

Trade of Plumbing

Module 2: Domestic Hot and Cold Water Service

Unit 6: Soldering

Phase 2

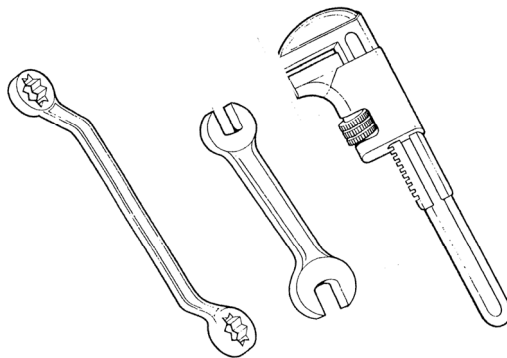


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Document Release History

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June 2006	V.1.0	
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Module 2 – Domestic Hot and Cold Water Service

Unit 6 – Soldering

Duration – 32 Hours

Learning Outcome:

By the end of this unit each apprentice will be able to:

- Form soft soldered capillary joints on copper pipe.
- Form hard soldered capillary joints on copper pipe.
- Assemble soft and hard soldered copper pipework projects.
- Form crossover on copper pipe using spring bending and machine bending machine.

Key Learning Points

Sc	Capillary action.
Sc	Heat transfer.
Rk	Range of soft soldered capillary fittings – end-feed and integral solder.
Sk	Preparation of pipe for soft soldering.
Rk	Types of solder wire.
RK	Types and purpose of flux, removal of flux from finished joint.
Sk H	Use of gas torches.
Sk	Soft soldering.
Sk Sc	Preparation of pipe for hard soldering.
Sk	Use and care of socket forming tools for hard soldered straight and branch joints.
Sk H	Use of drill, unidrill bit and dimple pliers.
Sk	Hard soldering joints, copper alloy rods.
Sk	Testing pipework.
Sk	Interpretation of drawings.
P	Planning.
P	Good working practice.
Sk	Assembly of soldered copper pipework projects.

Sk	Alignment of pipework.
P	Working independently.

Training Resources

- Classroom facilities, workshop facilities.
- Information sheets.
- Pipe expanding and extraction kits, sample capillary fittings.

Exercise

1. Apprentice to make sample hard soldered socket and branch pieces as in Exercise No. 2.2.6a in the curriculum document.
2. Assemble soldered copper pipework projects as in Exercise No. 2.2.6b.

Key Learning Points Code

M = Maths **D** = Drawing **RK** = Related Knowledge **Sc** = Science
P = Personal Skills **Sk** = Skill **H** = Hazards

Capillary Joint

A joint used extensively on copper and stainless steel tubing; the joint is made by melting solder which fills up into the fitting by *capillary attraction*. There are two types of *capillary attraction*. There are two types of capillary joints, those which are *soft soldered* and those which are *hard soldered*.

If capillary joints are used on mains supply the solder used must be lead free. The method of making a soft soldered joint is to first thoroughly clean the pipe end and internal surface of the fitting with wire wool; emery paper should not be used as this leaves a dirty film on the surface unseen to the human eye.

Once cleaned apply smear of flux to the pipe and joint; then assemble. Now heat up the joint with a blowlamp until solder which is applied melts and runs round and fills the socket. Do not melt on too much solder as it flows into the pipe possibly blocking it, remove the heat and allow the joint to cool. Upon completion flush out the pipeline and clean the external surface of the pipe of excessive flux.

Capillary Attraction (Capillarity)

A well known phenomenon, which many people find hard to believe, in which liquids can rise upwards between two surfaces. To demonstrate this phenomenon put a clear drinking straw into a glass of water; if the straw is squeezed together the water will rise even higher.

Capillary attraction is caused by the liquid adhering to the side walls of the straw and then, due to *cohesion* of the water molecules (the need to hold together), pulling itself up to the level of adherence, the water then adheres again to the sides of the straw and again the water pulls itself up to the level of adherence. This process continues until the weight of the water molecules is too great and pulling itself up the level of adhesion proves too much.

Thus it can be stated that capillary attraction is caused by the adhesion and cohesion qualities of liquids. The closer two surfaces are together, the higher the liquid will rise. Also should the surface be greasy or oily liquid will not readily adhere.

Capillary attraction can be put to use in plumbing works, such as with capillary solder joints, hence the need for cleanliness, to get good adhesion. But it can also cause problems and damage such as water passing between the laps in sheet weathering material.

Soldering

In plumbing there are two ways of soldering. They are known as hard soldering and soft soldering.

Hard Soldering

Hard Soldering is also known as silver soldering or cupro–techtic welding. This is because the rod used has a small amount of silver added to it to lower its melting point and to allow the molten metal to flow more easily.

A special kit of tools has been designed by the Rothenberger company for use with this type of hard soldering. This kit allows the plumber to make straight joints, branches and reduces without the use of any fitting. This has a number of advantages for the plumber. Since less fittings are required there are considerable cost savings.

Silver Soldering requires a lot of heat and special torches are available for this. One is the air-acetylene torch which gives a mixture of air and propane. Both of these flames are hot enough to melt the silver solder rod but not the copper pipe. Oxyacetylene equipment may also be used but care must be taken not to melt the copper. No flux is required for this joint due to the high temperature (600° - 500°).

The silver solder joint is one of the most reliable ways of jointing copper. The joint itself has almost the same characteristics as copper and it seldom leaks.

Note: Rothenberger equipment is made for metric size pipe and must be adjusted to suit Irish copper.

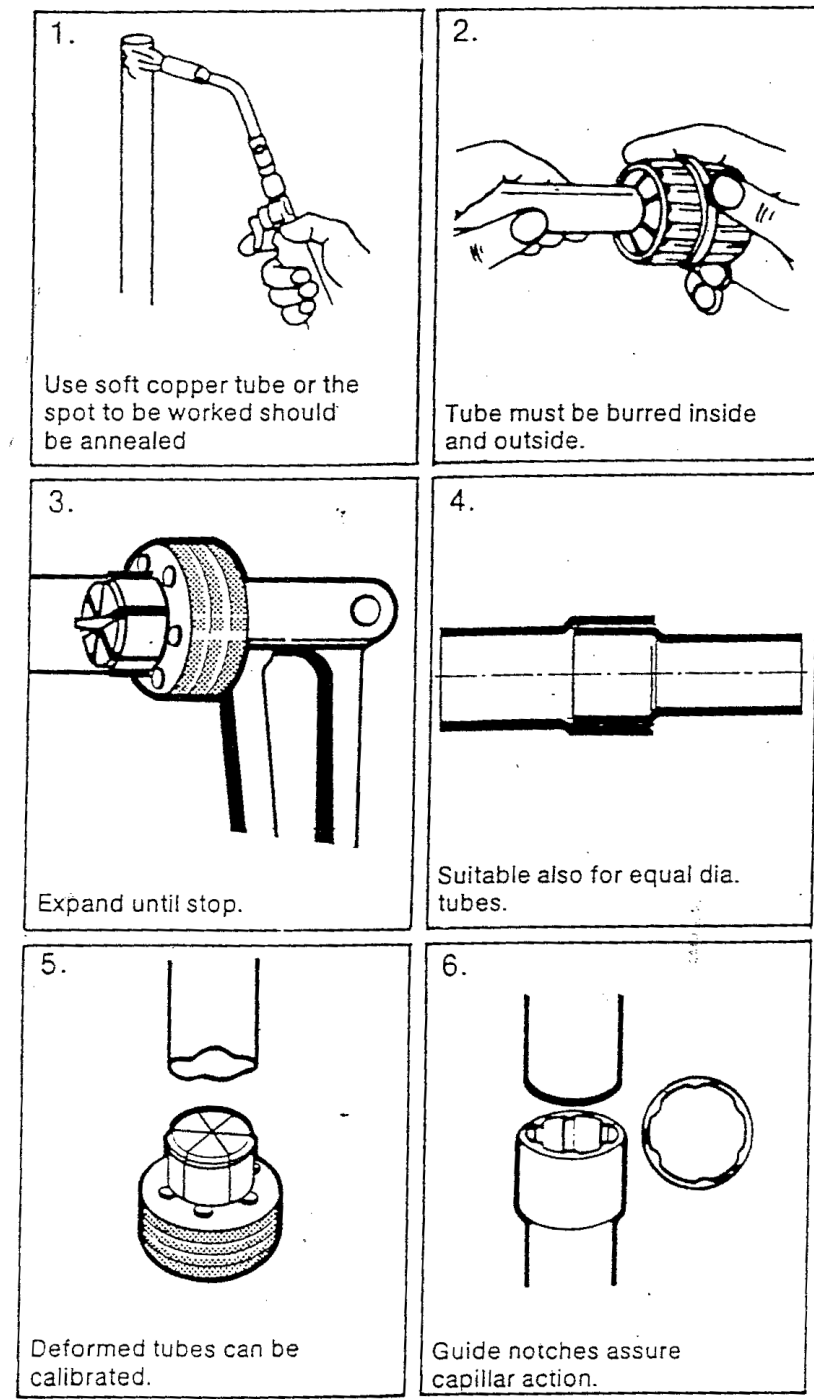


Figure 1. Demonstration

Soft Soldering

Soft soldering is a means of jointing pipe using traditional plumbers solder which is a mixture of tin and lead. A comprehensive range of fittings are available and the solder is usually incorporated into each one in the form of an integral ring. Fitting without this ring of solder are also available but are not as popular as the first type.

Soft Soldering does not require as much heat as silver soldering and a standard butane plumber's blowtorch or blowlamp is used. In fact too much heat is almost as bad as too little where soft soldering is concerned.

Because of the low temperature being used great care must be taken when preparing the joint. Both the outside of the pipe and the inside of the fitting must be thoroughly cleaned with steel wool or emery paper. Flux is then applied to both surfaces and the joint is then pushed together. All parts of the fitting must be prepared and jointed at the same time. Always try and do the lower joint first. When the heat is applied look for a small ring of solder which will appear at the face of the fitting. This is an indication that the solder is melting. Most plumbers like to add a small amount of solder to the joint to make sure the joint is sound. If too much solder is used the excess can be wiped off with a piece of rag or brown paper smeared with a small amount of flux.

Flux is applied to help clean the joint and should never be applied with the fingers or allowed come into contact with the skin as it is very corrosive. It should always be applied with a brush. When soft solder jointing is used in plumbing and heating systems, always ensure the system is flushed out thoroughly to remove any excess or residue flux.

Soft soldering is a lot cheaper than using compression fittings but care must be taken when using this method as leaking joints are quite common.

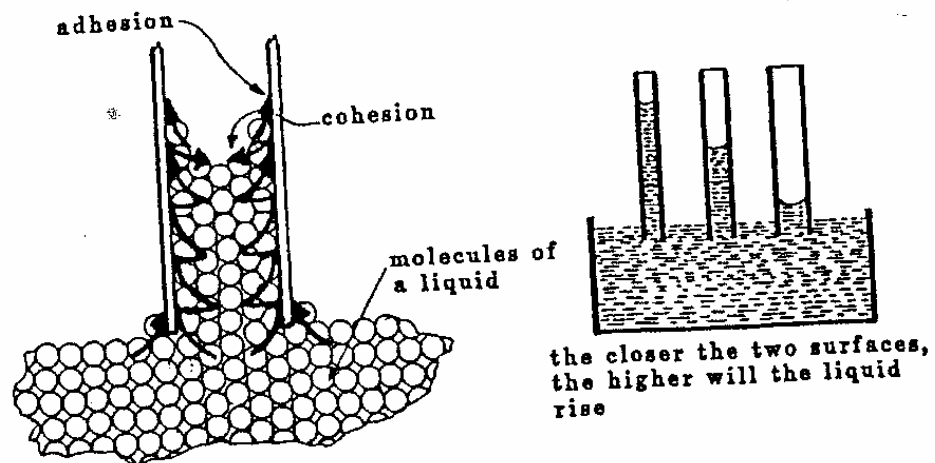


Figure 2. Soft Soldering

Self Assessment

Exercises

1. Define the term capillary action and explain how it applies to the soldering process.
2. Explain why a copper pipe should be annealed before being expanded.
3. On what type of pipework should lead-free solder be used and why.

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