase is backwash. Resins are lifted up and any possible agglomerates are broken up in order to remove channelling formed during the softener operation.

2. The second phase is brine suction and lasts the time necessary for restoring the content of sodium ions in cationic resins, which absorb sodium ions and release Calcium and Magnesium ions to the water conveyed to the drain.

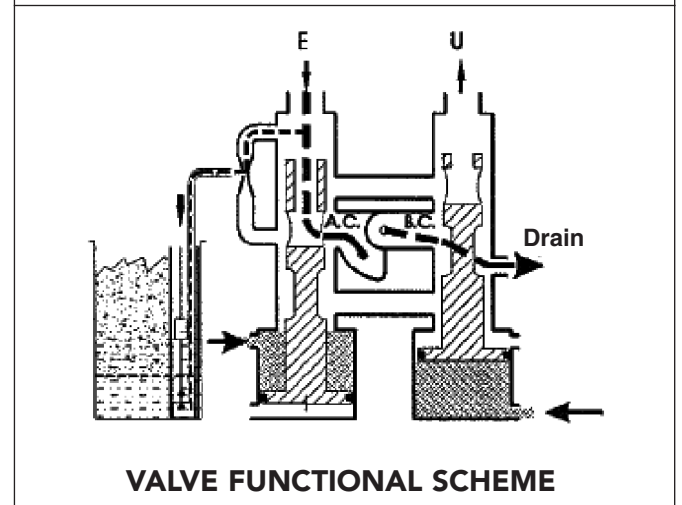
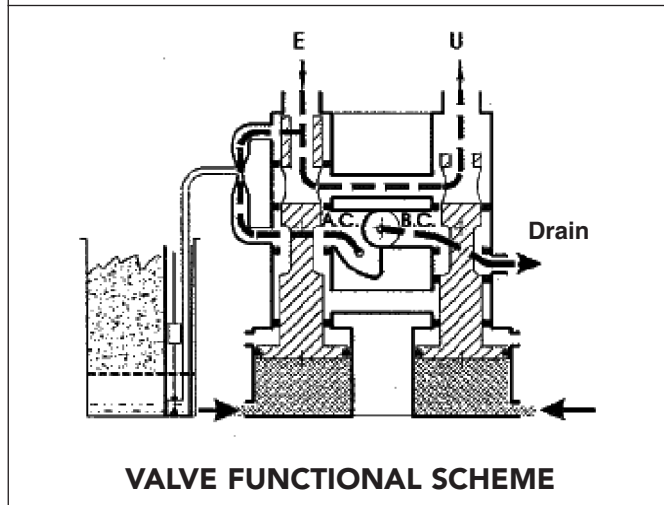
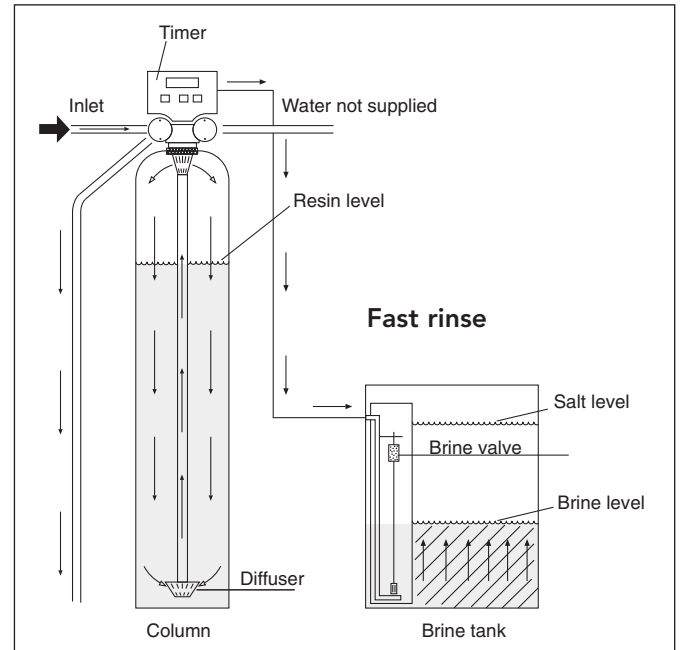
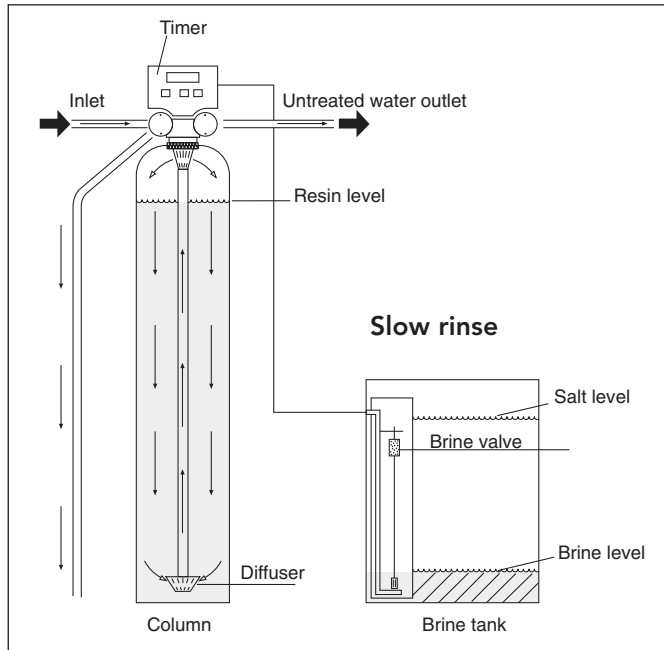


- water enters the valve from the inlet **E** and comes out not treated from the outlet **U**;
- at the same time, enters the diffuser pipe of the vessel from the central hole "B.C.";
- passes through the lower diffuser;
- washes the resins by passing through them from the bottom to the top (backwash);
- passes through the upper diffuser and enters the valve again through the small holes "A.C.";
- is conveyed to the drain of the valve.

- water enters the valve from the inlet **E** and comes out not treated from the outlet **U**;
- at the same time, passes through the Venturi injector and sucks brine from the tank;
- enters the upper diffuser passing through the small holes "A.C." of the valve;
- passes through and regenerates the resins with the brine;
- passes through the lower diffuser;
- goes up through the diffuser pipe;
- enters the valve again through the central hole "B.C.";
- is conveyed to the drain of the valve.

3. In the third phase, suction brine is completed and a slow rinse (down flow) of the resins is carried out only with the motive water coming from the injector, in order to remove the excess brine.

4. The fourth phase is fast rinse (down flow). Resins inside the vessel are made compact, excess salt is removed and brine tank is filled again.



- water enters the valve from the inlet **E** and comes out not treated from the outlet **U**;
- at the same time, passes through the injector and finishes sucking brine;
- enters the upper diffuser passing through the small holes "A.C." of the valve;
- washes the resins by passing through them in down flow;
- passes through the lower diffuser;
- goes up through the diffuser pipe;
- enters the valve again through the central hole "B.C.";
- is conveyed to the drain of the valve.

- water enters the valve from the inlet **E**;
- at the same time, passes through the injector and fills the brine tank;
- enters the upper diffuser passing through the small holes "A.C." of the valve;
- washes the resins by passing through them in down flow;
- passes through the lower diffuser;
- goes up through the diffuser pipe;
- enters the valve again through the central hole "B.C.";
- is conveyed to the drain of the valve.

P.S.: In this phase not treated water is very little.

4. OPERATING CONDITIONS

The table below summarizes the limits of softeners in operating conditions.

Parameters	Operating range
Pressure	2 ÷ 6 bar
Voltage	230 V ± 10%
Electrical absorption	12 VA
Room temperature	5 ÷ 40 °C
Water temperature	5 ÷ 30 °C
Oils	Absent
Fats	Absent
Hydrocarbons	Absent
Max. content of Sodium at the inlet	200 mg/l

Table 2.5 - Operating conditions of Softeners

5. PRELIMINARY DESIGN

Before operating on a softener, make sure it is designed properly. To preliminary design a softener for domestic use, it is necessary to know the following parameters:

- Hardness of water to be treated, measured in °f (French degrees)**
- Residual hardness required for treated water (for potable use 15 °f at the outlet are recommended)**
- daily water consumption (m3/day)**
- Max. peak flow rate requested (litres/min)**

a. If not known, **hardness of water to be treated** can be easily found out by using the water hardness Kit or turning to the water supply authority. For all calculations always refer to total hardness, as the softening treatment concerns all hardness salts, without distinction among temporary, permanent and total hardness.

The hardness of water at the outlet of a softening system is 0 °f, so if you need water with a certain residual hardness, it will be necessary to mix softened water with raw water.

b. Special uses may require a residual hardness; for

instance, **residual hardness** recommended for potable use is 15 °f, therefore when designing the softener you will have to consider the difference between inlet hardness and residual value of 10÷15 °f.

For instance, if hardness of a water for potable use is 35 °f, you will have to consider for the design a value of $35\text{ °f} - 15\text{ °f} = 20\text{ °f}$.

c. **Daily water consumption** should be calculated to set the autonomy between two regenerations of the water softener, as during regeneration phase the unit cannot deliver softened water; it is therefore necessary that regeneration takes place when water is not used or there is low water consumption, practically at night.

When daily water consumption is not known, it can be estimated according to the statistical data shown in Table 2.6, calculated for the different kinds of house. By multiplying the consumption show in table by the number of people living in the house, you get the average daily consumption. If the number of people living the house is not known, you should consider an average of four people.

d. The **maximum peak flow rate requested** can be calculated by adopting the method based on the **contemporaneity factor**.

Theoretical maximum peak flow rate

Table 2.6 lists the statistical values of maximum peak flow rate for different kinds of house; by multiplying these values by the number of houses you get the theoretical maximum peak flow rate, which you would have if all taps are opened at the same time.

Contemporaneity factor

Actually all taps are not opened at the same time, so a statistical factor called contemporaneity factor is introduced in the calculation. This factor corresponds to the percentage of taps which can be opened at the same time. The higher is the number of houses, the lower is the percentage, as the probability that all taps are opened the same time is decreasing.

Actual maximum peak flow rate requested

Instead of the theoretical maximum flow rate, we are using the actual maximum peak flow rate, which is obtained by multiplying the theoretical maximum peak flow rate by the percentage value of the contemporaneity factor obtained from Table 2.7.

Actual max peak flow rate = Theoretical max peak flow rate x contemporaneity factor

Example: 3 luxury houses
 Theoretical max flow rate = 3x18=54 l/min (Table 2.6)
 Contemporaneity factor = 60% (Table 2.7)
 Actual max flow rate = 54 l/min x 60% = 32,4 l/min

WATER CONSUMPTIONS AND MAXIMUM PEAK FLOW RATES		
Kind of house	Daily water consumption per person	Maximum peak flow rate per house
Normal houses with one bathroom	150 l/day	12 l/min
Large houses with two bathrooms	250 l/day	18 l/min
Luxury houses - Villas	400 l/day	28 l/min

Table 2.6 - Water consumption and maximum peak flow rate by kind of house

CONTEMPORANEITY FACTORS	
Number of houses	Contemporaneity factors in %
1	100
2	65
3	60
4	57
5	53
6	51
7	48
8	46
9	45
10	44
12	42
14	39
16	37
18	36
20	35
25	32
30	30
40	27
50	25

Table 2.7 - Contemporaneity factors

Once the main data are known, the design of a softener starts from the calculation of the daily cyclic capacity (d.c.c.), which is the hardness to be removed daily with the softener.

$$d.c.c. = (\text{inlet hardness } [^{\circ}f] - \text{residual hardness } [^{\circ}f]) \times \text{daily consumption } [m^3/g]$$

The daily cyclic capacity is used when calculating the litres of resin necessary for softening the amount of water used daily.

It is known that:

THE SPECIFIC EXCHANGE CAPACITY (S.E.C.) OF CATIONIC RESIN IS EQUAL TO $\frac{6 [^{\circ}f \times m^3]}{l}$

It means that a litre of resin is capable of removing 6 French degrees of hardness to a cubic metre of water.

The minimum quantity of resin necessary every day for softening is given by the formula below:

$$\text{minimum litres of resin per day} = \text{d.c.c.} : \text{s.e.c.} \\ = (\text{°f in} - \text{residual °f}) \times \text{m}^3/\text{day} : 6$$

Life time of cationic resins is about 1.200 regenerations with potable water; moreover, water consumption as well as hardness values can increase with time, so if the softener is sized with the minimum amount of resin (regeneration once a day), it may result undersized.

It is therefore recommended to size the softener for a regeneration frequency between 2 and 3 days.

The resin amount of the softener must be higher than twice or triple the daily amount calculated; among the models of softeners available in the catalogue, choose the one able to meet the **actual maximum peak flow rate**, calculated with the method of the contemporaneity factor already mentioned.

To size a softener in a fast way, it is also possible to use the tables in the GUIDA Acqua catalogue.

Contact GEL Technical Department for a more accurate and professional design as well as for sizing industrial water softeners.

5.1 EXAMPLES OF DESIGN

EXAMPLE 1

Calculation data:

- Two flat villa
- 4 people per flat
- inlet hardness 35 °f
- potable use (residual hardness 15 °f)
- Decalux softeners line

Design:

Daily consumption per person (Table 2.6): 400 litres/day

Total daily consumption: 400 l/day x 4 people x 2 flats = 3200 l/day = 3,2 m³/day

1. Calculate the litres of resin necessary every day l/day = (inlet hardness - residual hardness) x daily consumption : 6 = (35 - 15) x 3,2 : 6 = 10,7

2. Identify the first softener with capacity higher than twice the one calculated at step 1: 10,7 x 2 = 21,4 litres. The corresponding softener is the 25 l. one.

3. Calculate the actual maximum peak flow rate: Theoretical maximum peak flow rate (from Table 2.6) = 28 l/min x 2 flats = 56 l/min.

Contemporaneity factor (from Table 2.7) = 65%
Actual maximum peak flow rate = 56 l/min x 65% = 36,4 l/min

4. Identify among the models (multiples of 10,7) starting from Decalux 25 the one with peak flow rate higher than 36,4 l/min: Decalux 25, with a peak flow rate (potable use) of 40 l/min, is suitable for the application in example. With the consumptions calculated, Decalux 25 will regenerate every 2 days.

EXAMPLE 2

Calculation data:

- Large building with 4 flats
- 4 people per flat
- inlet hardness 40 °f
- potable use (residual hardness 15 °f)
- Decal softeners line

Design:

Daily consumption per person (Table 2.6): 250 litres/day

Total daily consumption: 250 l/day x 4 people x 4 flats = 4000 l/day = 4 m³/day

1. Calculate the litres of resin necessary every day l/day = (inlet hardness - residual hardness) x daily consumption : 6 = (40 - 15) x 4 : 6 = 16,7

2. Identify the first softener with capacity higher than twice the one calculated at step 1: 16,7 x 2 = 33,4 litres. The corresponding softener is the 45 l. one.

3. Calculate the actual maximum peak flow rate: Theoretical maximum peak flow rate (from Table 2.6) = 18 l/min x 4 flats = 72 l/min.

Contemporaneity factor (from Table 2.7) = 57%
Actual maximum peak flow rate = 72 l/min x 57% = 41,0
4 l/min

4. Identify among the models (multiples of 16,7) starting from Decal 45 the one with peak flow rate

higher than 41,04 l/min: Decal 45, with a peak flow rate (potable use) of 60 l/min, is suitable for the application in example.

With the consumptions calculated, Decal 45 will regenerate every 2 days.

6. SAFETY WARNINGS



Safety warnings are marked by the writings **DANGER** (high risk), **CAUTION** (medium risk), **NOTICE** (low risk) and by the danger sign.

Should the safety warnings not be observed, the following risks may arise:

Loss of performance of the softener.

Damages to people and environment.

Follow the directions of the instruction manual, the national regulations to be applied for preventing accidents as well as all technical methods known to operate in safety and proper conditions.



DANGER !

Carefully read safety data sheets of cationic resin and quartzite (Encl. 2.14.3 and 2.14.4), follow the safety measures indicated for use and wear Personal Protective Equipment (Section 7) during start up, maintenance and assistance of the water softener. During these operations the softener must not be plugged in.

In case of spill, cationic resin is irritating to eyes and makes floor slippery. Pick it up with mechanical means or pneumatic vacuum system. Be careful not to walk on granules to prevent accidental falls.

For applications for potable use, follow all precautions to prevent contamination of softener and pipes; if necessary disinfect the system after installation or after extraordinary maintenance operations.

7. EMERGENCY SITUATIONS



DANGER !

During an emergency of any kind in the installation place of the softener, immediately cut off power to the system and unplug the unit from the outlet.

The possible emergency situations occurring in the installation place of the softener are:

a) fire

b) flooding

- a. In case fire wear protective suit and self-contained breathing apparatus before entering the installation place; absolutely avoid breathing exhalations due to combustion of the softener components (vessel, head and media).
- b. In case of flooding immediately close the on-off valve before the softener. Should further water leaking take place, close the general valve placed in correspondence to the water meter.

8. INSTALLATION

8.1 INSTALLATION NOTES

1. For pressures below 2 bar it is necessary to install a surge tank before the softener, as the valve contained in the head requires a minimum pressure of 2 bar to work. For pressures above 6 bar it is necessary to install a pressure reducer before the softener, as the valve contained in the head blocks at pressures above 6 bar.
2. A socket 230 Volt + or - 10% is required.
3. The system must be fitted with two on-off valves (before and after the unit) and a by-pass valve to cut out the unit in case of problems.
4. Use flexible hoses or vibration-damping joints for connecting the softener head to the installation. This will prevent vibrations from being transmitted to the different components of the installation and will protect the plastic valve in case of accidental bumps to the vessel. The diameter of the flexible hoses (or vibration-damping joints) must fit the in-out connections of the softener head.
5. Connect in-out pipes to the softener head by following the direction of the arrows printed on the valve.
6. It is necessary to install a DEPUR filter before the softener to protect the valve contained in the head (for potable use it is recommended that the cartridge is easy to wash and has a degree of filtration above 50 microns).
7. Drain must be siphon type and must be placed below the drains of the valve and of the brine tank overflow; it must also be suitable for collecting and draining water.
8. The drain diameter must be at least 25 mm for models with valves V132 and V230, and at least equal to 40 mm for models with valve V250 (see Section 2.1).
9. Drain hoses of the softener and of the brine tank overflow must be connected to the drain separately.
10. The room to use for installation must be such that all working and maintenance operations of the softener are made easy.
11. If the system is for potable use, it is recommended to install a valve (if necessary build it from the installation) for mixing raw and softened water as well as the resins disinfection system.

8.2 INSTALLATION

During installation take into account all the installation notes listed in the previous step and check that pipes are without any working shavings or any other foreign bodies.

To guarantee the proper working of the timer, do not make any extension on electrical cables fitted with connectors.

After installation check that all connections are well tightened, that the valve is well screwed on the vessel and that the final system complies with the drawings at the next pages (Fig. 2.5 and following ones).

Make sure the customer has salt for filling the tank.

P.S.: After installation, do not start the softener in any case, not even to check the hydraulic seal.

The softener can be started up only by Technical Assistance or staff authorized by GEL.

Warranty is valid only if the above-mentioned directions are followed.

It is possible to check the hydraulic seal of the system by running water through the softener using the manual valves installed before and after the unit.

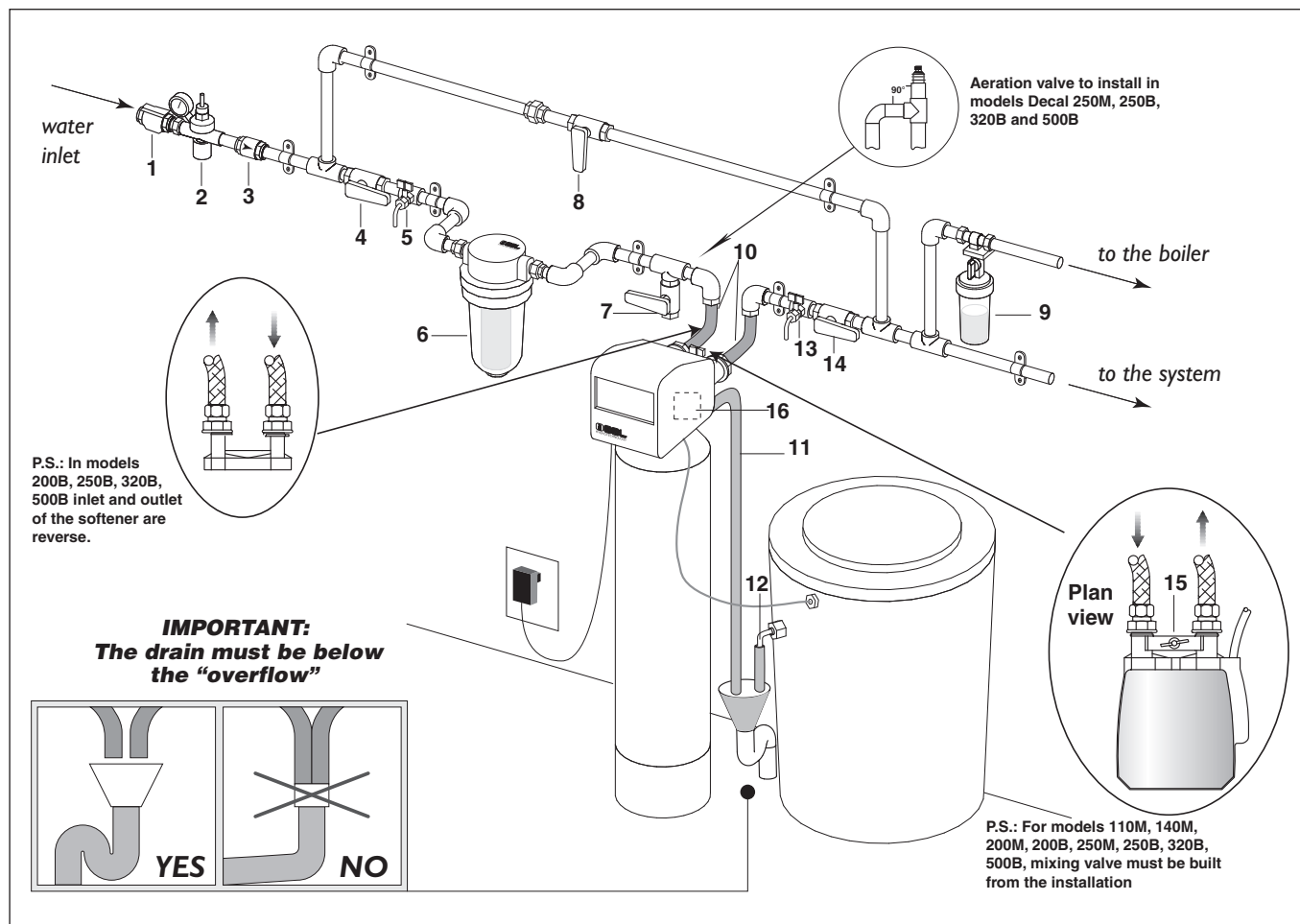


Fig. 2.5 - Installation drawing of DECAL water softeners

Caption

- 1) Water meter
- 2) Pressure reducer with pressure gauge *
- 3) Check valve
- 4) On-off valve before the system
- 5) Tap for raw water sample taking
- 6) Sand filter
- 7) Filtered water offtake for garden
- 8) System cut-out valve
- 9) Antiscaling dosing unit
- 10) Flexible hoses
- 11) Softener drain pipe
- 12) Brine tank overflow
- 13) Tap for softened water sample taking
- 14) On-off valve after the system
- 15) Mixing valve **
- 16) Disinfection system ***

- * For pressures below 2 atm. install a surge tank.
 - ** For potable use a residual hardness of 15° f is recommended.
 - *** For potable use the resins disinfection system is recommended (model with AD code).
- A check valve is necessary after the water meter and an antiscaling dosing unit is recommended before the boiler.

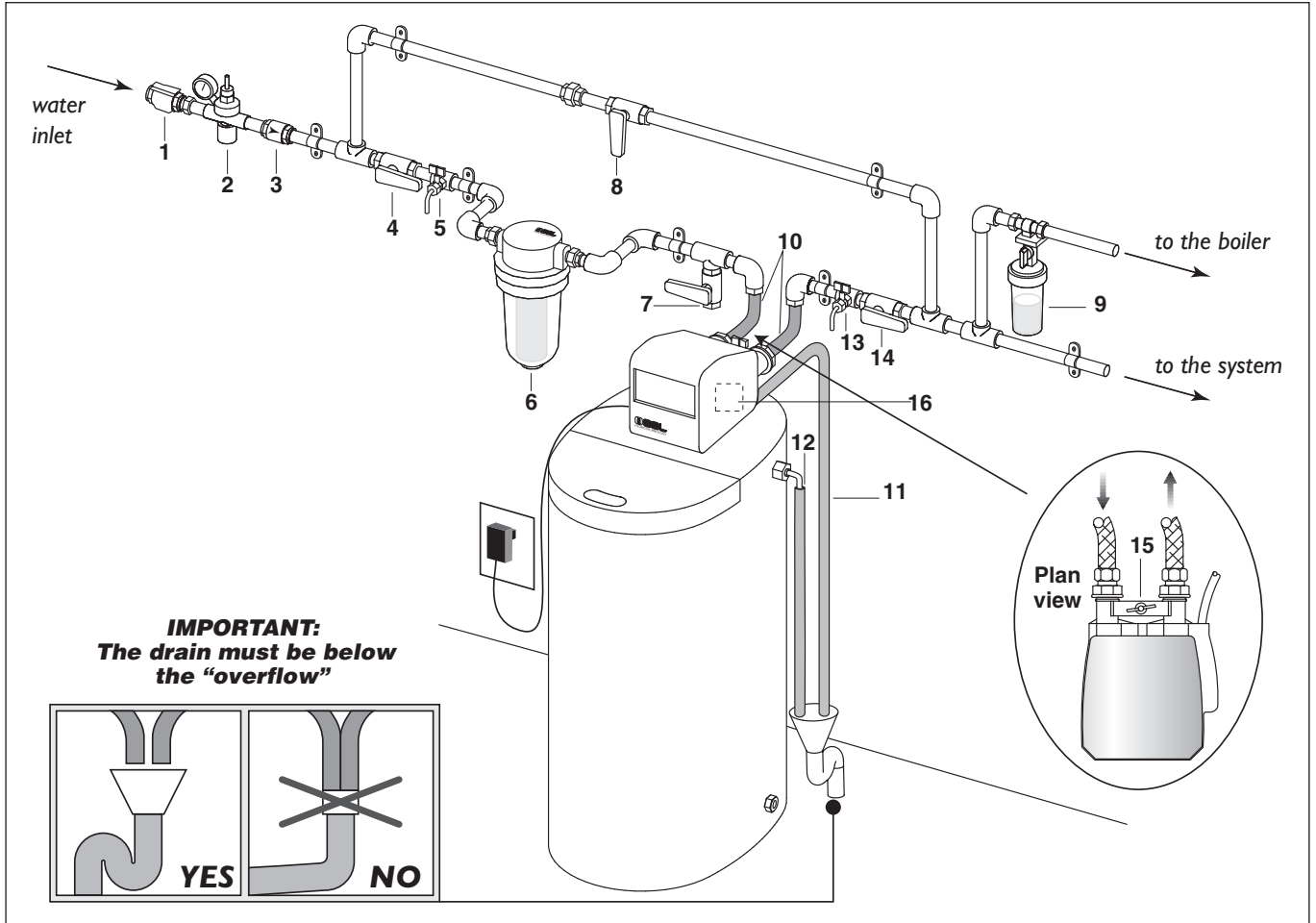


Fig. 2.6 - Installation drawing of DECALUX water softeners

Caption

- 1) Water meter
- 2) Pressure reducer with pressure gauge *
- 3) Check valve
- 4) On-off valve before the system
- 5) Tap for raw water sample taking
- 6) Sand filter
- 7) Filtered water offtake for garden
- 8) System cut-out valve
- 9) Antiscaling dosing unit
- 10) Flexible hoses
- 11) Softener drain pipe
- 12) Brine tank overflow
- 13) Tap for softened water sample taking
- 14) On-off valve after the system
- 15) Mixing valve **
- 16) Disinfection system ***

* For pressures below 2 atm. install a surge tank.
 ** For potable use a residual hardness of 15° f is recommended.
 *** For potable use the resins disinfection system is recommended (model with AD code).
 A check valve is necessary after the water meter and an antiscaling dosing unit is recommended before the boiler.

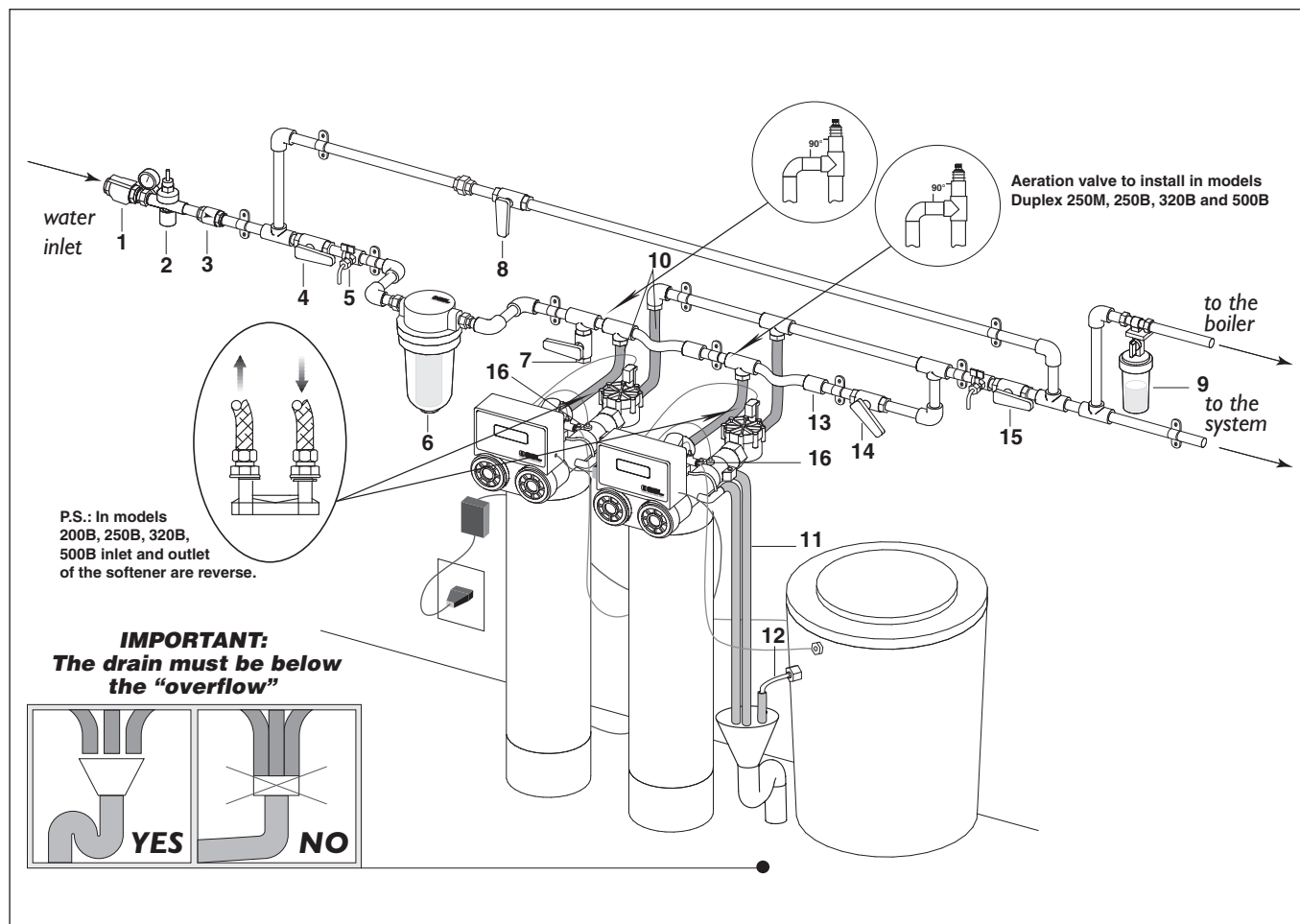


Fig. 2.7 - Installation drawing of DUPLEX water softeners

Caption

- 1) Water meter
- 2) Pressure reducer with pressure gauge *
- 3) Check valve
- 4) On-off valve before the system
- 5) Tap for raw water sample taking
- 6) Sand filter
- 7) Filtered water offtake for garden
- 8) System cut-out valve
- 9) Antiscale dosing unit
- 10) Flexible hoses
- 11) Softener drain pipe
- 12) Brine tank overflow
- 13) Tap for softened water sample taking
- 14) Mixing valve **
- 15) On-off valve after the system
- 16) Disinfection system ***

- * For pressures below 2 atm. install a surge tank.
 - ** For potable use a residual hardness of 15° f is recommended.
 - *** For potable use the resins disinfection system is recommended (model with AD code).
- A check valve is necessary after the water meter and an antiscale dosing unit is recommended before the boiler.

9. START UP

Before going to the customer to start up the system, call the installer to make sure the installation has been performed properly and the softener is capable of working (it is recommended to use as a memo the Installation Check Form - Encl. 2.13.2).

To start up the softener perform the operations listed in the following block diagram (Fig. 2.8).

9.1 - Phase 1:

CHECK INSTALLATION AND DOCUMENTATION

Before start up make sure that the softener has been designed properly and has not been already started up.

Check that the customer has received the instructions manual.

Check that the system has been installed according to the related installation drawing (Fig. 2.5; 2.6; 2.7) and to the indications listed in section 8 (Installation), and that the operating conditions specified in Table 2.5 are satisfied. Fill the Installation Check Form (Encl. 2.13.2).

For any problem during first inspection, contact GEL Technical Department before start up.

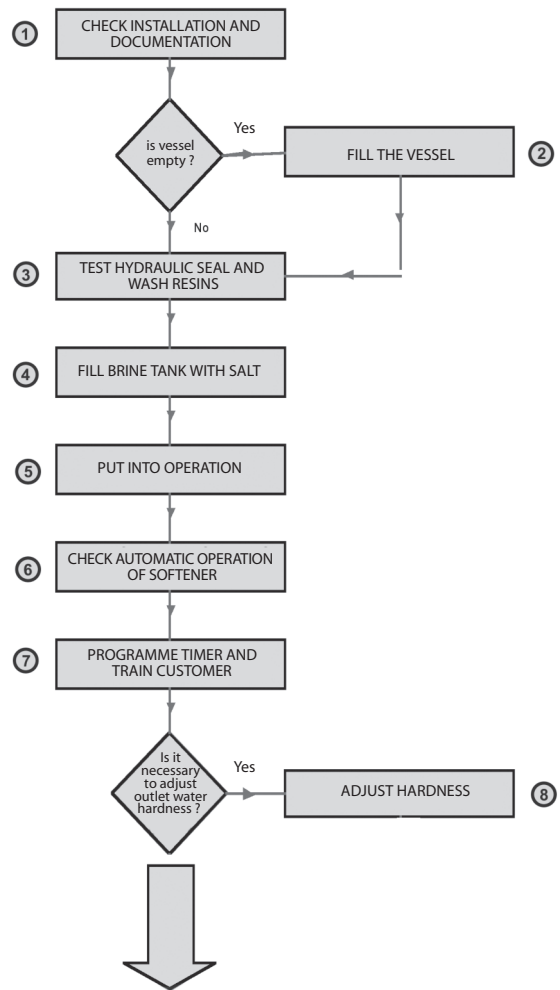


Fig. 2.8 - Sequence of start up operations

9.2 - Phase 2:

HOW TO FILL THE VESSEL

If the softener vessel is empty, it is possible to fill it in two different ways:

- disassemble the whole head and manually fill media according to the indications of section 2.6

or

- fill the vessel by using the components shown in the figure below:

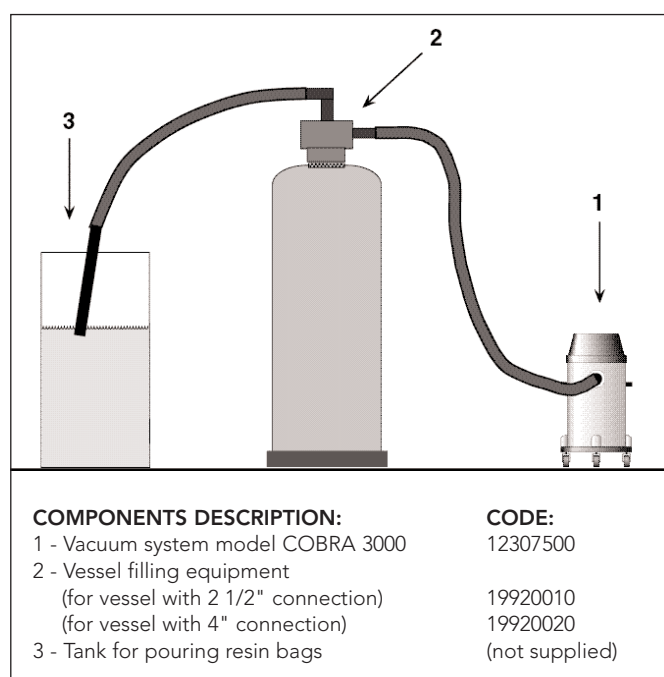


Fig. 2.9 - Vessel filling

9.2.1 - VESSEL FILLING PROCEDURE

- Insert into the vessel the diffuser pipe with the lower diffuser glued.
- Make sure the diffuser pipe is in contact with the bottom of the vessel.
- Check that, once placed on the bottom of the vessel, the diffuser pipe is long enough that the upper end reaches the vessel neck. The diffuser pipe must stick out from the vessel neck maximum 1 ÷ 1,5 cm; if too long, cut it.

P.S. For any reason the diffuser pipe must not be lower than the vessel neck.

- Temporarily close the upper part of the diffuser pipe (e.g. with a cloth or adhesive tape) to prevent quartzite or resin from entering the pipe.

- Put the filling equipment on the vessel (component 2 - Fig. 2.9).
- Connect the vacuum system to the filling equipment.
- Start the vacuum system and begin filling by inserting into the vessel first the quartzite 3-5 mm.
- Then fill the vessel with the total amount of resin supplied. For best performance of the softener, the media level must be between 2/3 and 3/4 of the internal height of the vessel.
- Before screwing the head, check that the diffuser pipe does not stick out from the vessel neck for over 1 ÷ 1,5 cm, otherwise slowly rotate the pipe downwards, without forcing nor beating it with any tools.
- Check that no quartzite or resin granules have remained in the vessel thread. If any, thoroughly clean the thread.
- Remove the plug previously put on the diffuser pipe and make sure that no resin and/or quartzite granules have entered the diffuser pipe.
- Screw the valve, fitted with upper diffuser, on the vessel.



CAUTION

When handling resin and quartzite follow all procedures and handling regulations indicated in the attached safety data sheets.

9.3 - Phase 3:

HOW TO FILL THE BRINE TANK

In this phase fill the brine tank of the softener with clean salt.

- Check in the related Table at Section 14 that the brine valve float is adjusted at the right level.
- Thoroughly clean the brine tank and make sure that all tank components (traps, brine valves, grids and fittings, brine pipe, drain pipe) are properly positioned.
- Connect the brine pipe from the injector to the softener valve to the brine tank (not necessary in DECALUX models) and tightly screw the fittings as shown in the figure below.

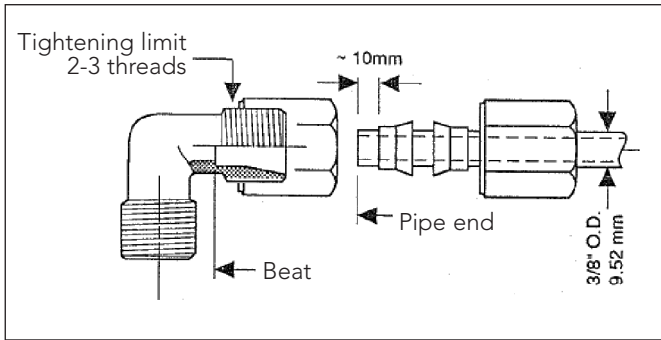


Fig. 2.10 - Brine pipe assembly

- d. *Decal and Duplex models:*
Lift the lid and fill salt up to about 5 cm below the tank overflow. In any case the salt level must be above the brine tank float.
- Decalux models:*
Fill salt up to the MAX level indicated on the cabinet side.

**9.4 - Phase 4:
HYDRAULIC SEAL TEST AND RESINS WASH**

In this phase perform all operations necessary to check the hydraulic seal of the softener and system. Contextually resins are first washed and then wash water is drained.

Follow the sequence of operations below:

- a. Connect the softener transformer to the 230V power supply socket.
- b. Slowly open the on-off valve before the softener (see installation drawings Fig. 2.5; 2.6; 2.7), leave the on-off valve after the softener closed and close the by-pass valve.
- c. Wait for water to flow in the tank (or in the cabinet) until it reaches the float adjustment level.

P.S. ONCE THE TANK (OR CABINET) HAS BEEN FILLED, CHECK THAT THE SALT LEVEL IS ABOVE THE WATER LEVEL.

- d. Check there is no leakage from valve, brine pipe, overflow of tank (or cabinet) and pipes.
- e. Programme the timer for an automatic regeneration by time: this will enable to check timer operation and clean media from possible working dusts, by sending wash water directly to drain. For programming follow the instructions at the next step 9.4.1.
- f. Wait until the timer displays time 00:00 and starts regeneration.
- g. During the first phase temporarily take out the softener drain pipe from the drain (see drawings Fig. 2.5; 2.6; 2.7) and check there is no resin or

- quartzite in the drain water. Put pipe into drain again and press key R to pass to the next phase.
- h. During the second phase temporarily disconnect the brine pipe from the valve injector and check the injector is sucking (depression). Connect the brine pipe again and press key R to pass to the next phase.
- i. At the beginning of the third phase press key R to immediately pass to the fourth one.
- j. Wait until the softener completes the fourth phase (fast rinse); temporarily take out the drain pipe and check the flow rate coming out is higher than the one drained during the second phase; put pipe into drain again.
- k. Close the on-off valve before the softener (see drawings Fig. 2.5; 2.6; 2.7) and open the by-pass valve.

9.4.1 HOW TO PROGRAMME AUTOMATIC REGENERATION

TIMER ET 500 and VT 1000

Follow the operations below:

- a. Enter timer programming by pressing key **A** and confirm by pressing key **B**;
- b. The led indicating hour and the first two figures on display will be flashing; press keys + or - to set hour to 23. Press key **B** to confirm;
- c. The led indicating minutes and the last two figures on display will be flashing; press keys + or - to set minutes to 58. Press key **B** to confirm;
- d. The led indicating regeneration time and the first two figures on display will be flashing; press keys + or - to set time to 00. Press key **B** to confirm;
- e. The led indicating regeneration interval days and the last two figures on display will be flashing; press keys + or - to set 1. Press key **B** to confirm;
- f. [Timer VT 1000 only] The led indicating operating mode (time, volume, volume/time) will be flashing; press keys + to change mode and set it by Time. Press key **B** to confirm;
- g. After two minutes the softener will start automatic regeneration.

TIMER VT 2000

Follow the operations below:

- a. Enter timer programming by pressing key **A**;
- b. By pressing keys + and - on the timer, position the flashing selection indicator on "Clock" function and press key **B** to confirm;
- c. The two figures indicating the hour will be flashing on display; press keys + or - to set hour to 23. Press key **B** to confirm;

- d. The two figures indicating the minutes will be flashing on display; press keys **+** or **-** to set minutes to 58. Press key **B** to confirm the setting and the main display is restored;
- e. Enter programming again by pressing key **A**;
- f. By pressing keys **+** and **-** on the timer, position the flashing selection indicator on "Regeneration" function and press key **B** to confirm;
- g. Press keys **+** or **-** on the timer to select "TIME" mode and press key **B** to confirm;
- h. The figure indicating regeneration frequency will be flashing on display. Press keys **+** or **-** on the timer to set the value 1, and press key **B** to confirm;
- i. The figure indicating regeneration time will be flashing on display. Press keys **+** or **-** on the timer to set the value 00, and press key **B** to confirm;
- j. After two minutes the softener will start automatic regeneration.

9.5 - Phase 5:

HOW TO PUT THE SOFTENER INTO OPERATION

Follow the operations below to put the softener into operation:

- a. Close the by-pass valve of the system (see drawings Fig. 2.5; 2.6; 2.7);
- b. Slowly open first the on-off valve before the softener, then the one after it;
- c. Completely close the manual mixing valve (if present) or programme the timer VT2000 (if fitted with automatic mixing system) for 0 °f of hardness out (see step 9.6);
- d. Run water in the softener by opening at least 2 taps for 1÷2 minutes, then test the water hardness of the furthest tap with the hardness kit. The hardness of softened water must be between 0 °f and 2 °f.

9.6 - Phase 6:

HOW TO ADJUST HARDNESS

If the water to be treated is for potable use, the residual hardness recommended at the outlet of the softener is between 10 °f and 15 °f; technical uses might require different values.

Softeners with manual mixing valve

1. Completely open at least two taps, run water for at least 30 seconds and leave the taps open;
2. Partially open the mixing valve, placed near inlet-outlet of the softener head or built from the installation (see Fig. 2.5; 2.6; 2.7);
3. Measure total hardness with the analysis kit in the further of the two taps (leave taps open);

4. Slightly open the mixing valve if hardness is below 15 °f or close it if hardness is above 15 °f;
5. Repeat steps 3 and 4 until hardness is between 10 °f and 15 °f.

Softeners with automatic mixing valve

If the softener is equipped with a timer VT2000 with automatic mixing system:

1. Take a sample of raw water from the tap before the softener (see Fig. 2.5; 2.6; 2.7) and test total hardness with the special kit; repeat the test more than one time to be sure about the result;
2. Enter timer programming by pressing key **A**;
3. By pressing keys **+** and **-** on the timer, position the flashing selection indicator on "Hardness" function and press key **B** to confirm;
4. The two figures indicating the water hardness will be flashing on display; press keys **+** or **-** to set the inlet water hardness value. Press key **B** to confirm;
5. The two figures indicating the outlet water hardness will be now flashing on display; press keys **+** or **-** to set it to 15 °f. Press key **B** to confirm;
6. Completely open at least one of the two taps and run water for at least 30 seconds;
7. Measure total hardness at the outlet of the furthest tap with the analysis kit supplied with the softener;
8. The tested value must correspond to the residual hardness value set on the timer, with ± 2 °f approximation.

9.7 - Phase 7:

TIMER PROGRAMMING AND CUSTOMER TRAINING

In this phase programme timer, set time and regeneration frequency. Once programmed during start up, timer does not require any further setting as it is fitted with a buffer battery that keeps dynamic data for max. 6 months and statistical data for 10 years; it is only necessary to update time when passing from daylight saving to solar time and vice versa (see Section 12).

9.7.1 TIMER PROGRAMMING

TIMER ET 500

Calculate regeneration frequency according to the exchange cyclic capacity of the softener (called in Section 6 "Preliminary Design") and set in the timer regeneration by time with the calculated frequency.

Example:

Decal 20 ET 500 AD (20 litres of resin)

Hardness in = 30 °f

Hardness out = 15 °f

Daily consumption = 2 m³/day

Daily cyclic capacity = (30 °f - 15 °f) x 2 m³/day = 30 °f m³/day

Cyclic capacity of softener = 20 litres x 6 °f m³/litre = 120 °f m³

Regeneration frequency = 120 °f m³ : 30 °f m³/day = 4 days

TIMER VT 1000

Set regeneration frequency to 4 days and regeneration mode to volume/time.

TIMER VT 2000

Set regeneration frequency to 4 days and regeneration mode to volume/time.

Also programme pressure at the inlet, the settings of the anti flood system Water Sentinel (if present), the settings for exhausted salt alarm (see Section 12).

9.7.2**CUSTOMER TRAINING**

Remind the customer that **the salt level must always be above the water level**. Train the customer to check the residual hardness value at the delivery with the special analysis kit supplied with the softener and to perform all ordinary maintenance operations within his/her competence, specified at Par. 10.

9.8 MEMO TO START UP SOFTENERS

Check installation and documentation

- check that the softener is designed properly
- check that the softener has never been started up
- check that the customer has received the instruction manual
- check that the system is installed according to the related drawing
- check that the operating conditions in Tab. 2.5 are satisfied

Fill the vessel (if necessary)

Fill the brine tank

- check the right level of the brine valve float
- check all components of the brine tank are placed properly
- connect the brine pipe
- fill the brine tank with salt (up to 5 cm below the overflow or MAX. level)

Hydraulic seal test and first resins wash

- open the on-off valve before the system and close the by-pass one
- set time to 23:58
- set regeneration to 00
- set regeneration frequency to 1 day
- check that the softener completes the four regeneration phases
- during the first phase check if there is resin in the drain
- during the second phase check if brine is being sucked
- close the on-off valve before the system and open the by-pass one

Put the unit into operation

- check that the by-pass valve is closed
- open the on-off valves before and after the system
- test the hardness of treated water (it should be between 0 °f and 2 °f)

Adjust hardness

- if the softener is for potable use, adjust hardness between 10 °f and 15 °f

Programme timer and train customer

- programme timer for automatic operation
- train the customer to make tests and perform maintenance operations.

10. PLANNED STOP AND PRESERVATION OF THE SYSTEM

10.1 PLANNED STOP

If the softener is not used for a period longer than 10-15 days, it is necessary to cut off power supply, close the on-off valves before and after the system and open the by-pass valve (see drawings in Fig. 2.5; 2.6; 2.7).

After this non-use period, connect power supply again, open the on-off valves before and after the system, and close the by-pass valve.

Carry out a manual regeneration by pressing key **R** on the timer.

10.2 PRESERVATION

When a softener has not been used for long (more than 30 days), it is recommended to take some precautions to prevent the following problems:

- a. Dehydration
- b. Freezing
- c. Bacterial proliferation

a. DEHYDRATION

To prevent resins from dehydrating, during the shutdown period the softener must be left full of water; if necessary, empty the softener or, if it is not installed yet, seal the vessel.

b. FREEZING

To prevent water from freezing, if during the shutdown period the softener risks exposure to low temperatures, before stopping it, start a manual regeneration and at the end of phase 2 (brine suction) close the on-off valve before the system. In this way resins are protected in a brine solution.

For risk of exposure to temperatures below - 5°C, contact GEL Technical Department.

c. BACTERIAL PROLIFERATION

To prevent bacterial proliferation in the resins, before shutdown it is necessary to carry out a regeneration (AD models) and repeat one before putting the softener back into operation.

In non-AD models it is necessary to carry out a regeneration and at the end of phase 2 (brine suction) close the on-off valve before the system; when putting the softener back into operation it is necessary to carry out a complete regeneration by sucking a solution at 2% of peracetic acid.

11. MAINTENANCE



CAUTION

All technical assistance and maintenance operations on the softener, except for inspection ones, must be performed by the Technical Assistance Service or by authorized staff equipped with suitable Personal Protective Equipment.

Before any maintenance or repair operation of the softener, disconnect the timer from the power supply.

11.1 ORDINARY MAINTENANCE

Ordinary maintenance includes all those operations necessary to keep the softener efficient.

The minimum operations recommended are the following ones:

OPERATION	FREQUENCY (days)	OPERAT.
Check there is salt in brine tank; if water level is above salt level, refill salt	depends on the number of regenerations (Regen. Autonomy) Tab. 2.1; 2.2; 2.3	Customer
Check and, if necessary, clean filter cartridge before the softener	About 60	Customer
Test water hardness in and out	About 60 (particularly in season change)	Customer
Clean brine tank	About 180	Technical Assistance
General overhaul of softener	About 365	Technical Assistance
Clean valve	About 365	Technical Assistance

Tab. 5.7 - Ordinary maintenance

11.2 EXTRAORDINARY MAINTENANCE

Extraordinary maintenance includes all those operations to restore the softener performance in case of anomalies due to failure and/or to water quality, and/or whenever indications for ordinary maintenance are not followed.

All extraordinary maintenance operations must be performed by the Technical Assistance Service or by staff authorized by GEL.

Follow the instructions below when carrying out extraordinary maintenance on softener components:

Vessel

If the vessel is damaged or leaking, it has to be replaced.

If you need to empty the vessel, you can either do it manually or by following the procedure below and referring to the components in figure 2.10:

- Remove the vessel head
- Insert the suction pipe into the vessel
- Start the vacuum system (models for liquids)
- Once filled the tank of the vacuum system, stop it and drain content in a container
- Repeat the operation until the vessel is completely empty.

For filling the vessel, please refer to the procedure at Par. 9.2 - Phase 2.

For best operation of the softener, total height of media must be from 2/3 to 3/4 of the internal height the vessel.

Timer

For operation and extraordinary maintenance of the timer, please refer to the part of Section 12 concerning the type of timer installed on the softener.

Valve

For operation and extraordinary maintenance of the valve, please refer to the part of Section 13 concerning the type of valve installed on the softener.

11.2.1 CLEAN UP PROCEDURE OF CATIONIC RESINS POLLUTED BY IRON

Iron pollution is a phenomenon which may occur on cationic resins used for softening regenerated with Sodium Chloride (NaCl); resins polluted by Iron ions gradually lose their exchange capacity. In these cases it is necessary to clean up resins by using Hydrochloric Acid (HCl).

The clean up procedure recommended is as follows:

1. Prepare in a plastic container a solution of Hydrochloric Acid with 10% concentration (1 litre of solution every 10 litres of resin);
2. Slowly close the on-off valve at the outlet of the softener, slowly open the by-pass valve (see Figures 2.5; 2.6; 2.7). If the system must necessarily be supplied with softened water (e.g. for technical use) the by-pass valve must remain closed;
3. Start a manual regeneration by pressing key **R** on the timer;
4. When the second phase starts (shown on the timer display), disconnect the brine suction pipe from the tank and insert it in the acid solution container;
5. Wait until the acid solution has been completely sucked, then close the on-off valve at the inlet of the softener;
6. Leave the acid solution in contact with the resins for at least 60 minutes (anyway the timer must complete the cam rotation and come back to the initial position);
7. Check if the resin level has decreased below the 2/3 of the vessel height; in this case, fill the vessel with new resin to come back to the initial height;
8. Slowly reopen the on-off valve at the inlet of the softener;
9. Reconnect the brine suction pipe to the tank and start a standard regeneration with Sodium Chloride by pressing key **R** on the timer;
10. Slowly reopen the on-off valve at the outlet of the softener.

P.S. For any reason the softener must not supply water to the system, for the entire duration of the operation. Keep the outlet on-off valve closed until the procedure has been completed.

If the problem is not completely solved after these operations, repeat the procedure by using a double amount of acid solution and, if necessary, increasing the contact time with the resins.

12. TROUBLESHOOTING


The table below lists some failure conditions of the softener with possible causes and solutions.

PROBLEM	CAUSE	SOLUTION
Softener does not regenerate	Power supply	Make sure the softener is plugged in and voltage is 230 V \pm 10%
	Cam does not rotate	Replace motor if burnt out, replace card if defective
Softener does not supply softened water	Salt missing in brine tank	Add salt in the tank up to 5 cm below the overflow, anyway above water level
	Injectors or suction filters clogged	Disassemble and clean clogged components
	Main pipe leaking	Check seal of the ring between valve and diffuser pipe and make sure pipe is not broken
Valve is leaking at the drain continuously	Foreign bodies in the valve or one of the internal O-rings of the valve is damaged	Remove pistons and distance rings, check O-rings and if necessary replace them. Check valve internally
	Mains pressure not enough, piston does not complete the stroke	Increase mains pressure. Pressure must be above 2 bar
Softener does not suck brine	Drain blocked	Check draining capacity
	Flow control clogged; drain pipe squashed or blocked	Check presence of solid particles in the flow control; check if the curve or drain pipe is squashed or blocked
	Injector clogged	Remove and clean injector
	Mains pressure not enough	Increase mains pressure. Pressure must be above 2 bar
	Foreign bodies in the valve or one of the internal O-rings of the valve is damaged	Remove pistons and distance rings, check O-rings and if necessary replace them. Check valve internally.
Softener uses too much salt	Brine valve float not properly adjusted	Check and if necessary adjust the level of the brine valve float (see Section 14).
	Salt level not enough	Add salt in the tank up to 5 cm below the overflow, anyway above water level.
Brine tank is leaking from the overflow	Drain blocked	Disassemble and clean drain.
	Injector group clogged	Disassemble and clean injector group.
	Brine valve blocked in open position	Disassemble and clean brine valve; replace if necessary.
Exhausted salt alarm	Power cut in electrodes connection cables	Replace electrodes connection cables.
	Pressure drop during regeneration	Increase mains pressure.
Timer blocks during regeneration	Voltage below 198 V	Check mains voltage and notify local authority
Timer goes wrong	Mains voltage changes	Install an antijamming filter on electric line.
Timer (ET500 or VT1000) shows four dashes [----]	No voltage during regeneration	Wait until the timer comes back to zero point and starts over again the regeneration previously stopped because of no power.
Softener regenerates continuously	Defective microswitch	Replace microswitch.

13. ENCLOSURES

Encl. 2.13.1 - Service Report Form

GEL S.p.A. - 60022 Castellidardo (AN) Italy - Via Enzo Ferrari, 1
Tel. 071 7827. - Fax 071 7808175 - E-mail: info@gel.it - www.gel.it



GEL
HYDROTECHNOLOGY FOR LIFE

Service Report

No XXXX

dated 02-12-05

Service requested on 01-12-05

from: GEL

Service at:

name MARIO

surname ROSSI

address VERDI 2

city ROMA

state RM

zip 00100

telephone 06

mobile

e-mail

Type of service:

Start up

Under warranty

Out of warranty

Other

Identification data :

Model

DECAL 15 VT 1000 AD

Serial no. Z6000001

Purchase date 01-11-05

Service description:

START UP AND TESTING

USE: POTABLE

WATER HARDNESS IN: 30 °f

RESIDUAL WATER HARDNESS SET: 15 °f

HOUSE

4 PEOPLE - 2 BATHROOMS - 1 KITCHEN

PROPER INSTALLATION

MARIO ROSSI
Via Verdi, 2
00100 Roma

Stamp - Technical Assistance Service

Customer signature _____

Technician signature _____

Materials used:


no.	code	description

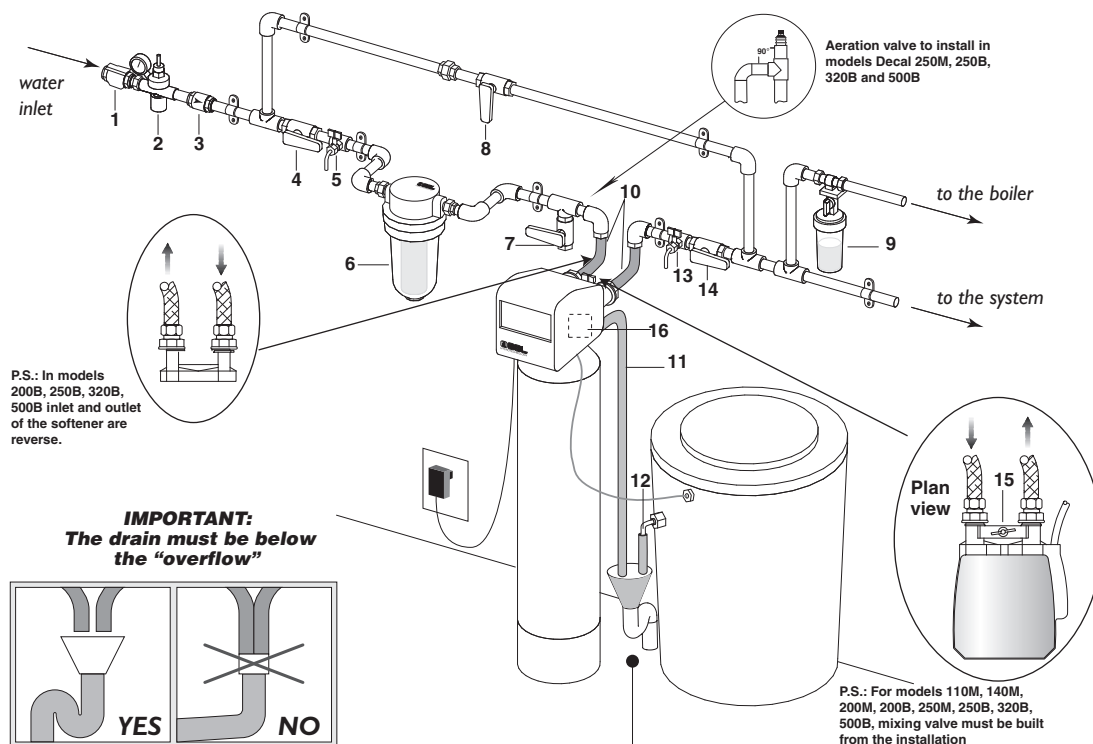
Date	Service start	Break	Service end	Km to go	Hours to go	Km to return	Hours to return	Total hours

ZCI.015.00

Mod51.FIG

Encl. 2.13.2 - Installation Check Forms

	GEL S.p.A. Via Ferrari, 1 - 60022 Castelfidardo (AN) Tel. +39 071 7827 - Fax +39 071 7808175 www.gel.it - info@gel.it
	
Installation Check Form	Product: DECAL WATER SOFTENER
Ref. Service Report No.	Date:





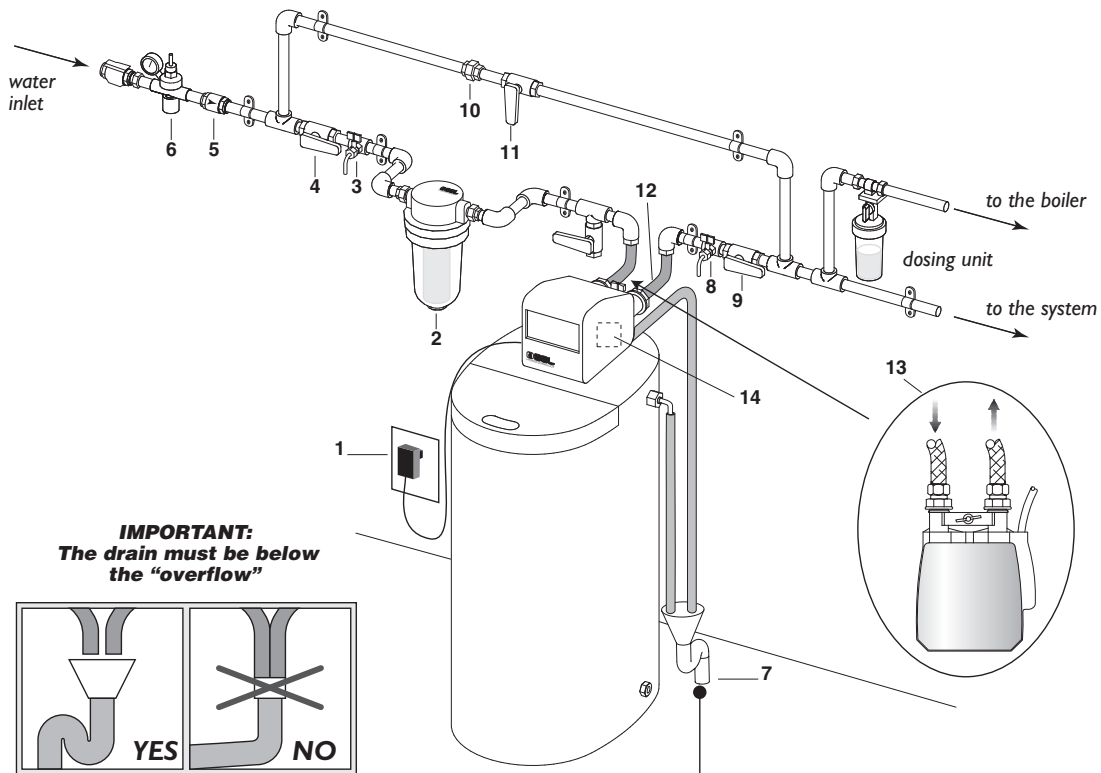
- 1. Socket 230 V ± 10%
- 2. Filter before the softener: type _____ cartridge _____
- 3. Tap for raw water sample taking (optional)
- 4. On-off valve before the softener
- 5. Check valve
- 6. Pressure reducer for pressure gauges (if P > 6 bar) or surge tank (if P < 2 bar)
- 7. Drain at atmospheric pressure
- 8. Tap for softened water sample taking (optional)
- 9. On-off valve after the system
- 10. Cut out valve
- 11. Aeration valve (only DECAL models 250M,

- 250B, 320B and 500B)
- 12. In/out connections connected in the right direction and through flexible hoses
- 13. Mixing by-pass for hardness adjustment (for potable use only)
- 14. Resins self-disinfection system (for potable use only)
- 15. Salt for filling brine tank

Stamp and signature
 Technical Assistance Service Customer signature

P.S.: If the system is non compliant, Technical Assistance Service and GEL cannot be held responsible for the malfunctioning of the softener and/or for any damages to it.

	GEL S.p.A. Via Ferrari, 1 - 60022 Castelfidardo (AN) Tel. +39 071 7827 - Fax +39 071 7808175 www.gel.it - info@gel.it
	
Installation Check Form	Product: DECALUX WATER SOFTENER
Ref. Service Report No.	Date:

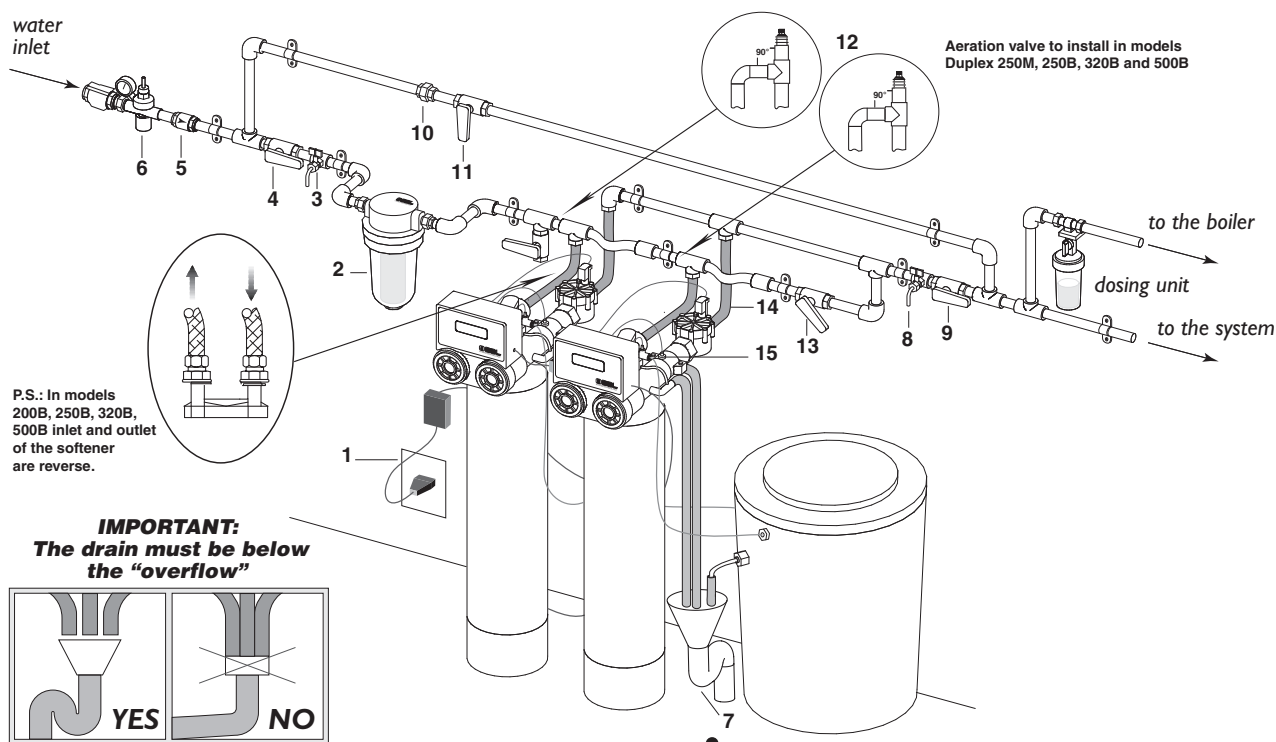


- | | |
|---|---|
| <ul style="list-style-type: none"> <input type="checkbox"/> 1. Socket 230 V ± 10% <input type="checkbox"/> 2. Filter before the softener:
type _____ cartridge _____ <input type="checkbox"/> 3. Tap for raw water sample taking (optional) <input type="checkbox"/> 4. On-off valve before the softener <input type="checkbox"/> 5. Check valve <input type="checkbox"/> 6. Pressure reducer for pressure gauges
(if P > 6 bar) or surge tank (if P < 2 bar) <input type="checkbox"/> 7. Drain at atmospheric pressure <input type="checkbox"/> 8. Tap for softened water sample taking
(optional) <input type="checkbox"/> 9. On-off valve after the system <input type="checkbox"/> 10. Pipe union fitting <input type="checkbox"/> 11. By-pass valve | <ul style="list-style-type: none"> <input type="checkbox"/> 12. In/out connections connected in the right
direction and through flexible hoses (or
vibration-damping joints) <input type="checkbox"/> 13. Mixing by-pass for hardness adjustment (for
potable use only) <input type="checkbox"/> 14. Resins self-disinfection system (for potable
use only) <input type="checkbox"/> 15. Salt for filling cabinet |
|---|---|

Stamp and signature
 Technical Assistance Service Customer signature

P.S.: If the system is non compliant, Technical Assistance Service and GEL cannot be held responsible for the malfunctioning of the softener and/or for any damages to it.

 HYDROTECHNOLOGY FOR LIFE	GEL S.p.A. Via Ferrari, 1 - 60022 Castelfidardo (AN) Tel. +39 071 7827 - Fax +39 071 7808175 www.gel.it - info@gel.it
    	
Installation Check Form	Product: DUPLEX WATER SOFTENER
Ref. Service Report No.	Date:



- | | |
|---|--|
| <ul style="list-style-type: none"> <input type="checkbox"/> 1. Socket 230 V ± 10% <input type="checkbox"/> 2. Filter before the softener:
type _____ cartridge _____ <input type="checkbox"/> 3. Tap for raw water sample taking (optional) <input type="checkbox"/> 4. On-off valve before the softener <input type="checkbox"/> 5. Check valve <input type="checkbox"/> 6. Pressure reducer for pressure gauges
(if P > 6 bar) or surge tank (if P < 2 bar) <input type="checkbox"/> 7. Drain at atmospheric pressure <input type="checkbox"/> 8. Tap for softened water sample taking
(optional) <input type="checkbox"/> 9. On-off valve after the system <input type="checkbox"/> 10. Pipe union fitting <input type="checkbox"/> 11. By-pass valve | <ul style="list-style-type: none"> <input type="checkbox"/> 12. Aeration valve (only Duplex models 250M,
250B, 320B and 500B) <input type="checkbox"/> 13. Mixing by-pass for hardness adjustment (for
potable use only) <input type="checkbox"/> 14. In/out connections connected in the right
direction and through flexible hoses (or
vibration-damping joints) <input type="checkbox"/> 15. Resins self-disinfection system (for potable
use only) <input type="checkbox"/> 16. Salt for filling brine tank |
|---|--|

Stamp and signature
 Technical Assistance Service Customer signature

P.S.: If the system is non compliant, Technical Assistance Service and GEL cannot be held responsible for the malfunctioning of the softener and/or for any damages to it.