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Fluxes, solders and capillary jointing

Plumbing and heating systems make full use of the exceptional performance of soldered joints using capillary fittings. 'Soldering' is a simple and very effective method of jointing copper tube, giving durable and reliable pipework installations. Correctly made, a soldered joint will help to give your installations long service lives.

The steps required to make a correct soldered joint are very simple, but it is important not to cut corners. The following information will give you the necessary knowledge to complete successful soldered joints every time.

Our list of components includes copper tube and fittings (obviously!), flux, solder and a heat source. We have four essential stages in our process:

- Preparation
- Fluxing and assembly
- Heating
- Removing flux

1 - Preparation

The first step in any copper jointing technique is to prepare the tube end. It is vital that burrs, which can be created on the tube end by cutting, are removed from both the inside and outside edges. Burrs left on tube ends can disrupt the smooth flow of water and can affect the integrity of a joint.

Having de-burred the tube end an abrasive pad should be used to clean any dirt or oxide layer from the surface that will be used in the joint. The internal surface of the fitting should also be cleaned. Steel wool was used in the past for cleaning but there is the possibility that small steel particles may get embedded in the copper and then into the pipework, which is something we want to avoid.

2 - Fluxing and assembly

The purpose of the flux is to enable the solder to wet, adhere to and alloy with the surface of the copper, forming a water-tight joint. For soldering of plumbing fittings the types of fluxes used will be zinc-chloride or zinc-ammonium-chloride. The 'self-cleaning' fluxes, which contain free hydrochloric acid, should be used with extreme care.

Having cleaned the tube end, a thin layer of flux should be applied to the jointing surface. It is not necessary to apply flux to the jointing surface of the fitting. The tube is then inserted into the fitting up to the tube stop whilst twisting the tube round so that the flux is spread across the fitting surface. Any excess flux on the surface at this point should be removed.

Flux is not applied to the jointing surface of the fitting because there is the potential for the tube, when it is inserted into the fitting, to push flux inside the fitting. What we do not want is for flux to remain inside the pipework on completion of joints as this can lead to problems with the installation in later years.

3 - Heating

Once the tube is located inside the fitting, the heat, or flame,



An integral solder ring fitting

can be applied. Heat is usually applied with an LPG blowtorch and the flame needs to be kept moving around the joint as overheating one spot can lead to charring of the flux, affecting its performance.

For an integral solder ring fitting, once it has reached the required temperature, the solder will melt and a bead will form in the mouth of the fitting, all the way around. This shows that the joint is complete. With this type of fitting there is no need for any additional solder to be fed into the joint, as the fitting already has the correct amount of solder.

For an end-feed fitting, the solder is brought into contact with the heated tube and if it melts then the flame is withdrawn and the solder flows into the joint, forming a bead in the mouth of the fitting. Should the solder not melt on contact with the tube, then further heating is required.

For pipework that will carry drinking water only lead-free solders will do. Integral solder ring fittings have a lead-free solder, EN 29453 alloy 23, incorporated. This solder melts between 230°C and 240°C and can be used on all copper pipework applications, both water and gas.

It is still possible to use a leaded solder on gas and heating systems but you will need to be extremely careful not to mix-up your solders. Using a leaded solder on a drinking water installation will land you in a great deal of trouble.



An end-feed fitting

If you want to ensure that you avoid any problems with solder types, then use the lead-free solder alloy for all your installations.

If you want to install capillary fittings without using a naked flame there are a couple of options: electric hot air gun, electric resistance soldering tool. Both of these methods can be used on small diameter tube and fittings and where it is thought that a naked flame may cause damage to the fabric of a building.

4 - Removing flux

When your integral solder ring and end-feed joints are completed, with a bead of solder showing in the mouth of the fitting, it is important to allow them to cool so that the solder has a chance to solidify. Moving the assembly before the solder sets can affect the integrity of the joint, perhaps leading to leaks.

At this stage it is of vital importance to remove any flux residues on the outside and inside of the pipework. Fluxes on the outside can be removed with a damp cloth. Fluxes on the inside should be removed by flushing the pipework with fresh cold water as soon as possible. This flushing will remove water-based fluxes, however, grease-based fluxes will require flushing with hot water. If fluxes are not flushed away, corrosion damage can occur during the service life of the installation.

If you use a 'self-cleaning' flux, flushing of pipework is extremely important.

Note on plastics-coated tube

Capillary fittings can be used in conjunction with plastic-coated copper tube. For this, the plastic coating is cut lengthwise down the tube so that about 100mm of copper is exposed. The joint is made in the same way as described earlier but extra care is needed here as we don't want to burn the plastic coating, or allow flux to become trapped between the copper and the plastic covering. Once the joint is made and has cooled, and fluxes removed, the plastic coating is folded back into place and spirally wrapped with a suitable tape, self adhesive polythene or PVC. The tape should cover the last 25mm of intact plastic coating and at least 25mm of immediately adjacent bare copper tube.

The capillary jointing system has been evolving for over fifty years and we can now say that, in the hands of the professional plumber, it is completely reliable. This simple, effective jointing technique will give you a trouble-free installation and your customer a tried and tested copper plumbing system.

This article was provided by Nicholas Hay, Project Manager Building and Construction, on behalf of the UK Copper Board.



Questions:

1. What type of solder must you use on drinking water pipelines?
2. Is it ever OK to leave flux inside a completed soldered joint?
3. Before inserting the tube into the fitting do you de-burr the outside edge of the tube, inside edge of the tube or both?
4. Do you need any solder wire when using an integral ring solder fitting?
5. When using an end-feed fitting, what do you do if the solder does not melt when it is touched on the tube?
6. What is the number of the lead-free solder alloy?
7. Can you make soldered joints when using plastic-coated copper tube?
8. How can you tell when a soldered joint is complete?
9. If you are in a hurry is it OK to dip the tube end in the flux instead of applying it with a brush?
10. When cleaning the tube with an abrasive pad how much of the tube do you need to clean?

Name..... Membership number.....

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