

United Nations Development Programme



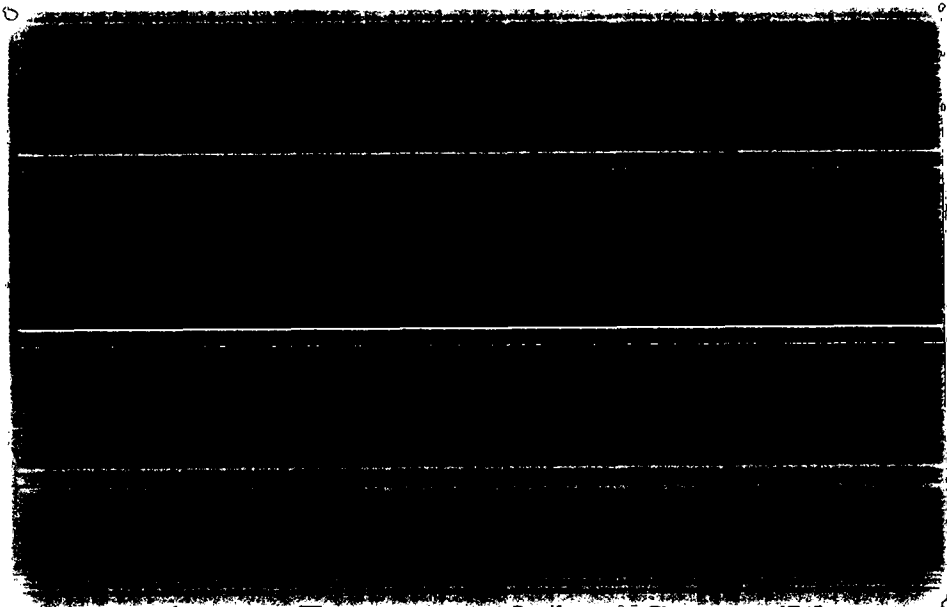
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DEPARTMENT OF TECHNICAL COOPERATION
FOR DEVELOPMENT

United Nations Water Resources Assessment
And Planning In Pacific Islands

RAS/87/009



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WATER RESOURCES ASSESSMENT AND PLANNING
IN PACIFIC ISLANDS

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- PLASTIC PIPEWORK
- MARKING OUT AND INSTALLING PIPEWORK
- SANITARY PLUMBING
- REPAIRING TAPS AND VALVES

DRAFT

UNEP
 INTERNATIONAL CENTRE
 FOR CLEAN WATER SUPPLY AND
 SANITATION (ICWSS)

PREFACE

TO BE A TRADESMAN

In developing skills and knowledge, the trainee should be aware of, and endeavour at all times to develop correct procedures and attitudes towards his work.

To be a successful tradesman and potential supervisor, the trainee must be able to demonstrate the technical aspects of the trade and accept increasing responsibility.

The following lists some of the attributes that a good tradesman should adopt or aspire to;

- be punctual
- do a fair day's work
- be methodical, plan your work
- be honest and reliable
- maintain a comprehensive tool kit
- follow instructions carefully. "If in doubt ask".
- be safety conscious
- reduce wastage of material
- take a keen interest in the job
- be neat and tidy
- develop a good working relationship with others
- whenever the opportunity presents itself, continue to learn and acquire new skills.



Title: PLASTIC PIPEWORK

THIS GUIDE IS ONE OF A SERIES OF BOOKLETS DESIGNED TO SUPPORT PRACTICAL TRAINING FOR THOSE WORKERS ENGAGED IN PROVIDING BASIC WATER SUPPLIES AND SANITATION FOR RURAL COMMUNITIES IN THE PACIFIC REGION.

THE PRINCIPAL AIMS AND OBJECTIVES OF THIS GUIDE ARE TO:

- IDENTIFY DIFFERENT PLASTIC PIPES AND FITTINGS USED FOR WATER SUPPLY
- SELECT APPROPRIATE MATERIALS REQUIRED FOR A SPECIFIC INSTALLATION
- ACCURATELY CUT PIPES TO LENGTH AND MAKE WATERTIGHT JOINTS
- SECURE PLASTIC PIPEWORK
- REPAIRS TO LEAKING PIPEWORK
- CONNECTING PIPEWORK TO FIXTURES AND APPLIANCES

EQUIPMENT AND MATERIALS REQUIRED:

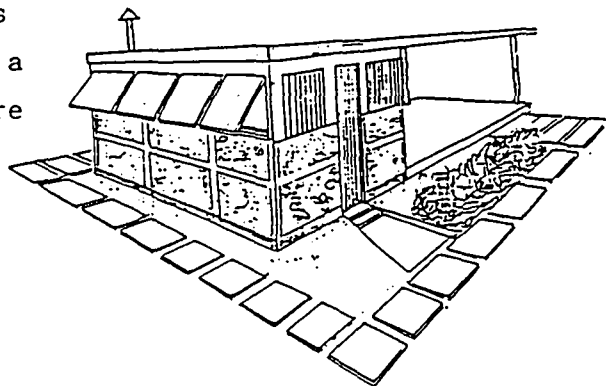
- FINE TOOTH SAW
- UTILITY KNIFE/FILE
- TAPE MEASURE/PEN
- ADJUSTABLE SPANNERS
- SOLVENT CEMENT AND BRUSH
- PTFE TAPE
- SELECTION OF VARIOUS TYPES AND SIZES OF FITTINGS
- PIECES OF PVC AND PE PIPE UPTO 25 MM DIAMETER



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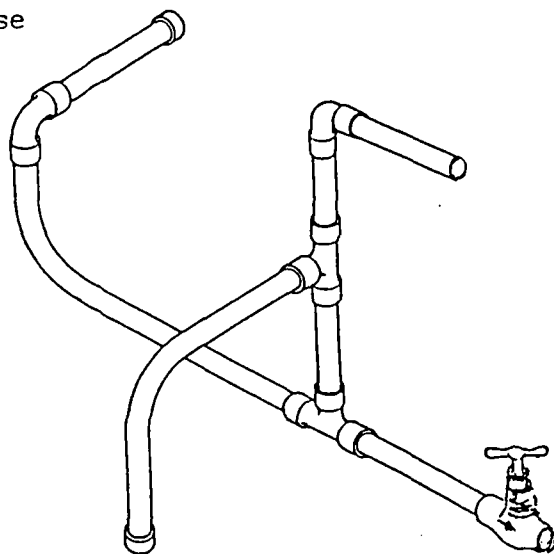
1. Plastic pipes and fittings are used extensively for cold water services throughout the Pacific. They have a number of advantages over other more conventional materials.

- extensive range of fittings, readily available
- relatively light in weight compared to metals
- do not corrode
- easy to work with, requiring limited skills
- easy to transport
- relatively inexpensive



2. There are also some disadvantages in using plastic pipes and fittings, these are:

- easily damaged
- do not withstand high pressure and temperature
- requires additional support and protection

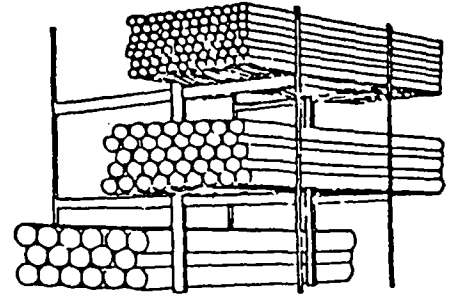


3. Of the many types of "plastics" available, two are in common use for domestic cold water supply.



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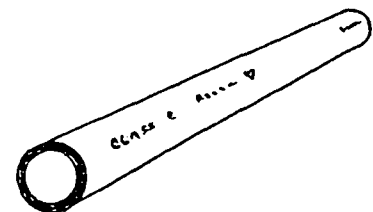
4. PVC, stands for polyvinyl chloride and is grey or white in colour. Sizes range from 15 mm - 100 mm with lengths of upto 6 m. A wide range of pipe fittings are readily available. The method generally used to join pipes and fittings is solvent cement welding.



5. PE stands for polyethylene and is black in colour. Coils of pipe are available in a range of sizes from 15 mm and lengths of up to 50 m. Being very flexible and relatively strong it is recommended for underground use. Jointing is done using compression fitting with either flared ends or metal inserts.



6. Plastic pipes are marked at regular intervals along their length, to denote the class and standards of its manufacture. A table of identification markings should be obtained before selecting a particular pipe for high pressure services.



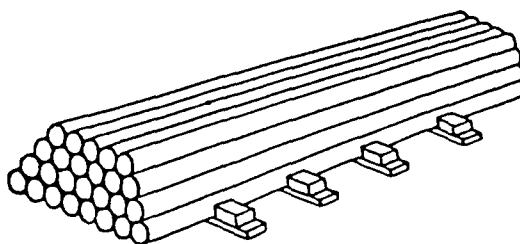


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7. Pipe lengths should be stored flat, and covered, to protect them from direct sunlight. PVC when heated changes its shape, and is easily deformed.



8. A range of commonly available PVC pipe fittings, for cold water services is illustrated to assist you in identifying their names and purpose for which they are used.

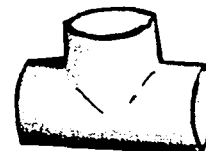
(a) 90° plain elbow sizes 15,20,25,32, 40,50,80 and 100 mm. Used to change direction of a water pipe.



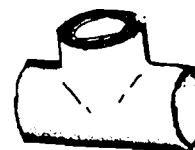
(b) 45° plain elbow, sizes 15,20,25,32, 40 and 50 mm. Used to change direction.



(c) 90° plain tee, sizes 15,20,25,32,40, 50 and 80 mm, used to branch one pipe from another.



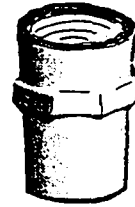
(d) 90° reducing tee, sizes 20 x 15, 25 x 20, 32 x 25 used to branch a smaller pipe from a larger one.



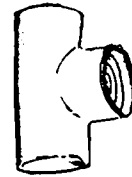


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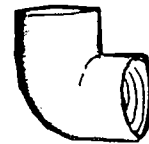
- (e) Tap coupling, sizes 15 - 100 mm,
one end threaded the other plain.
Used to connect taps to the
pipeline.



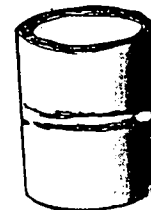
- (f) Tap 90° tee sizes 15,20 and 25 mm
centre of tee threaded into which
a tap or fitting is screwed.



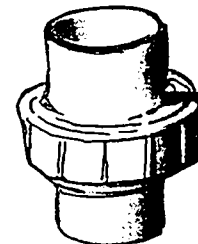
- (g) Tap 90° elbow, sizes 15,20,25 and 32 mm
one end threaded, into which a tap or
fitting is screwed.



- (h) Plain coupling sizes 15 - 100 mm,
used to connect two straight lengths
of pipe together, by solvent cement
welding.



- (i) Straight union, sizes 32 and 40 mm,
used to dismantle or join together
lengths of pipe.



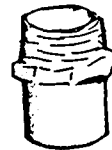


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- (j) Valve socket sizes 15 - 100 mm, one end has external (male thread) the other an internal (female thread) used to connect valves and fittings together.



- (k) Valve spigot sizes 15 - 50 mm one end threaded, the other end plain. Used to connect onto straight lengths of pipe or into a valve or fitting.



- (l) Plain threaded bush sizes 20 x 15 and 25 x 20 mm. Used to reduce the size between pipe and fittings.



- (m) Reducing sockets size 20 x 15 on upto 100 x 80 mm. Solvent cement welded joints between different size of pipes.



- (n) Reducing bush sizes from 20 x 15 - 50 x 40 mm, one end is threaded internally and is used to connect pipes and fittings of different sizes.



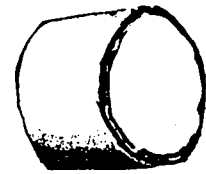


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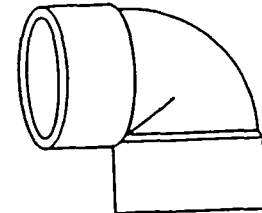
- (o) Plain end caps, sizes 15 - 100 mm used to plug or block off the end of a pipe.



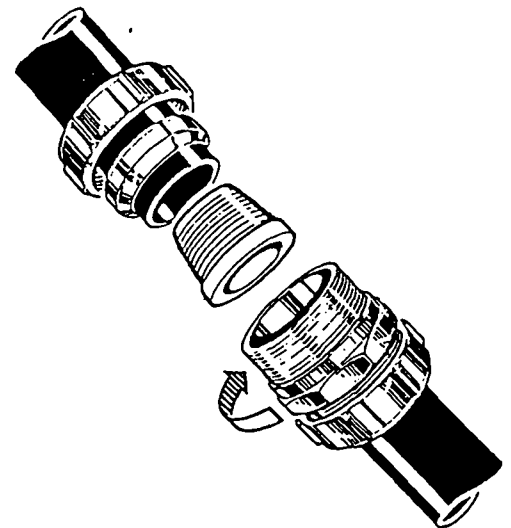
9. When ordering pipe fittings always specify:

- the type of fitting
- the diameter or size
- the angle
- the number required

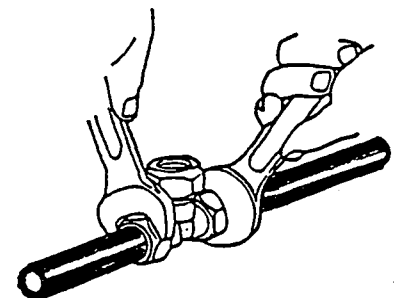
Example: 5 only 25 mm plain
PVC 90° elbows.



10. To join polyethylene (PE) pipe, a compression fitting is used. A copper sleeve is first inserted into the end of a pipe, and a nut is slid over the pipe. With the end of the pipe firmly seated in the fitting, the nuts are then tightened.



11. In tightening the nuts, two adjustable spanners, open spanners, or pipe grips are used. One to tighten, and the other to hold against the force applied.





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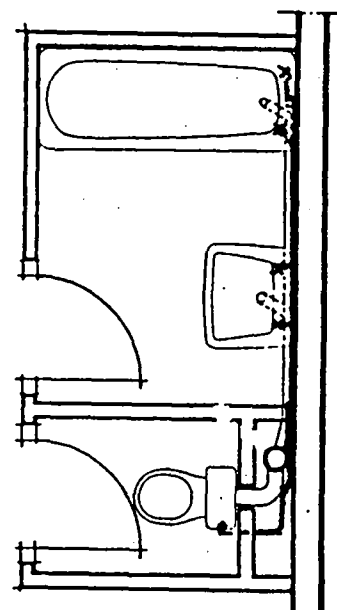
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12. To connect PVC to PE pipes, compression fittings with threaded adaptors are used. A PVC fitting is connected to the adaptor and jointed to the PVC using solvent cement.

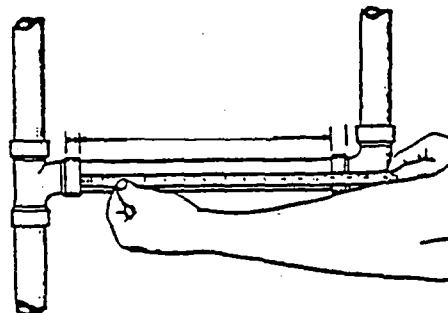


13. Before commencing on the installation of the pipework, it is most important to carefully plan the pipe runs. Points to consider are:

- size of pipework
- length and direction of pipework
- protection of pipework
- access to joints and valves
- availability of fittings
- methods of jointing



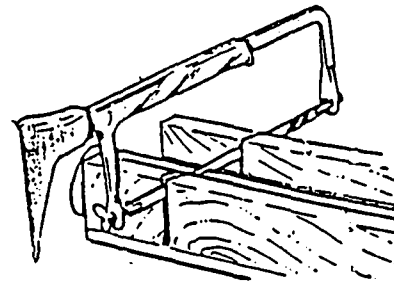
14. Starting from one end of the pipe run, carefully measure the exact length of pipe required, not forgetting to allow for the depth of the socket. The overall length of the pipe should be measured from the inside to inside of the fittings.



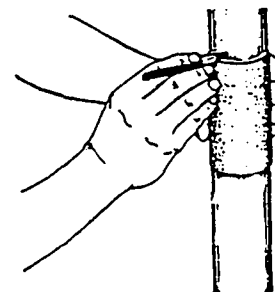
REMEMBER MEASURE TWICE CUT ONCE!



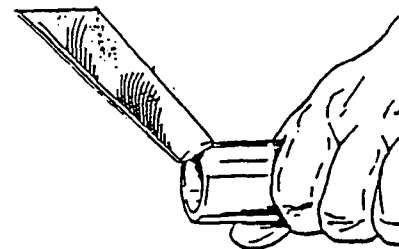
15. The cut ends of the pipe must be square. Use a miter box that has saw cuts of 90° to the base line.



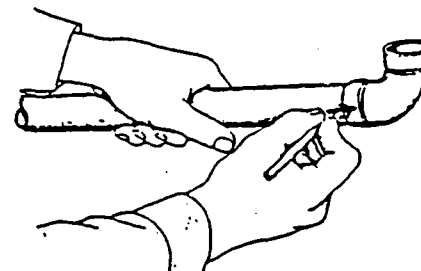
16. Tape or paper can be wrapped around the pipe on the line of the cut. Mark around the edge using a felt tipped pen or pencil.



17. With a fine tooth saw, carefully cut through the pipe. File or cut away the rough edges inside the pipe, and smooth around the outside edge.



18. Before jointing, assemble sections of pipe and fittings. Check that each piece of pipe has fully entered their fittings. Mark the pipe at the face of the joint, also the corresponding angle of the fittings to the pipe.

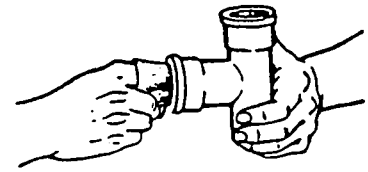


19. Dismantle the joints. It can be clearly seen whether the pipe has fully entered the fitting.

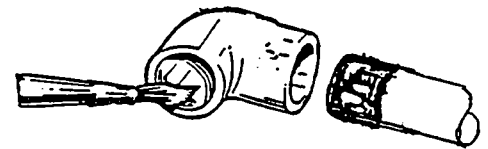


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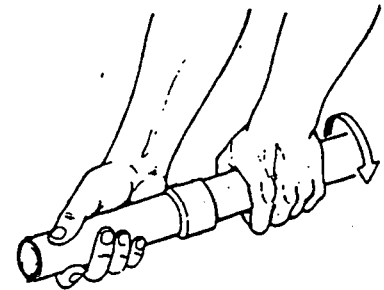
20. To make a water tight joint, it is important to thoroughly clean the end of the pipe and inside the fitting, using a recommended PVC cleaner or methylated spirit.



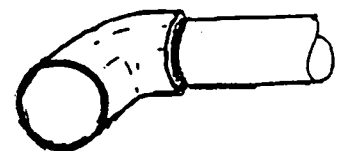
21. With a small brush (not your finger) apply PVC solvent cement around the end of the pipe, to the depth of the fitting.



22. Without wasting time, push the fitting firmly onto the end of the pipe, giving it a slight twist, to spread the solvent cement, and to correctly position the fitting in relation to the pipe, or connections.

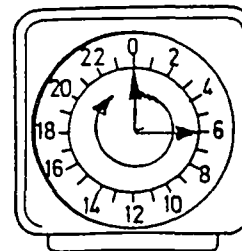


23. Carefully check to see that a bead of solvent cement has formed around the edge of the fitting. If so wipe of any excess, and be sure to replace the cap on the can of cement, as this dries up very quickly.

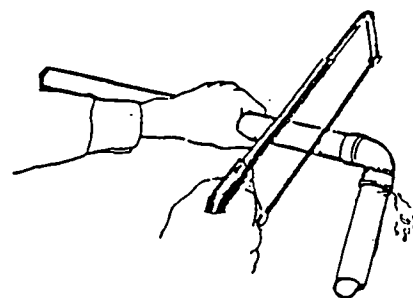




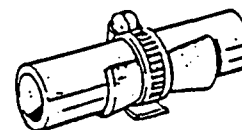
24. The joint will harden, usually in a few minutes. Wait at least 24 hours before subjecting the joint to high pressure.



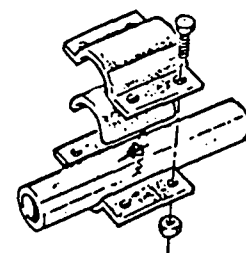
25. A rapid hardening solvent cement is available, which will allow the joint to be pressurised after 6 hours.



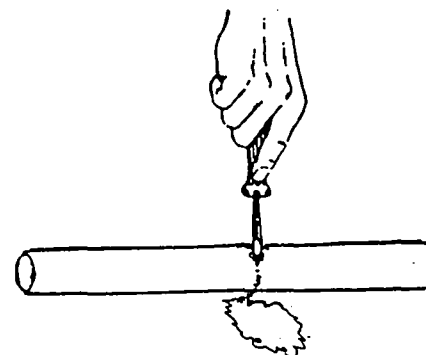
26. Should a solvent cement joint leak, it is almost impossible to effect a lasting repair. As the joint cannot be dismantled, that section should be cut out and replaced.



27. To carry out temporary repairs to small leaks on plastic pipes, patch kits can be used. A piece of rubber inner tuber is clamped around the leak using a jubilee clip or bolted bracket.



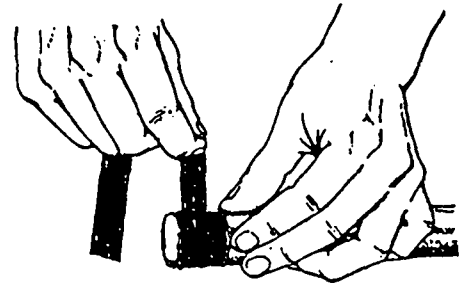
28. If water is leaking from a small hole, rather than a crack in the pipe, a metal self tapping screw is screwed in and an adhesive epoxy such as "araldite" is applied to the head of the screw.



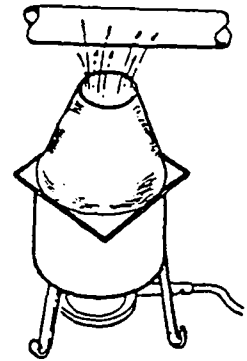


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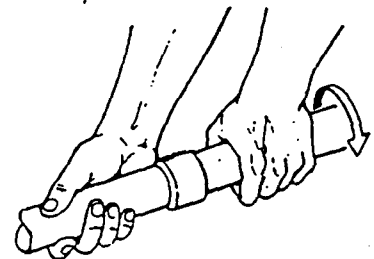
29. In an emergency, sockets can be formed on the end of a piece of pipe by wrapping a single thickness of tape around one end of a pipe, to the full depth of a socket.



30. Warm the end of another piece of pipe over a fire or in boiling water until it becomes pliable. Use only indirect heat, otherwise the flame will scorch and burn the pipe.



31. With the end of the pipe softened, quickly insert the taped pipe end into the softened pipe, and twist it until it reaches its full depth.



32. On cooling, the taped pipe can be withdrawn, and the piece of tape removed. Completed the joint as previously described.

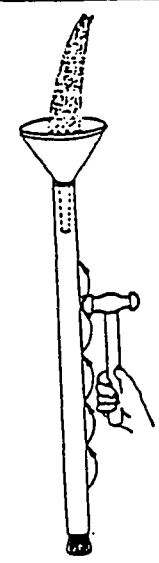


33. To make large radius bends it is necessary to load the pipe with dry fine sand. Two tapered wooden plugs are made to fit the internal diameter of the pipe.

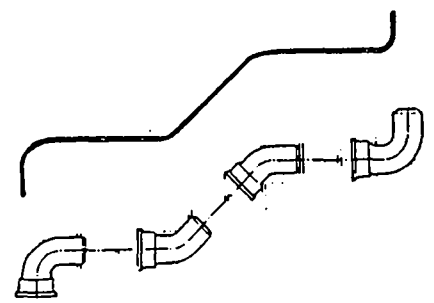


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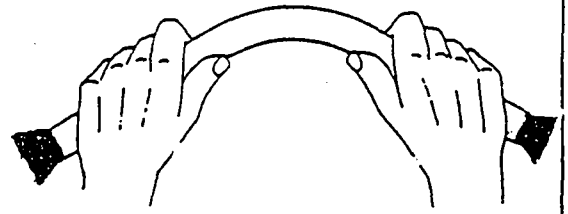
34. One plug is inserted and the pipe filled with dry fine sand. The sand must be well compacted in the pipe. The other plug is fitted and tapped into the end of the pipe to seal it.



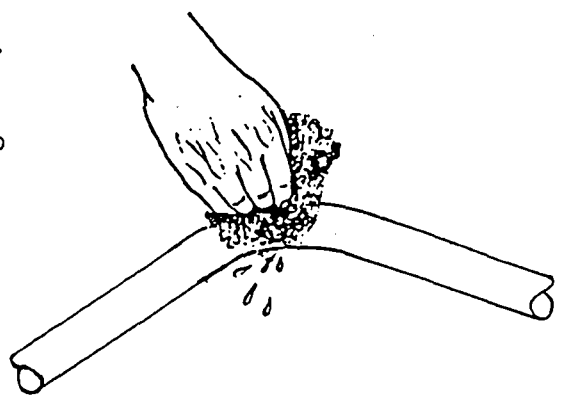
35. A piece of wire or rod is bent to reproduce the required angle. This template or pattern is used to check the accuracy of the angle during bending.



36. Using indirect heat, warm the pipe around the bending marks, until it becomes soft and pliable. Working steadily start forming the bend by hand, using the template to check the accuracy of the bend.

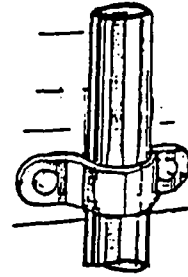


37. Cool the pipe with a wet cloth, remove the plugs and empty out the sand. Wash out the pipe thoroughly. There should be no burn marks, or kinks on the finished bend. Cut to size and install as previously described.

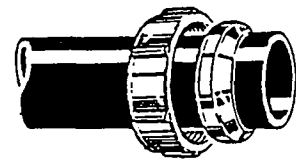




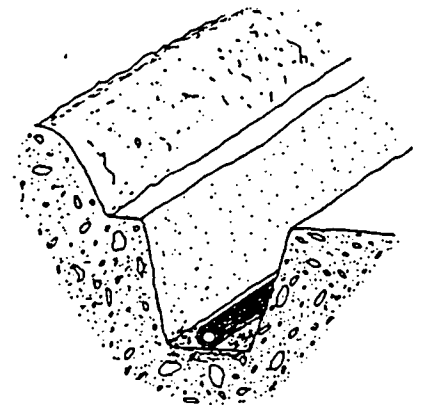
38. Plastic or metal pipe clips which neatly fit the outside diameter of the pipe, should be fitted 1.0 m apart, to support the pipe, preventing it from sagging and putting undue strain on the joints.



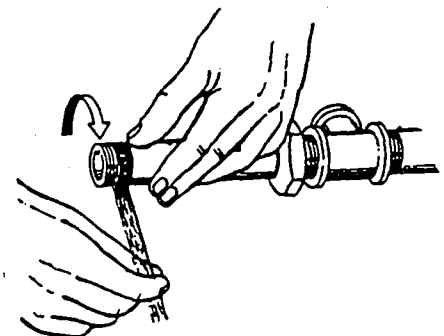
39. Black polyethylene (PE) pipe is more suited to underground pipe work. It is flexible and has thicker pipe walls than PVC.



40. When laying underground services, a trench is dug to a minimum depth of 350 mm. A 50 mm layer of sand is spread uniformly over the bottom of the trench. The pipe is laid, and a further layer of sand is added completely covering the pipe. Soil is used to backfill the trench. The sand prevents sharp stones from damaging the pipe.



41. To join threaded fittings, a white plastic tape known as poly tetra fluoro ethylene (PTFE) is used. The tape should be wrapped around the thread in a clockwise direction.



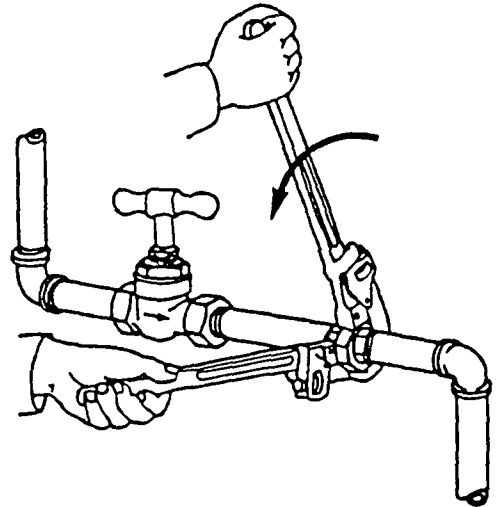


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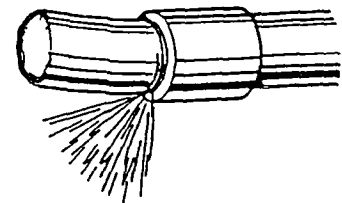
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42. The fitting should be tightened with a spanner, until the fitting is tight and in position. Do not overtighten, as this will cause the fitting to crack.



43. Care must be taken to ensure that the pipe is well protected and not exposed in positions where it could easily be damaged.

44. Slowly turn on the water supply, and carefully check each pipe and the joints for leaks. If there are any, repair them immediately.



45. Glossary of Terms

- pliable - soft and easy to shape
insert - fitting pushed into a pipe end
template - pattern or layout of a bend
indirect - not in direct contact with
flexible - easy to bend
jubilee clip - circular metal strap and screw
adhesive - type of glue
kinks - small ridges around the bend

NOTES

USE THESE SHEETS TO MAKE ADDITIONAL NOTES, CALCULATIONS
OR DRAWINGS.



THIS GUIDE IS ONE OF A SERIES OF BOOKLETS DESIGNED TO SUPPORT PRACTICAL TRAINING FOR THOSE WORKERS ENGAGED IN PROVIDING BASIC WATER SUPPLIES AND SANITATION FOR RURAL COMMUNITIES IN THE PACIFIC REGION.

THE PRINCIPAL AIMS AND OBJECTIVES OF THIS GUIDE ARE:

- ACCURATELY POSITION SANITARY APPLIANCES WITHIN A BUILDING
- SETTING OUT OF PIPE RUNS AND TRANSFERRING MEASUREMENTS
- CORRECTLY INSTALLING PIPE RUNS
- TESTING PIPEWORK FOR SOUNDNESS

EQUIPMENT AND MATERIALS REQUIRED:

- TAPE MEASURE
- SPIRIT LEVEL
- PLUMB BOB
- HAMMER AND COLD CHISEL
- SELECTION OF PIPE BRACKETS
- SELECTION OF PIPE AND FITTINGS
- PROVING PUMP OR AIR PUMP

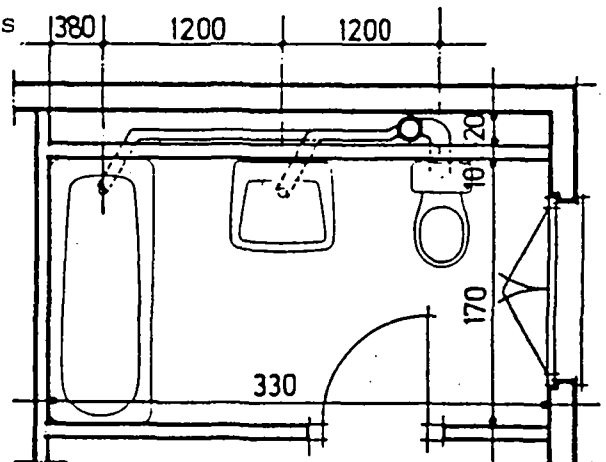


1. Before work can begin on supplying water and sanitary services to any building, careful thought and planning has to be given, as to where to locate the appliances and run the pipework.

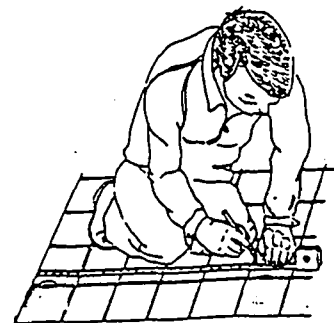


2. If building plans are available, refer to the location of sanitary appliances and scale off the drawings to fix the exact position of such fixtures or appliances as;

- water closet
- wash basin
- shower
- kitchen sink
- bath
- laundry tubs



3. Check the measurements shown on the drawings against the actual space you are working in. If there are any differences in these measurements, consult your supervisor.





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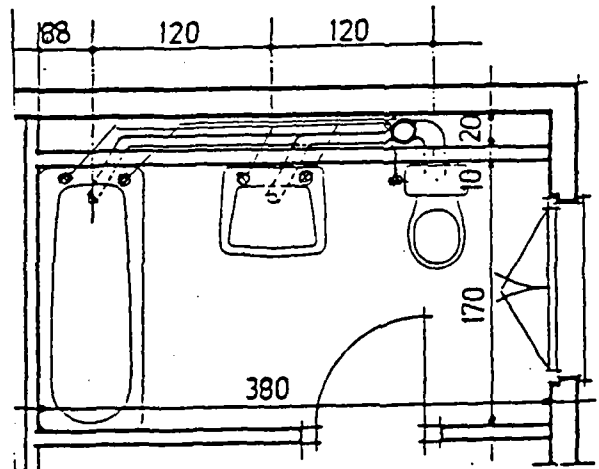
4. If no drawings are available, then consult your supervisor or the home owner as to where the appliances should be installed.



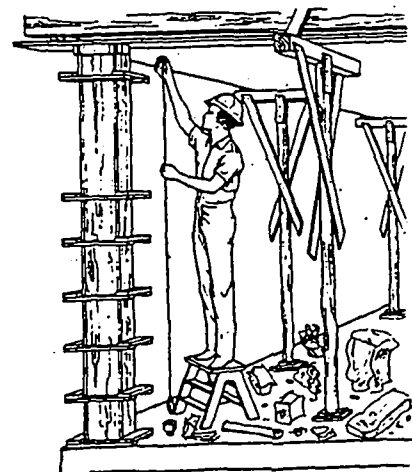
5. This information is needed so that the hot and cold pipework, waste and drainage pipes can be routed around the building in the most effective and economic way.

6. It is important to consider the following when planning the lay out of pipe runs.

- Length of pipes
- Diameter of pipes
- Gradient or fall of pipes
- Access to pipes
- On or below surface fixing of pipes
- Methods of jointing pipes
- Points of connection and discharge of wastes



7. Before beginning to mark out pipe runs, and the position of sanitary appliances, clean out the working area. It is difficult to transfer measurements when the area is covered with builders rubbish.

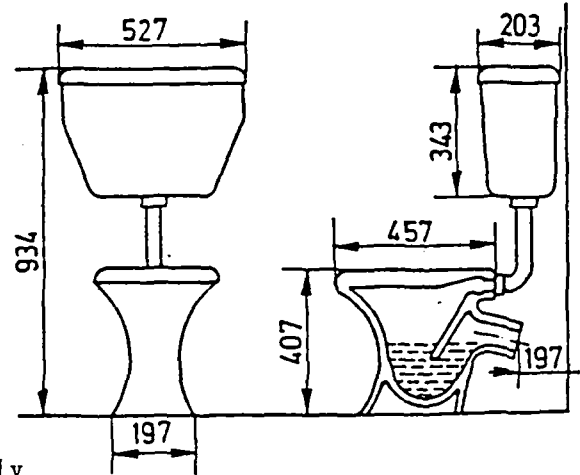




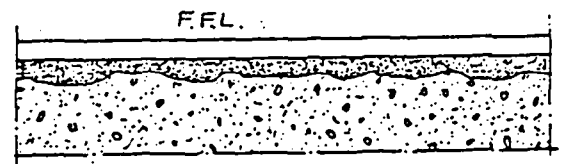
Title: MARKING OUT AND INSTALLING PIPEWORK

8. Manufacturers of sanitary appliances, supply plans and drawing, detailing the dimensions and fixing instructions for appliances.

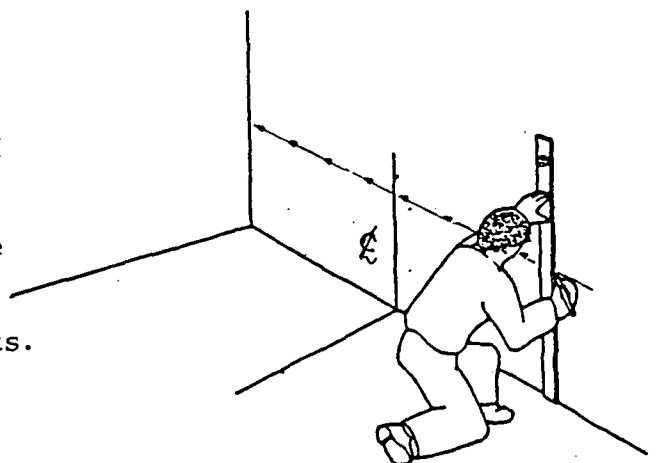
9. Study these instructions carefully, so that the necessary allowances are made to allow the pipework to connect directly to the appliance.



10. Such things as the type and height of the finished floor level, and the thickness of wall finishes should be taken into account. If allowances have not been made then the pipework will not line up properly with the appliances and connections.

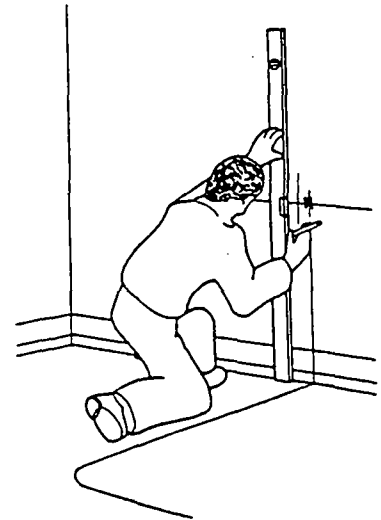


11. Begin marking out on the floors and walls, the centre line of the pipe runs. Check that the pipe runs are not in the way of doors, windows, or other major structural components.

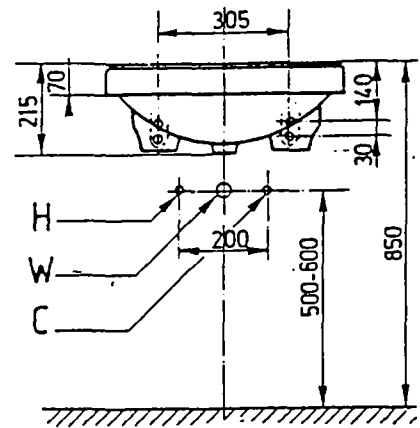




12. Mark out the centre line of the appliance and position of taps and valves. By taking care at this stage it can be readily seen if the proposed pipe run is feasible, or an alternative route must be found.

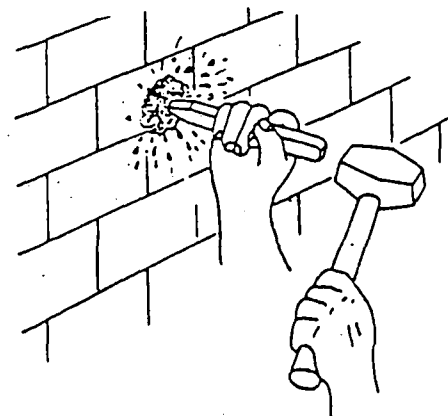


13. If no catalogues or instructions are available to take dimensions from, assemble the sanitary appliance, support it temporarily in position, and carefully measure and mark all the relevant dimensions.



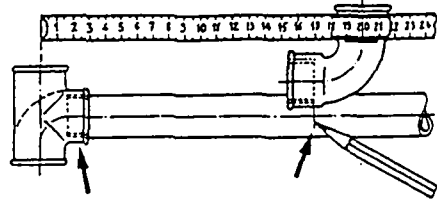
14. Work can now proceed in cutting neat holes through the walls, or grooves along the walls and floor to allow the pipework to be hidden.

15. Sometimes it is not possible to run pipework on the surface. If it has to be buried care must be taken to ensure the pipe and joints are well protected and do not leak.



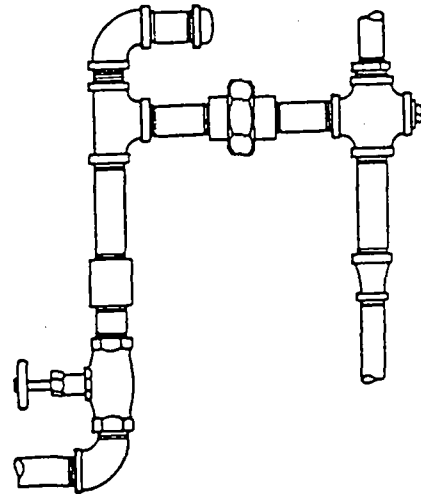


16. Measurements can now be taken for individual lengths of pipe. When measuring the pipe do not forget to allow for the pipe to enter the fitting.



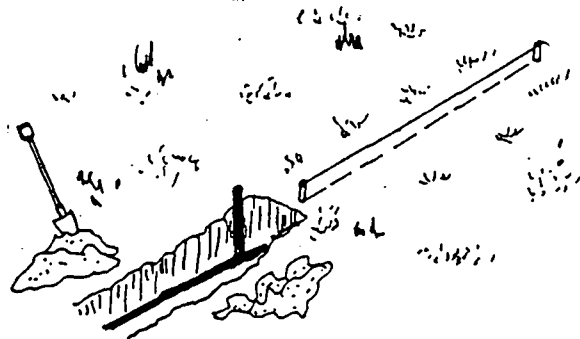
17. Selecting which material to use for a job, depends on a number of factors such as;

- pressure of water supplied
- corrosive nature of the water
- temperature of the water
- location of the pipework
- availability of pipes and fittings
- costs



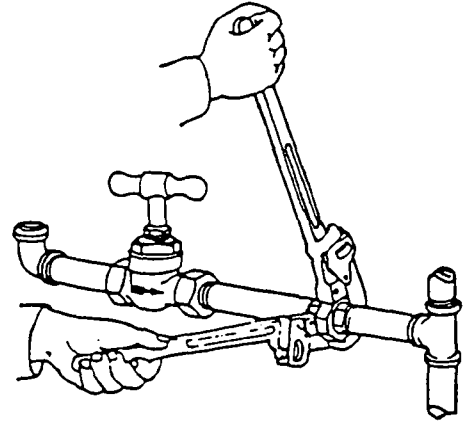
18. PVC is suitable for cold water, low/medium pressure, where the risk of corrosion is high and the pipework can be well protected.

19. PE pipe is suitable for underground cold water services and irrigation systems. The pipework must be well protected.



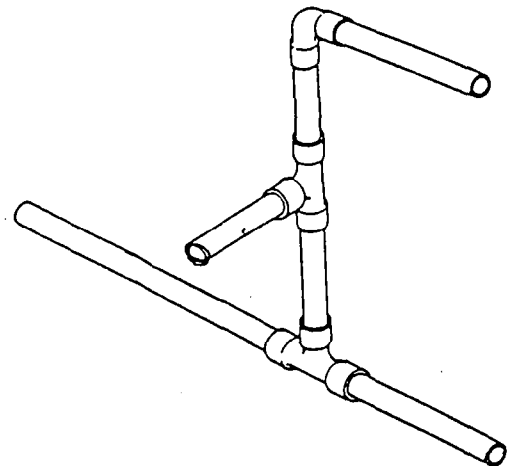


20. Galvanised iron is strong and rigid, and is suitable for hot and cold services though tends to rust, if not looked after. Not easily damaged.

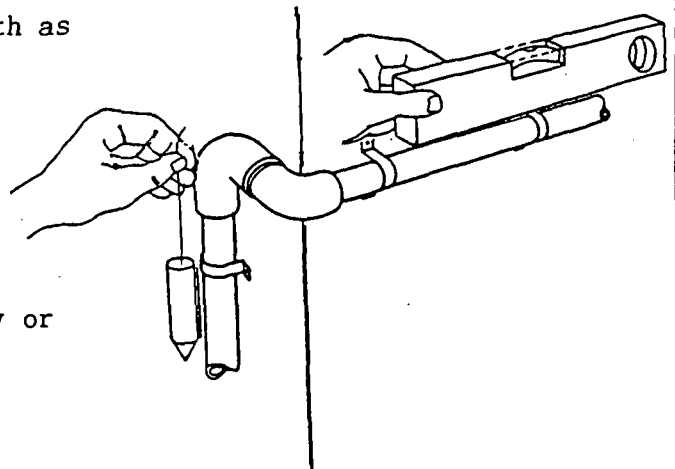


21. Copper is suitable for both hot and cold water supplies. It does not corrode under normal use and is very durable.

22. Whichever material is selected, the techniques and methods used to cut, bend, joint and secure the pipework must be carefully studied and practised.



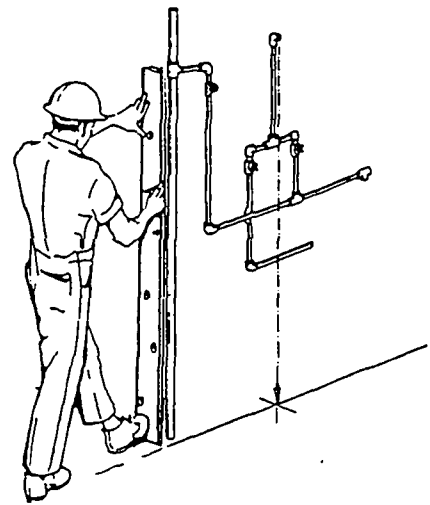
23. Start assembling the pipework from a given point such as a water main or storage tank. The pipes should follow the most direct route with as few bends as possible.



24. Wherever practicable all pipes should be installed horizontally or vertically.

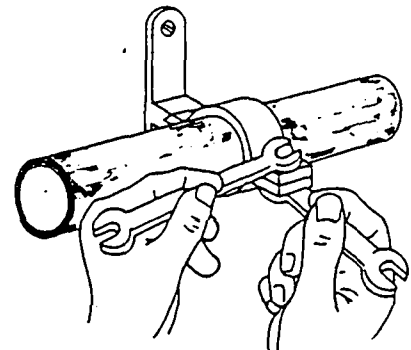


25. A spirit level is used to check whether a pipe is horizontal. A plumb bob or spirit level checks whether the pipe is vertical.



26. With sections of pipework, fittings and valves assembled, they can be installed in the building. In some cases it is easier to prefabricate sections of pipework off the job, and install them later.

27. With all the joints completed, a careful check should be made to see that the pipework is properly secured. Loose pipework cause rattles and water hammer.

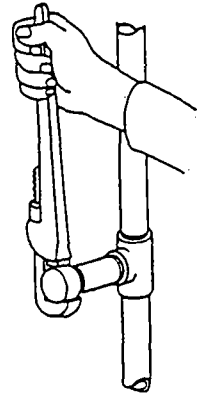


28. A wide variety of clips, brackets and saddles are available and should be used to secure the pipework. For 15 mm PVC pipe, brackets should be fixed every metre along its length.

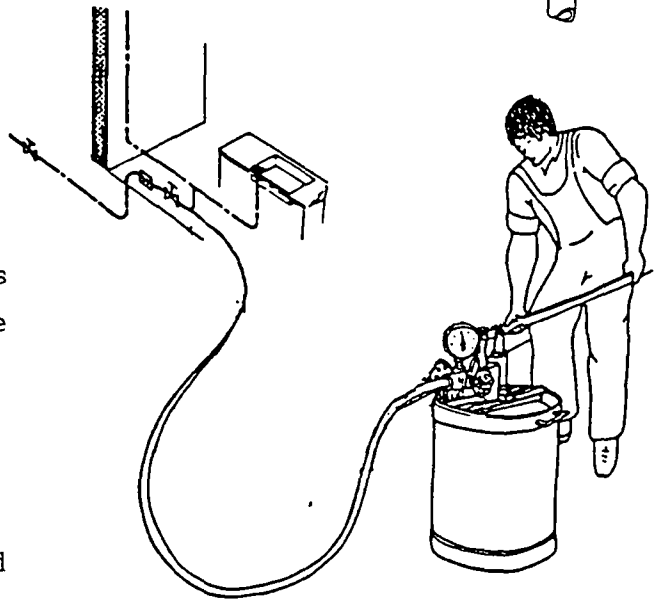




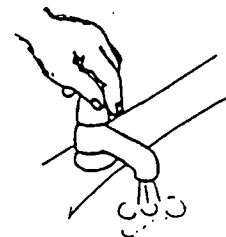
29. With the pipework securely fixed, the system is ready for testing. First close off all taps, and temporarily blank off open ends of pipework.



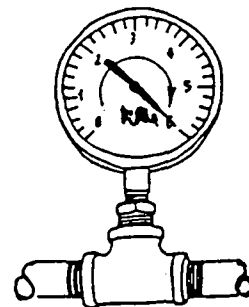
30. For larger installations, a proving pump can be used. The pump outlet is connected to the system, and water from bucket is pumped under pressure around the pipework.



31. Taps and valves should be opened to allow any air within the pipework to escape. Once the pipes are full of water, the handle is pumped to force enough water into the pipework, to raise the pressure to that required.

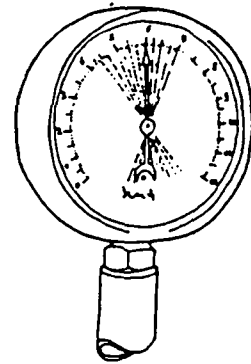


32. Normally the pressure applied is double that of the working pressure. The gauge on the proving pump records the pressure under which the pipework is subjected to.

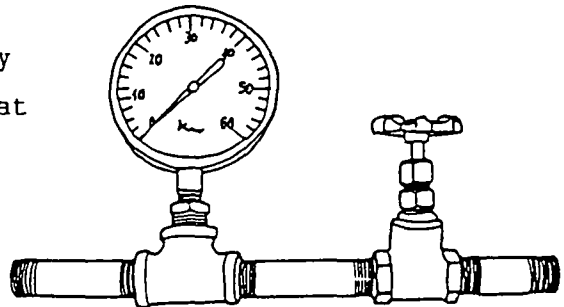




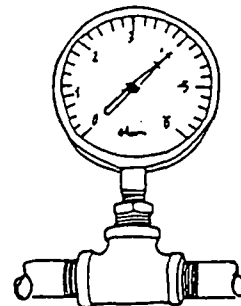
33. If the needle on the gauge is constantly moving back and forth, this indicates that there is air in the pipework. This should be bled off, by opening the tap furthestest away from the pump.



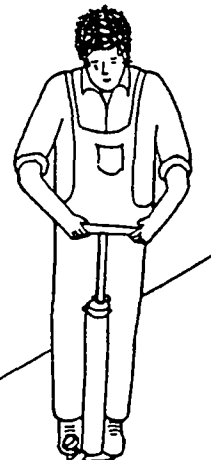
34. Should the needle on the gauge slowly drop back to zero, this indicates that there is a leak somewhere in the system. The leak should be traced and repairs carried out. The pipework should then be retested to ensure it is leakproof.



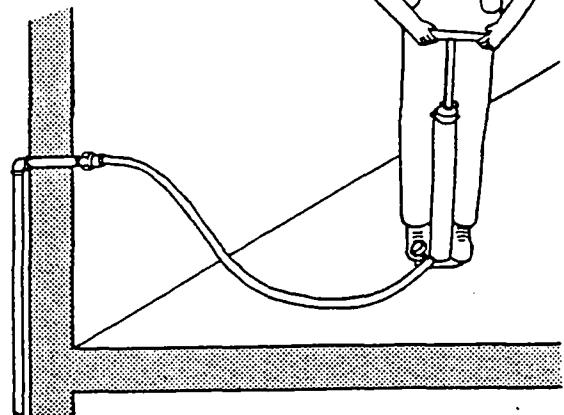
35. If the needle remains constant after 1 hour, this shows that the pipework and joints are sound and the system has successfully passed the test.



36. Another method is to apply an air test. This is done in much the same way as a water test, except that air is pumped into the pipework.



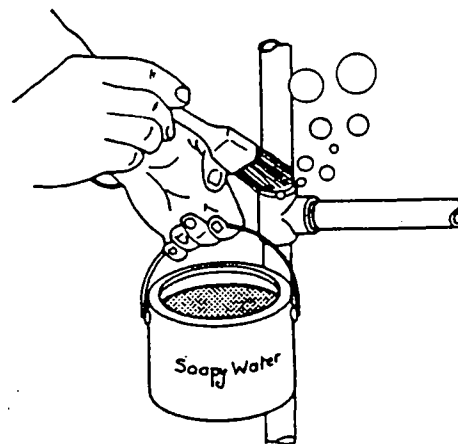
37. When applying an air test, pump the pressure upto 3 times the working pressure of the system.



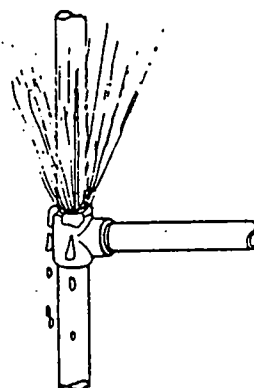


Title: MARKING OUT AND INSTALLING PIPEWORK

38. If the needle on the gauge falls back, check for leaks by using a soapy solution and a small brush. Small bubbles will appear on those joints which leak.



39. Testing a pipe for soundness is important, not only in preventing wastage of water, but in preventing contamination of the water supply.



40. Glossary of Terms

- appliances - sanitary ware, basins, sinks, etc
- corrosive - corrodes or wearing away
- rigid - unbending
- proving pump - hydraulic hand pump
- soap solution - water and liquid soap

NOTES

USE THESE SHEETS TO MAKE ADDITIONAL NOTES, CALCULATIONS
OR DRAWINGS.



Title: SANITARY PLUMBING

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THIS GUIDE IS ONE OF A SERIES OF BOOKLETS DESIGNED TO SUPPORT PRACTICAL TRAINING FOR THOSE WORKERS ENGAGED IN PROVIDING BASIC WATER SUPPLIES AND SANITATION FOR RURAL COMMUNITIES IN THE PACIFIC REGION.

THE PRINCIPAL AIMS AND OBJECTIVES OF THIS GUIDE ARE:

- CORRECTLY IDENTIFYING VARIOUS SANITARY APPLIANCES
- INSTALLING SANITARY APPLIANCES
- CONNECTING WATER SUPPLIES AND WASTE PIPES
- TESTING COMPLETED INSTALLATIONS

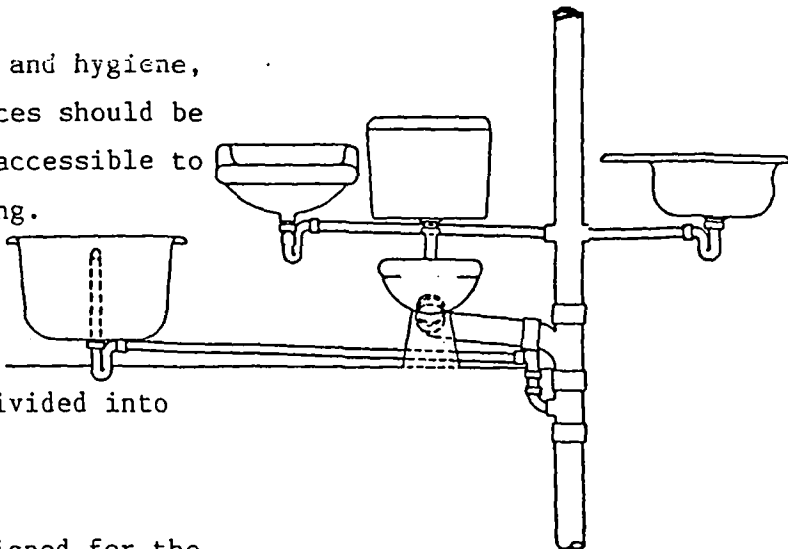
EQUIPMENT AND MATERIALS REQUIRED

- TAPE MEASURE
- INSTALLATION INSTRUCTIONS
- PIPE FITTINGS AND JOINTING MATERIALS
- LEVEL AND PLUMB BOB
- PIPE SPANNERS
- SCREW DRIVER, SELECTION OF SCREWS
- SELECTION OF PIPE CLIPS
- BASIC PLUMBING HAND TOOLS



Title: SANITARY PLUMBING

1. In the interest of health and hygiene, suitable sanitary appliances should be installed, and be freely accessible to the occupants of a building.



2. Sanitary appliances are divided into two groups:

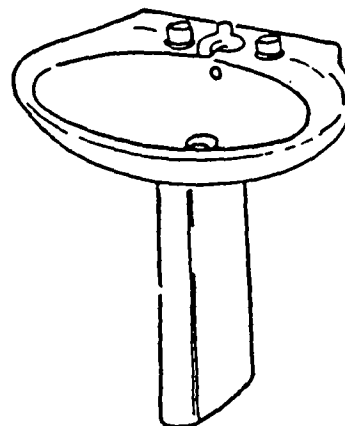
- soil appliances, designed for the collection and discharge of excretory matter, (faeces and urine). Soil appliances include, water closets, urinals and slop hoppers.

The discharge from soil appliances is by way of soil pipes and drains, to areas of treatment such as septic tanks, or sewage treatment plants.



- sanitary waste appliances, designed for the collection and discharge of water used for cooking, washing, bathing and other domestic purposes. Waste appliances include wash basins, sinks, showers, baths, laundry, tubs, drinking fountains, and other specialised equipment.

The discharge from sanitary appliances is by way of waste pipes, and drains, to soakage pits or other approved areas.

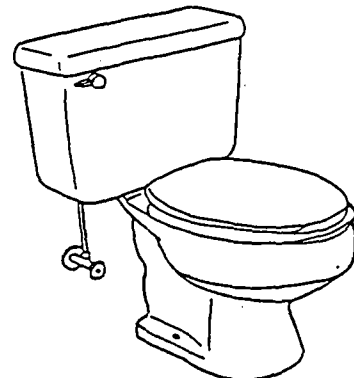




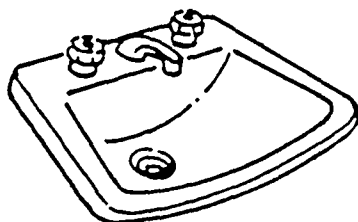
Title: SANITARY PLUMBING

3. Sanitary appliances of various types and designs, made from different materials are illustrated.

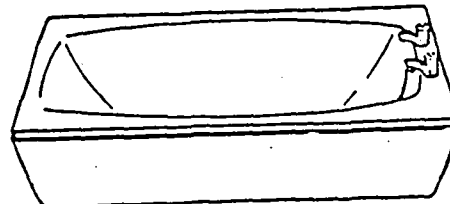
(a) Water closets and flushing cisterns.



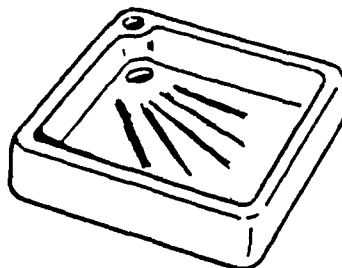
(b) Wash basins



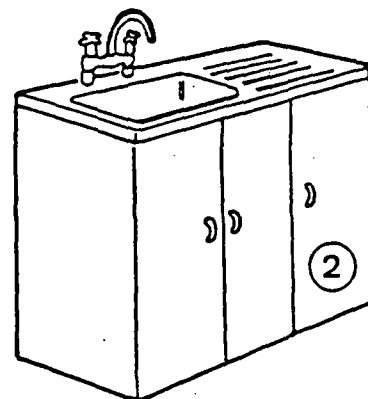
(c) Baths



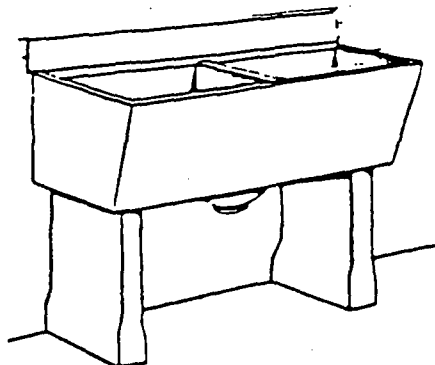
(d) Showers



(e) Sinks



(f) Laundry tubs





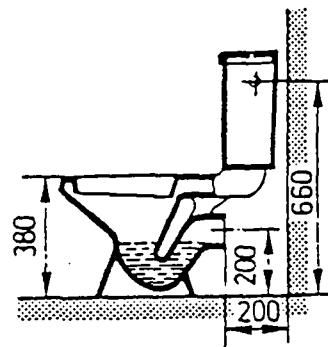
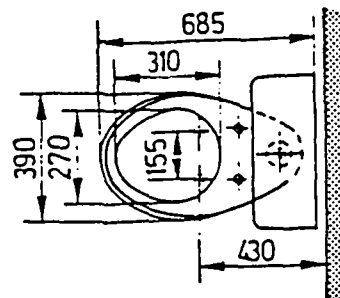
Title: SANITARY PLUMBING

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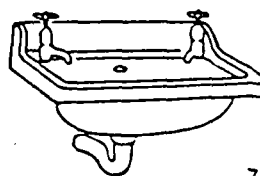
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4. Refer to the manufacturers catalogues for detailed information on:

- methods of assembly and fixing
- height, width and depth of the appliance
- position of pipe connections
- standard height for fixing

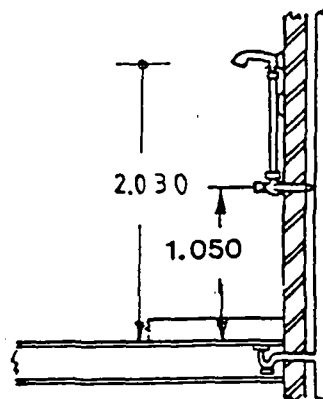


5. Wall or surface mounted wash basins are fixed at a height of between 78 cm and 86 cm. While sinks should be fixed to a height of 92 cm.

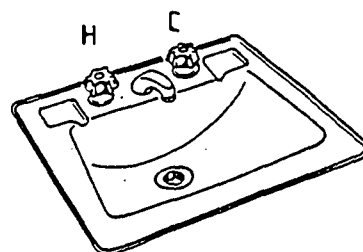


6. Wash basins and sinks are generally supported on brackets, or built into the top of wooden cabinets.

7. For showers, the height of the shower rose should be 203 cm above floor level. With the height of the taps at 105 cm.

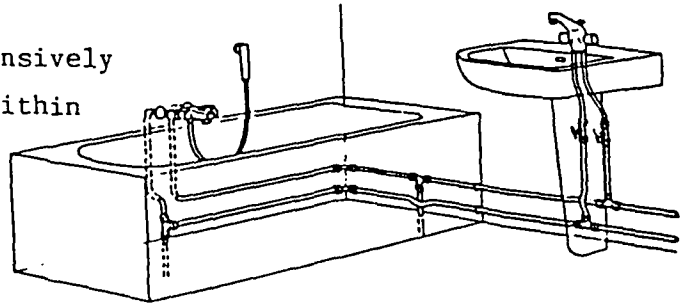


8. For uniformity, all cold taps should be fitted on the right hand side, and hot taps on the left hand side of the appliance, when viewed from the front.

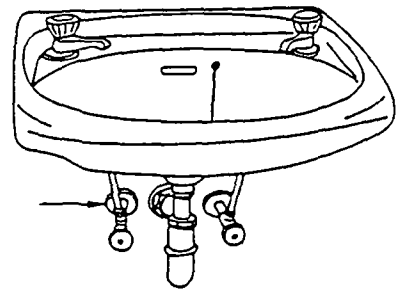




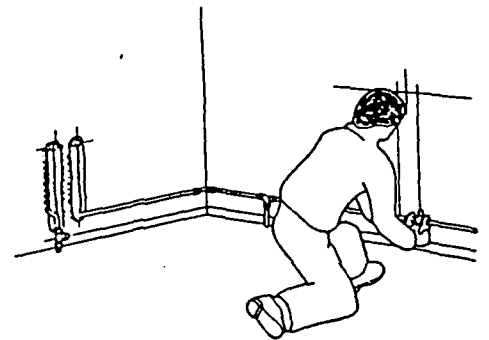
9. Copper or PVC pipework is used extensively for hot and cold water services within a building.



10. Stopcocks and gatevalves should be installed within the system, to turn off branch lines, and those appliances which require regular servicing or maintenance.

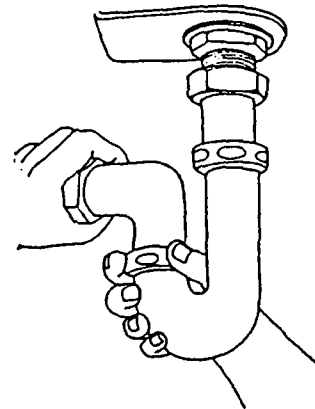


11. Tap connectors, which have a union nut on one end, are used to connect the pipework to the appliance.



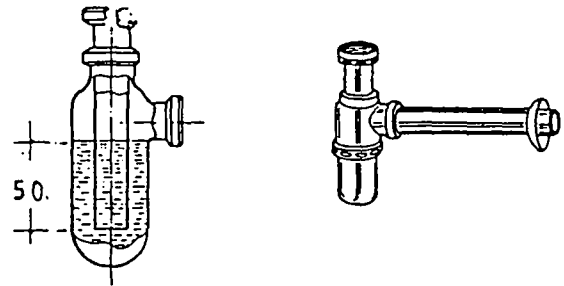
12. Pipework to sanitary appliances should be installed as neatly as possible. Avoid unsightly on surface pipe runs.

13. Waste pipes from sanitary appliances should be connected to the drainage system. To prevent foul gases from entering the building, a TRAP is used.

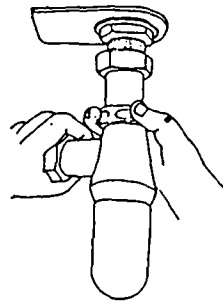




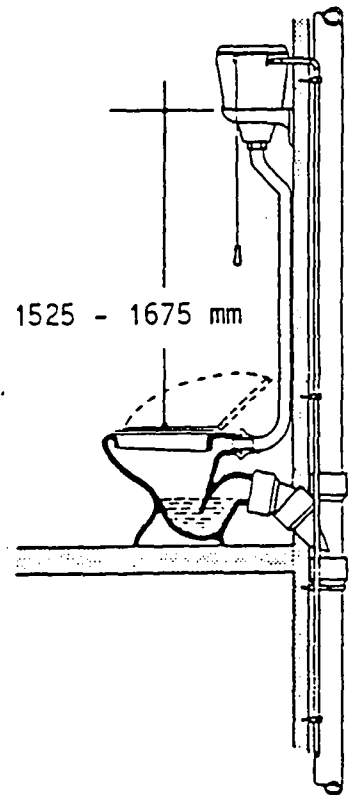
14. A trap is designed to retain a small quantity of water, which forms a barrier stopping the foul air from gaining access to the room.



15. Traps should be connected directly to the outlet of the appliance, preventing such problems as syphonage from occurring.

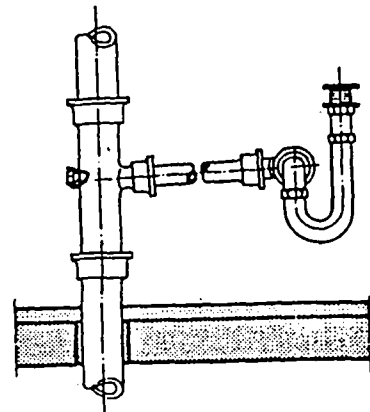


16. Soil fixtures do not require additional trapping. Appliances such as water closets (WCs) already have them built in.



17. Waste pipes should be as short as possible, having a gradual fall towards the point of discharge.

18. The number of bends should be kept to a minimum. Where changes of direction occur, access fittings should be installed. Plugs on the fittings can be unscrewed, and cleaning rods inserted into the waste pipes to unblock them.



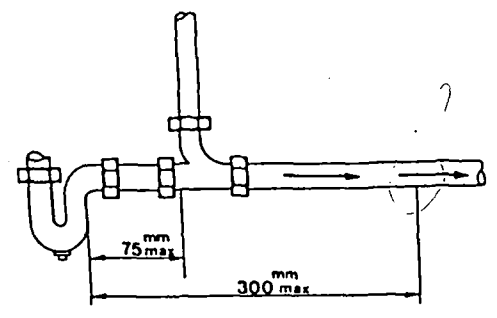


Title: SANITARY PLUMBING

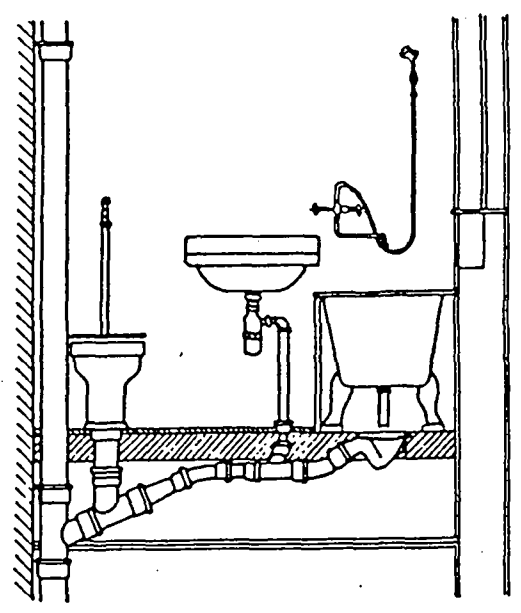
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19. If a number of appliances are connected to a common waste, then the system will need back venting. This is necessary to prevent syphonage, causing the loss of the water seal from the trap and entry of foul air into the building.



20. After completing the installation, turn on the water, and carefully check each joint to see that it is not leaking. Test each waste pipe, by filling the appliance with water, and emptying it. The water seal in the trap should be retained under normal operating conditions.



Clean up leaving everything neat and tidy!

Glossary of terms

- appliances - sanitary ware
- excreta - body waste
- barrier - obstacle
- syphonage - drawing water out
- access - opening into
- venting - balancing air pressure

NOTES

USE THESE SHEETS TO MAKE ADDITIONAL NOTES, CALCULATIONS
OR DRAWINGS.



Title: REPAIRING TAPS AND VALVES

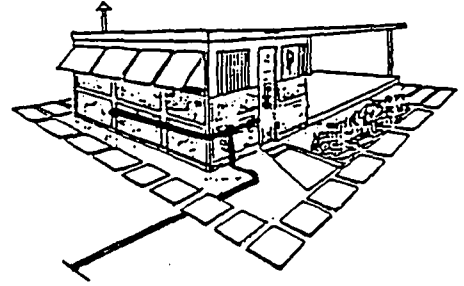
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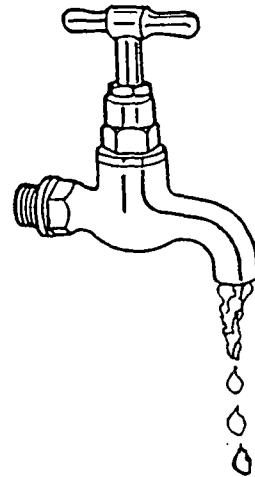
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1. In many areas throughout the Pacific, the provision of adequate supplies of potable water remains a problem. Water is a vital resource and should not be wasted. Service and maintain all taps and valves regularly. If they leak, repair or replace them as soon as possible.



2. As an example, one defective tap which leaks to the extent where a stream of water breaks into drops, will waste 91 litres of water a day or 2,650 litres in one month. This increases to a staggering 31,800 litres a year.

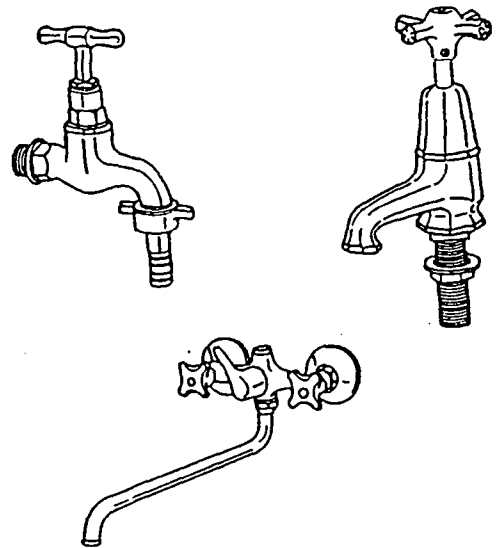


3. This quantity would be sufficient to cover the basic requirements and needs of two people for a whole year.



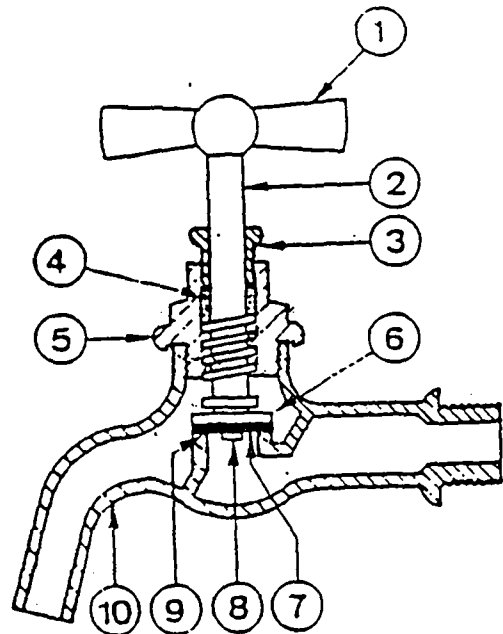


4. Taps and valves are used on water installations to control the flow. Many different types and patterns of screw down water taps are available, but they all basically work on the same principle, as such the repair procedures are similar.



5. The illustration shows the internal parts of a common screw down tap.

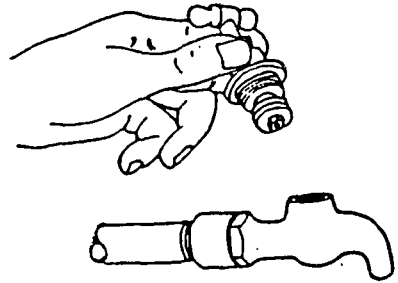
- 1) key, handle or crutch
- 2) spindle or shaft
- 3) gland nut
- 4) stuffing box or packing
- 5) bonnet or cover
- 6) jumper or washer disk
- 7) washer either rubber, leather, fibre or plastic
- 8) washer nut
- 9) valve seat
- 10) tap body



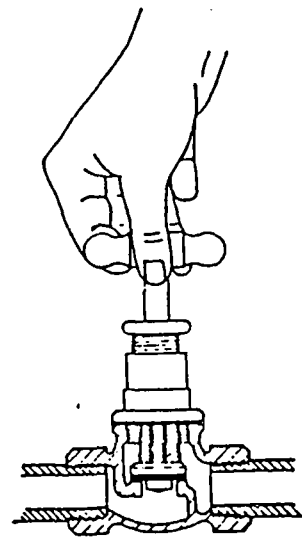


Title: REPAIRING TAPS AND VALVES

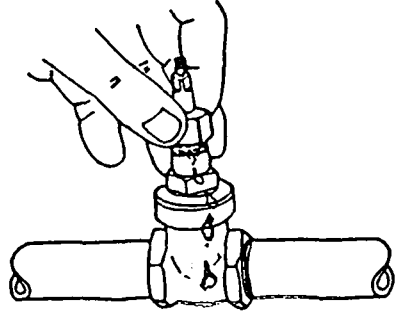
6. Primarily a tap has two main parts. The body and the shaft. Usually if a tap leaks it is either caused by a worn out washer, or leaking spindle.



7. When a tap is screwed down, the washer is squeezed between two metal surfaces, which stops the flow of water through the tap. However, if the washer is old and worn out, water will leak from the tap. With badly worn washers the leak can be considerable.



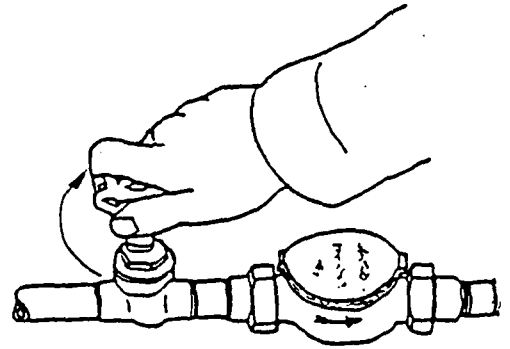
8. Water leaking from around the spindle and gland nut is caused by worn out packing. Asbestos string, or hemp, with a soft graphite grease is used to make a new packing. When the gland nut is tightened the packing is compressed making the joint watertight.





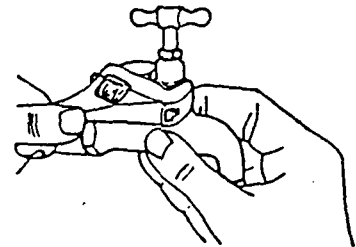
Title: REPAIRING TAPS AND VALVES

9. When repairing a tap, shut off the water at the main, or at a point which will isolate the tap to be repaired from the rest of the system.

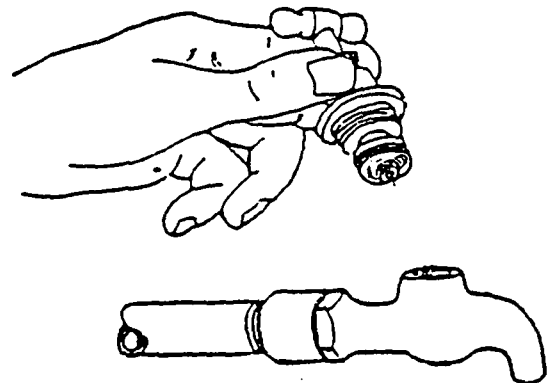


10. After turning off the water supply, fully open the tap that has to be repaired, to drain out any water in the pipe.

11. Unscrew the bonnet from the body using an adjustable spanner. Taking care not damage the pipe.



12. With the bonnet now loose, completely unscrew and remove the shaft. The jumper and washer can now be removed from the spindle.



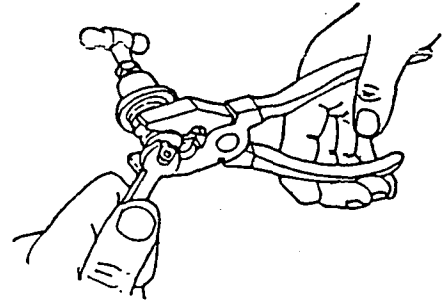


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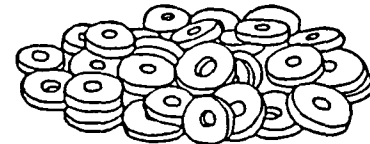
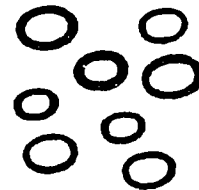
13. Hold the jumper with a pair of pliers and unscrew the small nut underneath the washer with a spanner.



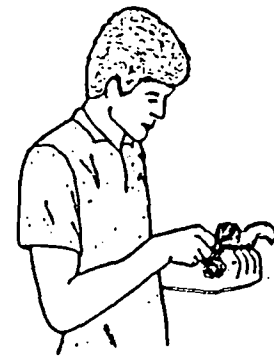
14. Remove the washer from its seating. Check the size and type of the worn out washer and replace it with a new one.



15. For cold water taps, the washer should be vulcanised rubber, leather or plastic (neoprine). Ordinary rubber should not be used, as it is not hard enough. For hot water taps, washers should be of red fibre as this material will withstand the heat.



16. With the tap dismantled, carefully examine the seat of the tap. If it is smooth and shiny in appearance, without any grooves or ridges, the tap can be reassembled in the reverse order it was taken apart.



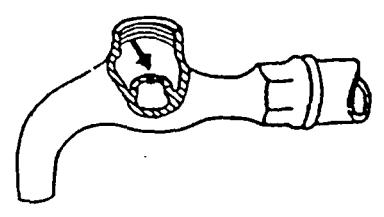


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17. If the seat shows signs of wear or damage it will have to be re-cut. To do this a reseating tool is used.



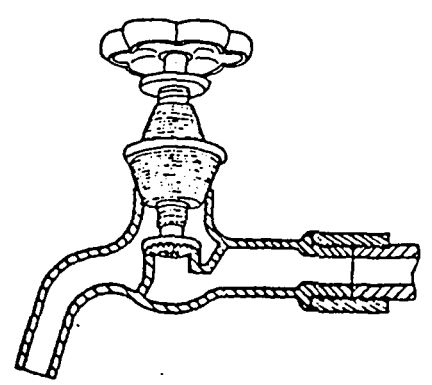
18. A reseating tool has a cone shaped threaded body, which will fit most sizes of taps.



19. Through the centre of the body is a hole into which the cutter shaft is fitted. Depending on the tap size, a suitable sized cutter is screwed onto the shaft. Fixed to the other end of the shaft is a turning handle, and feed screw adjuster.



20. Select the appropriate size of cutter, and screw it to the shaft. Slacken off the screw adjuster and insert the body of the reseating tool into the tap and tighten it finger tight.



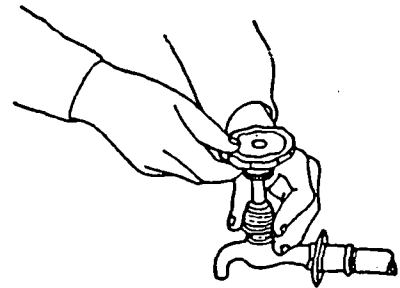


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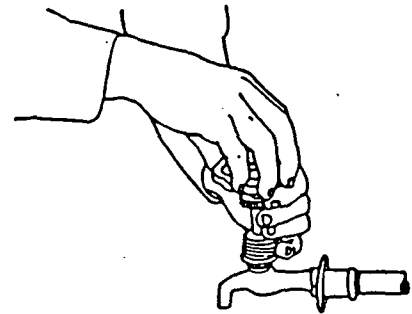
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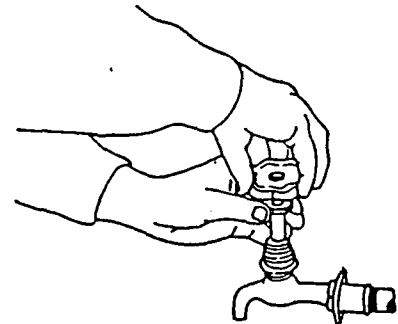
21. Hold the handle steady and turn the feed screw adjuster clockwise, until you feel the cutter just touching the seat of the tap.



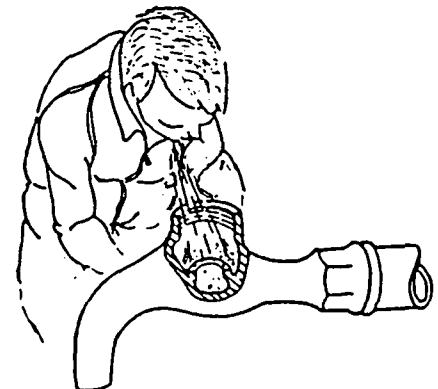
22. Holding the feed screw, slowly turn the cutter handle clockwise. You will feel the cutter skimming off the surface of the seat. Keep turning until no more resistance is felt from the cutter.



23. Tighten the feed screw a fraction and repeat the process. It is important not to overtighten the feed screw, as the cutter blades will jam into the seat damaging it.



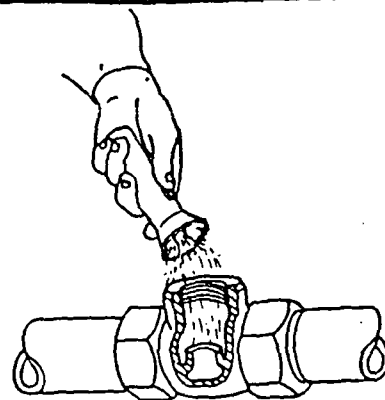
24. Unscrew the adjuster and then the body from the tap. Blow out any metal particles in the tap. Do not put your finger into the tap seat, as you could receive a nasty cut.



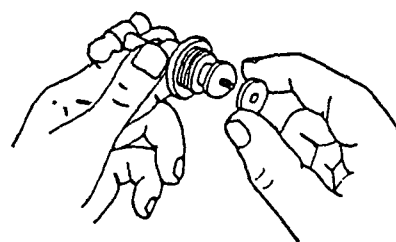


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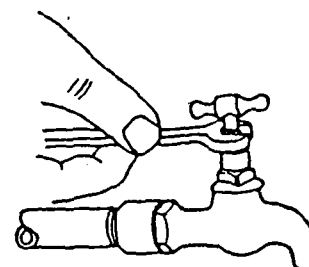
25. Using a flashlight, carefully inspect the seat. The seat should have a bright polished look about it, with no cuts or blemishes on the surface.



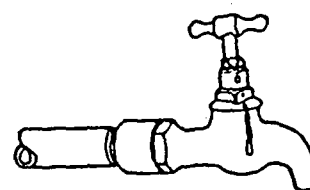
26. Fit a new washer and reassemble the tap, making sure that the thin fibre washer under the bonnet is in place and not damaged in any way.



27. Water can also leak from around the spindle. If the leak is minor, carefully tighten the gland nut to compress the packing around the spindle. Do not overtighten, as it will be difficult to open and close the tap.

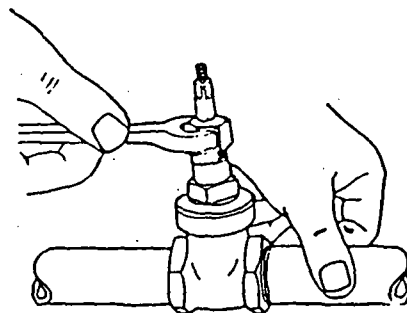


28. If water continues to leak from around the spindle, the old packing or sealing ring will have to be removed and replaced.

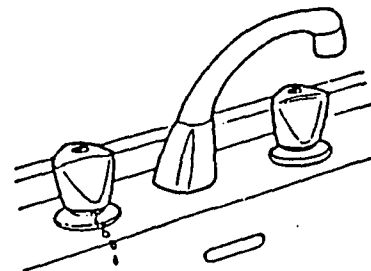




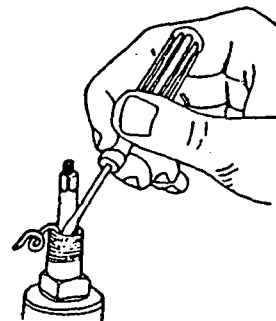
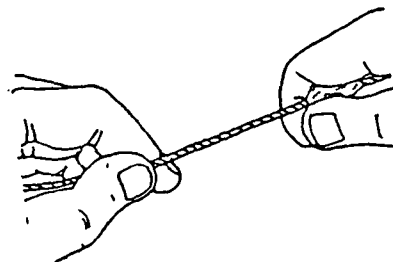
29. With a spanner, slacken off the gland nut. Lift the gland nut clear of the bonnet. Using a sharp pointed tool pick out the old packing material from around the spindle.



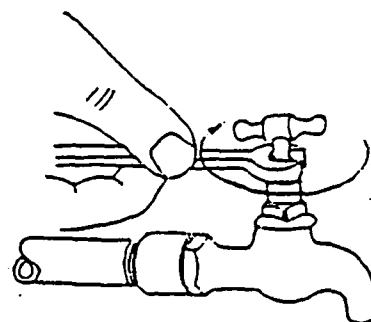
30. If fitting a new "O" ring it will be necessary to remove the tap handle, to slide the new ring down around the spindle.



31. Cut a short piece of asbestos string, or yarn, to make a new packing. Smear it with water pump grease, petroleum jelly or graphite. Do not use ordinary oils or grease as they could contaminate the water and are quickly dispersed.

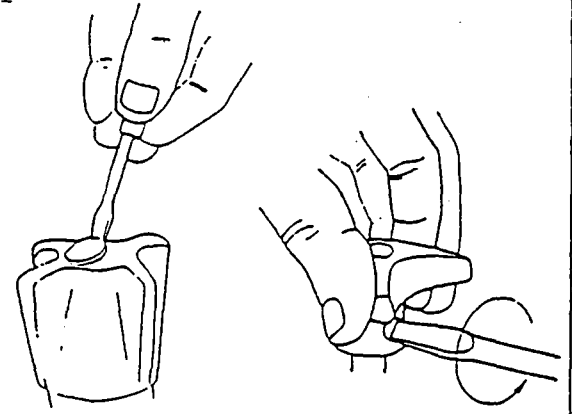
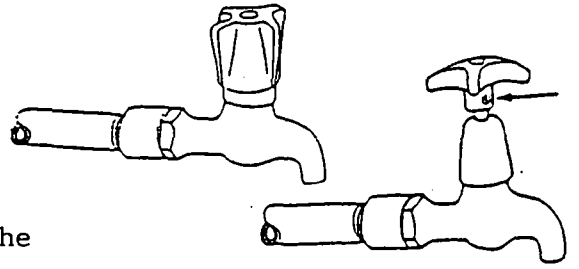


32. Coil the new packing around the spindle, and push it down with the blade of a small screwdriver. Tighten the gland nut sufficiently to stop water from flowing out around the spindle.

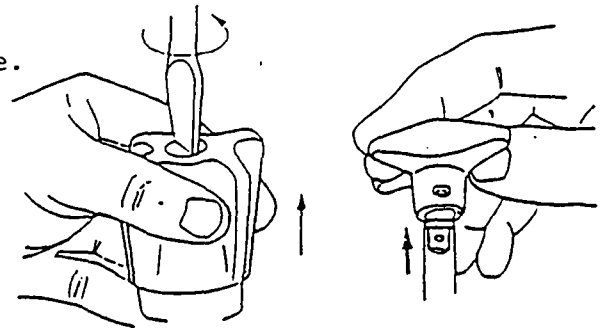




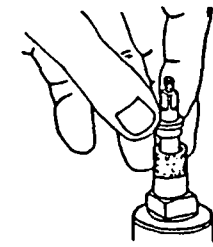
33. In removing the handle from a tap, first carefully check to see how the handle is secured. On some types of taps, a small grub screw is used to hold the handle in place. It could be located under a small button on top of the handle, or on the side of the tap handle.



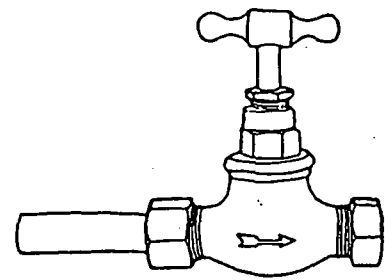
34. Remove the grub screw, and using minimum force pull the handle off the spindle. It may require a gentle knock with a piece of wood to free it from the spindle. Do not use excessive force, as this could damage the appliance and pipework.



35. With the handle removed, the bonnet can be unscrewed, revealing the gland nut and the joint between the upper and lower part of the tap body.



36. When installing stopcocks make sure that the arrow stamped on the side of the stopcock is pointing in the direction of the flow.



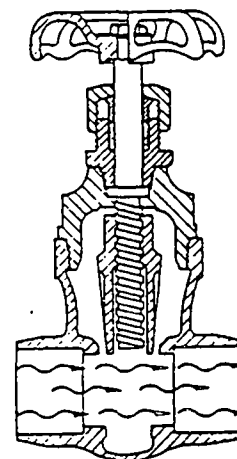


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37. If no arrow is visible, open the stopcock and blow through it. The side which is easy to blow through is the inlet side.

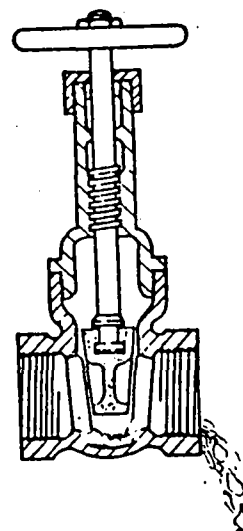


38. Gatevalves do not have a jumper and washer. Instead a gate or wedge shaped disk is screwed down into the body of the valve cutting off the flow.



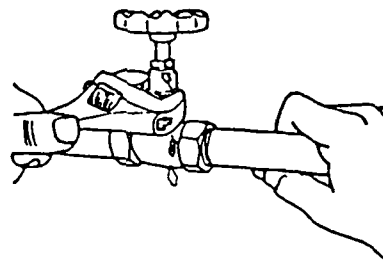
39. Gatevalves can be positioned in any direction and the rate of flow can be better regulated, than through stopcocks.

40. If the sliding gate is damaged, either by over stressing, or excessive wear caused by abrasion, to the point where the flow through the valve cannot be stopped, then the valve should be replaced.

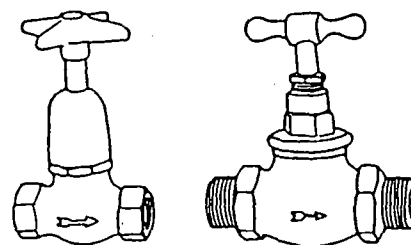
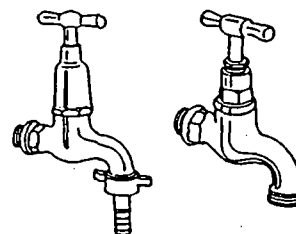




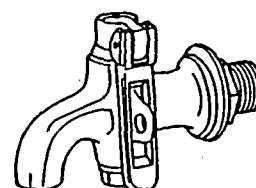
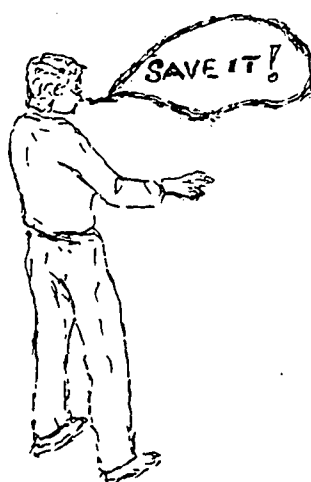
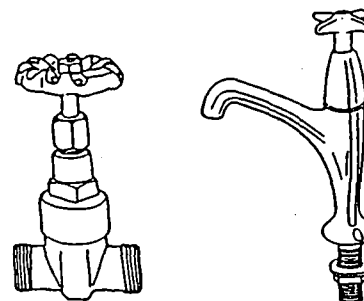
41. If water is leaking from around the spindle, the gland nut should be unscrewed and the old packing removed, and replaced as described in para 31.



42. Of the many types, designs and sizes of taps and valves found in plumbing installations throughout the Pacific. All without exception require periodic maintenance and servicing. This could be a simple rewashing or repacking job, or a more complex one of stripping down the tap, reseating it and replacing any worn parts.



43. Remember, conserve water by not wasting it. Repair leaking taps, valves, pipes and joints, as soon as possible. By doing this much can be done to conserve a vital resource.



NOTES

USE THESE SHEETS TO MAKE ADDITIONAL NOTES, CALCULATIONS
OR DRAWINGS.
