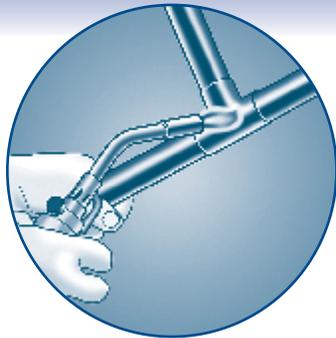


Solders & Fluxes



No. 9-04-02
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Edition 3

Use of lead solder is illegal for drinking water systems



INSTALLATION METHOD APPROVED BY YOUR LOCAL WATER SUPPLIER

If you install or use any plumbing systems or plumbing fittings which are to take water from the public water supply, you must follow certain requirements. The requirements are the same in England and Wales, where they are called the Water Supply (Water Fittings) Regulations 1999, as in Scotland, where they are called the Scottish Water Byelaws 2004.

The Regulations and Byelaws say you must connect water fittings 'in a workmanlike manner'. One way to do this is to use a method of installation approved by your local water supplier.

This leaflet sets out the method which has been approved by your local water supplier for using solders and fluxes for connecting water fittings. If you follow what it says, you will be making joints 'in a workmanlike manner' as required by the Regulations and Byelaws.

1. Introduction

- The illegal use of lead solder and the improper use of fluxes have caused concerns about health risks particularly amongst Water Suppliers, Plumbing Associations, Water Fittings Manufacturers, Local Authorities and Health Authorities.
- The use of excess flux has caused corrosion of copper pipework, leading to blue discoloration of water due to high levels of copper. There has been a confirmed case of lead poisoning directly attributable to the illegal use of lead based solder.
- From 1987, the Water Supply Byelaws outlawed the use of lead based solders for domestic hot and cold water systems.
- Under Regulations (Scottish Water Byelaws 2004), solder containing lead can be used, but only on non-drinking water installations where the water is not required to be wholesome, such as closed circuit central heating systems.

2. Regulations

The Water Fittings Regulations (and Scottish Water Byelaws 2004), ban the use of lead based solders for domestic hot and cold water systems and other installations where the water is required to be wholesome (i.e. water to be used for drinking, cooking or food production purposes) (Regulation 3(2) and DETR Guidance Clause G2.1).

3. Enforcement

Water suppliers have a duty to enforce the Regulations and where the illegal use of lead based solder is found, the Water Supplier will require the installation to be cleared of all joints containing lead solder at the installer's cost. The installer may also face a criminal prosecution for not complying with the Regulations.

4. Lead-free solder

- For capillary jointing in water systems where the use of lead-based solder is not permitted, joints shall be made either by using fittings with integral lead-free solder rings or by the end-feeding of lead-free solder. The packaging of the solder shall indicate that the solder is lead-free.
- The use of lead free solder such as Number 23, Tin/Copper Alloy Soft Solder made to EN29453, with a melting point of 230°C to 240°C and suitable for making end feed capillary joints, will satisfy the requirements of the Regulations (Byelaws).

- Where joints are made by end-feeding solder, only sufficient solder should be used to fill the capillary gap around the tube. As a guide on small tubes using solder wire, a length of solder approximately equal to the diameter of the tube should be sufficient.

5. Types of fluxes

- Common fluxes in use today are based on either zinc chloride or zinc ammonium chloride and are known as 'active fluxes' or 'Powerfluxes'. Some fluxes contain other active ingredients such as amines. Although they are neutral at room temperature, when heated they become alkaline. They are effective but the residues are very corrosive both at the joint and well away from it, due to the rapid evaporation when this type of flux is heated.
- Fluxes have to be corrosive to some extent to clean the copper. 'Self-cleaning' or 'acid' fluxes contain hydrochloric acid and are generally more corrosive than conventional fluxes. They require careful handling and should only be used in accordance with the manufacturer's instructions.

- Water soluble organic fluxes, developed over the past twenty years, are as effective as acid fluxes. However, they can be skin irritants and they lack lubrication for sliding the pipe into the fitting.

- Fluxes are frequently mixed with petroleum jelly (Vaseline or similar) which does not drain off the work piece so readily as liquid fluxes. The jelly also lubricates the joint but has the big disadvantage that it is not readily removed by flushing with cold water.

6. Fluxes for use with lead-free solders

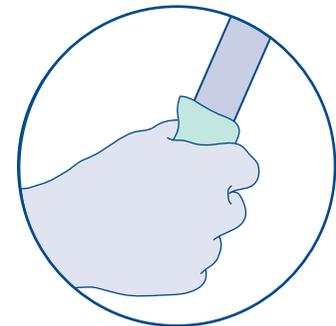
- Fluxes designed for use with lead solder may not be suitable for use with the higher melting point lead-free solders. The higher temperature causes old-style fluxes to burn or char before the solder melts, leaving carbon deposits in the pipe which can accelerate corrosion. The change to lead free solders requires the use of an appropriate flux.
- Water soluble fluxes are preferred for use with lead-free solder because they are more easily cleaned from pipework after use than grease based fluxes. (See Section 10)
- Fluxes shall be used in accordance with their manufacturers' instructions.



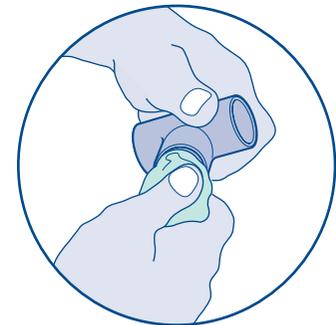
CAPILLARY JOINTING USING SOLDERS AND FLUXES

7. Cleaning

- The outside of the tube and the inside of the fitting shall be cleaned to give bright metal surfaces without particles or burring affecting the area to be jointed. (Illustration)
- Cleaning by use of an abrasive impregnated nylon scouring pad is effective and will help to prevent particles of steel entering the system. (Illustration)



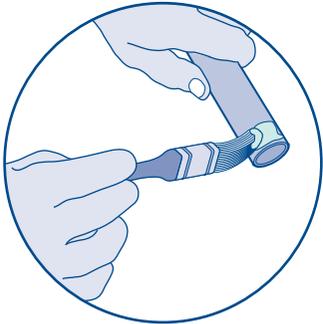
7(a). Cleaning the outside end of the tube



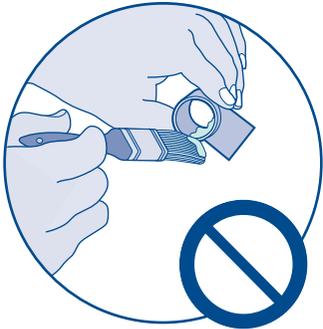
7(b). Effective cleaning with a nylon scourer

8. Fluxing and assembly

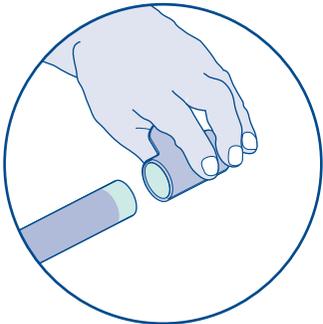
- (a). Once cleaned the outside surface of the tube should be fluxed immediately. (Illustration)
- (b). Apply sufficient flux to the tube only to thinly cover the cleaned area of the tube.
- (c). Do not apply flux to the fitting. (Illustration)
- (d). Assemble the connection by twisting the fitting onto the tube to ensure an even coat of flux in the joint. (Illustration)
- (e). Wipe off any excess flux and the joint is ready for heating. (Illustration)



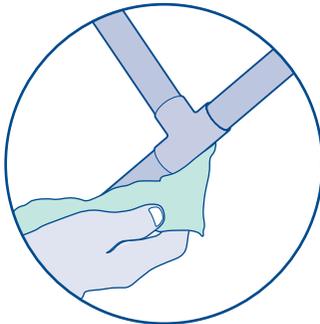
8(a). Applying flux to the outside of the tube



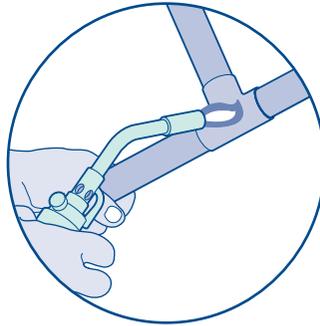
8(c). **WRONG** application of flux inside the fitting.



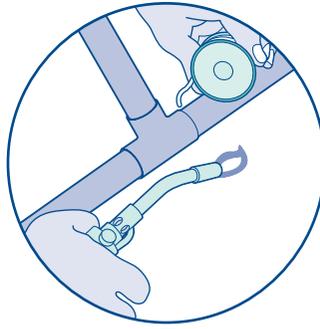
8(d). Insert and twist to spread flux evenly.



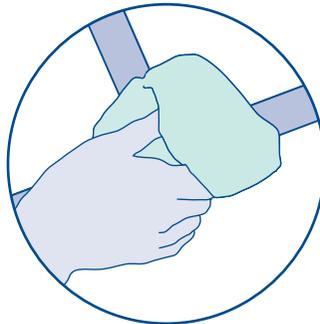
8(e). Wipe off any excess flux.



9(a). Apply heat evenly to tube and fitting.



9(c). For end-feed fitting add limited solder after heating.



10(a). When cool, remove flux external residues.

9. Heating

- (a). Using one of the recognised methods (LPG blowtorch, electric hot air gun, electric resistance soldering tool) apply heat evenly to the tube and fitting. (Illustration)
- (b). For integral ring fittings, heat until a ring of solder shows at the mouth of the fitting.
- (c). For end-feed fittings apply heat to the tube and fitting, checking at intervals with the heat source removed until the solder melts when it is touched on the tube. Remove the heat source and add only sufficient solder to fill the capillary gap (see 4(c) above). (Illustration)
- (d). Allow solder in the joint to cool sufficiently to solidify before moving or stressing the joint.

10. Finishing off the outside and inside of pipework and fittings

- (a). Once the joint has been made, it is important to remove any residue of flux from the outside of the tube and fittings by wiping it off with a wet cloth and warm water. (Illustration)
- (b). The internal pipe work and fittings should be flushed as soon as reasonably practicable to remove any flux residues or filings. Factors that should be taken into consideration when determining what is reasonably practicable include:-
 - Whether or not there is likely to be debris in the system;
 - The complexity of the system, and whether it would be appropriate to consider staged flushing;

- The possibility of the flux drying out.
- (c). A cold water flush will usually remove water based fluxes.
- (d). Where grease based fluxes have been used, they must be thoroughly removed by flushing with hot water.

11. Prevention of stagnation causing 'blue water'

- (a). When premises are occupied, the normal pattern of using water lays down a protective layer on the inside of new copper pipework and protects it against attack by the water. Especially in soft water areas, if the new pipework is not regularly used after it has been filled and tested, water may stagnate in it and this protective layer cannot form. As a result, copper dissolves from the pipe walls and can turn the water blue. It can be difficult to clear this problem once it has started.
- (b). Where newly completed copper pipework is unlikely to be used within a few days after testing, it should be drained down to prevent it being left with water standing in it.
- (c). If this is impracticable, the water system should be flushed once or twice per week to prevent the water stagnating. It is also sensible to do this where existing copper pipework temporarily is not being used, otherwise the protective layer may be removed resulting, in a few cases, in prolonged discoloured water.

12. Further information

- (a). 'Installation Tips – Fluxes and Solders', is a comprehensive leaflet on the subject published by the UK Copper Board, 30/34, New Bridge Street, London. EC4V 6BJ. Further information is available from their website www.ukcopperboard.co.uk.
- (b). The Water Regulations Advisory Scheme (WRAS) offers a free advisory service on matters relating to the Water Fittings Regulations, but for local matters contact the local Water Supplier (see Yellow Pages).
- (c). WRAS can be contacted by telephone, e-mail or letter at the address below.

