

Information for Installation of Ion Exchange Water Softeners for Systems Supplying Water for Domestic Purposes

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1. Introduction

In hard water areas water softeners can provide benefits to the user in terms of reduced soap and detergent usage, reduced scum deposits on sanitary ware and reduced energy consumption due to absence of scale on water heating appliances.

In ion exchange water softening, the hard water flows through a bed of ion exchange material (the resin) which retains the calcium and magnesium ions that cause hardness and replaces them in the softened water by sodium ions. The ion exchange capacity of the resin is gradually used up and when exhausted, it is regenerated by treatment with a strong brine (common salt) solution, which is subsequently rinsed out to waste.

This Information and Guidance Note (IGN) relates to the use of ion exchange softeners for supplying water for domestic purposes, which includes use of water for cooking, personal washing and bathing, clothes washing and drinking, (but see Section 8 regarding drinking water). Although principally referring to softeners in domestic premises, it is applicable to the same types of softener supplying water for domestic purposes in non-domestic premises (e.g. an office canteen).

Where an ion exchange water softener is used for the treatment of water for other than domestic purposes, this IGN does not apply but regard should be had to its contents, giving especial attention to the adequacy of backflow prevention requirements which may be increased by the uses of the soft water 'downstream' of the water softener. The IGN does not apply to non ion exchange water softening equipment.

The IGN has been produced by WRAS on behalf of the public Water Suppliers, in conjunction with the UK Water Treatment Association (UKWTA) to provide guidance on the installation of ion exchange water softeners in compliance with the Water Fittings Regulations.

2. The Water Fittings Regulations

If water softeners receive water from the public water supply, their installation and use in the UK is covered by regulations and byelaws governing plumbing systems. The Water Supply (Water Fittings) Regulations 1999 in England and Wales, (and the Scottish Water Byelaws 2004 and Northern Ireland Water Regulations), (collectively known as 'the regulations'), are intended to prevent the waste, misuse, undue consumption or contamination of public water supplies. All who install water fittings, plumbing systems or water-using appliances or use them have a legal duty to comply with these regulations.

Water softeners must be designed, installed and maintained to meet the regulations' requirements. Plumbing materials and fittings, including ion exchange water softeners, must be of a suitable standard. The regulations also require all appliances to have adequate backflow protection to prevent contaminants entering the plumbing system (see Section 6).

Regulation 5 of the Water Fittings Regulations requires that the Water Supplier must be notified in advance of the proposed installation of a water softener and give its consent. Details of notification are given in the WRAS leaflet 'Information on Notification of Proposed Plumbing Work' available on the WRAS website (see Section 12 Further Information).

It is important to install the softener in accordance with the manufacturer's instructions and this Guidance Note is intended to explain why the specific requirements of the installation instructions are necessary and to give guidance on compliance with the Regulations.

3. Softener construction

Regulation 4 requires that 'every water fitting shall be of an appropriate quality and standard and be suitable for the circumstances in which it is used'.

Parts of a water softener which are in contact with water which is intended for domestic purposes must not cause contamination of the water. This requirement is met if non-metallic components such as plastics, colourants, elastomers, sealants, etc., including softener connection hoses, comply with BS 6920:2000 (Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water).

Components must also be capable of withstanding without leakage or damage 1.5 times the maximum water pressure to which they will be subjected.

The person who installs the softener and the people using it are legally responsible for its compliance with the Regulations. It is therefore essential that suitable components are used and it is necessary to demonstrate their compliance. It is recommended that the products and materials used are listed in the on-line WRAS Water Fittings and Materials Directory, as these have been assessed on behalf of the Water Suppliers as meeting the Fittings Regulations providing they are installed in accordance with the specified conditions (see Section 12 Further Information).

4. Water efficiency

The Regulations require that fittings shall not waste or misuse water. The softener regeneration process results in a discharge to waste of water containing spent regenerant. Water softeners which exceed the water consumption criterion set out in the Regulators' Specification for water softeners (which specifies that per regeneration cycle, the softener shall use no more water than 18 times the volume of the resin) may be considered by Water Suppliers to waste or unduly consume water, in contravention of the Regulations. Softeners manufactured to comply with BSEN 14743 'Water Conditioning Equipment inside Buildings – Softeners' will satisfy this consumption requirement.

5. Backflow prevention

Backflow prevention for the supply pipe feeding the connection to the softener is intended to prevent softened water or, - in the event of a malfunction of the softener – regenerant solution, flowing by back-syphonage or back pressure into the upstream part of the domestic plumbing system or into the water supply mains. Figure 1 illustrates how, if the mains pressure drops, water from the premises can flow back into the mains possibly contaminating the public mains supply.

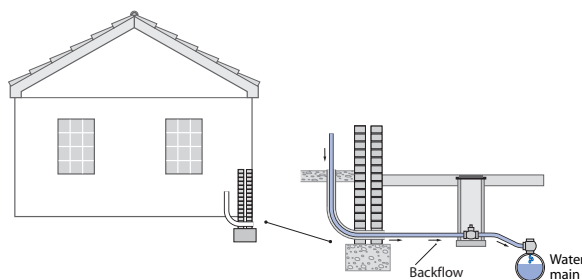


Fig 1: Indication of backflow into a water main.

The level of backflow protection required is defined by fluid categories given in Schedule 1 to the Regulations and a backflow prevention device rated to at least the same fluid category must be used for each backflow risk. Domestic Ion exchange water softeners are in fluid category 2. A type EA or EB single check valve is suitable backflow protection for fluid category 2 and should be fitted to the supply pipe immediately before the tee feeding the softener (Figure 2).

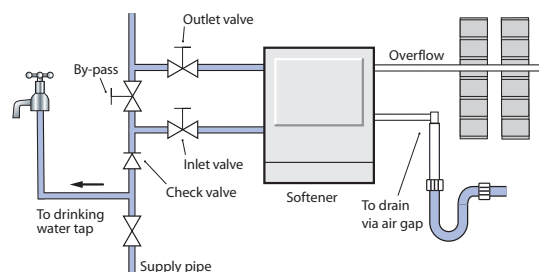


Fig 2: Bypass, connections and check valve

6. Connections/hoses

The softener requires four plumbing connections: the hard water inlet, the soft water outlet, the drain and the overflow. Some softeners also require connection to the

electrical supply to power the electronics for the automatic regeneration system.

The connections between the supply pipe and the softener are normally made in flexible pipe to enable the softener to be moved for servicing. Where the softener is located in a confined space that would impede maintenance, the length of flexible connections should be cut to allow the unit to be moved (after closing the bypass valves) to a position such that maintenance access is acceptable. The hose used must be suitable for drinking water applications – dishwasher, washing machine or garden hoses are not suitable.

Bypass

A bypass should be provided for the softener so that the unit can be isolated for maintenance purposes. This should comprise, as a minimum, isolation valves on the inlet and outlet of the softener and a bypass valve between the inlet and outlet T-pieces to and from the softener (Fig. 2).

7. Wastewater connections

Air gap to drain

The drain is connected to the drainage system which is a backflow risk in fluid category 5. Clearly the prevention of possible backflow of sewage into the water supply is of paramount importance. The requirement for this connection is therefore an air gap which must satisfy the Regulator's Specification. (Figure 3).

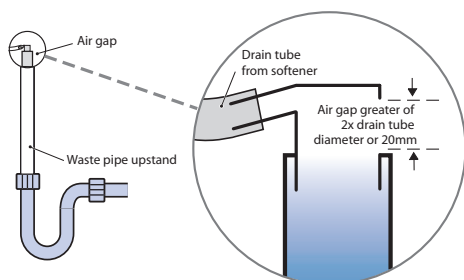


Fig 3: Connection to drainage system via an air gap

The drain connection from the softener can be via a waste pipe upstand but it must incorporate an air gap to drain, which is designed to provide an unobstructed gap between the outlet from the softener and the drain connection, as shown in Figure 3. Thus, if there is a blockage or back-pressure in the drain, water from the drain cannot be drawn into the softener if the water supply pressure fails at the same time.

It requires a minimum unobstructed air gap of 20 mm (or twice the diameter of the drain tube from the softener – whichever is the greater).

Overflow

The overflow from the brine tank should be connected using pipe with a minimum 15mm diameter with a continuous free fall through an outside wall to a location that will be readily evident to warn the consumer of an overflow fault condition. The outlet should not be directed into a drain or gully in such a way that immediate evidence of overflow condition is obscured to the user. It should be kept as short as possible to allow

maximum drainage capacity and the bore should not be reduced by alternative tube or any connector that may be needed. Where flexible hose is used, care must be taken to minimise the length of flexible hose and it must be routed and supported such that any movement during maintenance cannot cause it to kink.

8. Drinking water tap

Advice from the World Health Organisation and the Department of Health about drinking softened water leads Water Suppliers to recommend that where water in premises is to be softened, a separate unsoftened water tap should be provided for drinking water. This should preferably be at the kitchen sink but alternative positions such as at a utility room sink can also be acceptable. The separate unsoftened drinking water tap should be connected into the supply pipe upstream (before) of the bypass to the softener and run directly to the tap (Fig 4).

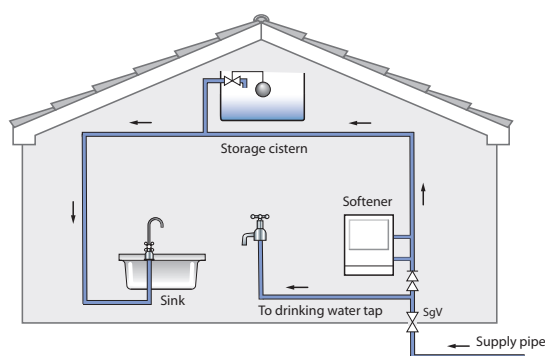


Fig 4: Connection for drinking tap upstream of the water softener.

The Regulations require that 'All premises supplied with water for domestic purposes shall have at least one tap conveniently situated for the drawing of drinking water'. Drinking water must comply with the Water Supply (Water Quality) Regulations 2000, which stipulate a maximum limit of 200 mg/l (milligrams per litre) for sodium. The Department of Health recommends that this sodium limit should not be exceeded for infant feed preparation and for those individuals on a medically supervised low-sodium diet.

The provision of an unsoftened drinking water tap is essential where the hardness of the public supply and its sodium content as supplied would result in the softened water exceeding 200 mg/l sodium limit.

For ion exchange softened water, this limit will be exceeded where the water is extremely hard, i.e. above 425 milligrams per litre as CaCO₃ (assuming zero sodium in the public supply).

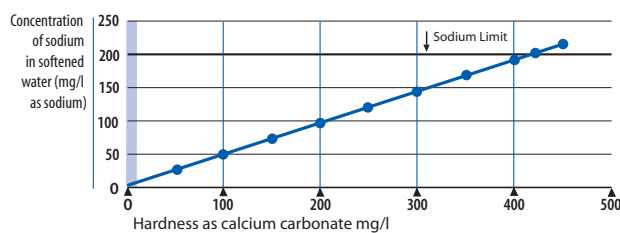


Fig 5: Sodium content resulting from softening water of a given hardness (with no allowance for sodium content of the water as supplied)

Before installing the water softener, installers must check by asking the local water supplier the level of water hardness and sodium in the area, so that the sodium level after softening will not exceed the 200 milligrams per litre value, and advise the customer accordingly.

9. Garden supply

For reasons of salt consumption and water wastage, it is obviously preferable for unsoftened water to be used for outdoor purposes. It is recommended, for convenience and economy, that the garden tap is connected to the hard water supply, upstream of the softener connection. Where this is not possible due to plumbing complexity, an option is for the consumer to bypass the softener (*see bypass above*) when using water for garden purposes.

10. Installation guidance

Location of the softener

Proper siting of the softener is vital. It must be positioned so that the user can readily access the unit in order to check the salt level and replenish it as necessary. Access to the bypass valves is also essential. There should be sufficient clearance between the top of the softener and its enclosure to be able to operate the manual regeneration function.

The ideal location is under the kitchen sink, because it will be regularly visible to the customer for checking salt level, and installation of the separate tap will be simpler. However, proximity to the incoming supply pipe (if this is not under the sink) is also important in order to minimise long pipe runs to the softener connections.

To minimise any temperature rise in cold water supply, the softener should be located away from any sources of heat, such as oven, boiler, hot water cylinder, etc. Also close proximity to hot water pipes should be avoided. Where this is not possible, suitable thermal insulation should be applied to the hot and cold pipes as necessary. Any cold pipe runs should be beneath, not above, any hot water pipes that are near. All pipe runs should be kept as short as possible.

For installation outdoors, or in an unheated outhouse, protection against freezing is essential to prevent damage to the unit and consequential water loss.

If as part of the installation the existing pipework is interrupted, particularly by use of a non-metallic bypass set, the earth bonding should be checked by a suitably-qualified person to maintain safe electrical earthing, although the supply pipe should never be relied upon exclusively for this purpose.

Plumbing route

As with any plumbing work, pipe runs should be kept as short as possible to minimise pressure loss and stagnation. Similarly, bends and fittings should be minimised to reduce pressure loss. The route will be determined primarily by the location of the softener, but the pipe route for the hard water drinking tap will also need careful planning to avoid unnecessary disruption to the existing premises.

Supply Pressure

Before installing a softener the local water supplier should be contacted for information relating to the normal operating pressure for a supply area to confirm that it is neither too high nor too low when checked against the manufacturer's instructions. If the pressure is too low it may affect the functionality of the softener; if the pressure is too high it may cause leakage or premature failure and a pressure reducing valve may be required.

11. Maintenance

Manufacturers of water softeners should include written instructions giving clear advice on routine checks to be made on operation of the system to ensure continuous and effective function. Installers should ensure the operating instructions are given to the users. Inadvertent or intentional isolation of the softener for extended periods should be avoided and reinstatement of operation after a period of several days' interruption should be preceded by manual regeneration of the unit. In the case of a twin cylinder unit, both cylinders should be regenerated sequentially.

12. Further information

Further information and advice can be found in the following publications:

BS 6700:2006 Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.

The Water Regulations Guide, available from WRAS, contains the Regulations and technical Schedules, the Government Guidance and the Water Industry's recommendations for complying with the Regulations.

The Water Fittings and Materials Directory lists products which have been tested and approved by the WRAS for their compliance with the Regulations (available on the WRAS website www.wras.co.uk/products).

Information and Guidance Notes are available on the WRAS website (www.wras.co.uk).

Softened Drinking Water Booklet available from UKWTA (info@UKWTA.org)

For further copies of this Information and Guidance Note and technical information may be obtained from WRAS website or by contacting WRAS at:

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