TVET CERTIFICATE III In PLUMBING

MAINTENANCE OF TOOLS, EQUIPMENTAND SYSTEMS

CSTES301

Use embroidery materials, tools and equipment

Competence

Credits: 3

Learning hours: 70

Sector: 5

Sector: Construction

Sub-sector: Domestic Plumbing

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Purpose statement

This module describes knowledge and skills required to use embroidery materials, tools and equipment. It describes the skills, knowledge and attitudes required for the trainee to repair tools and equipment and maintain domestic plumbing and appliances and equipment.

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Learning Unit 1 – Repair tools and equipment

LO 1.1 – Report any defect on tools and equipment to the responsible

- **Content/Topic 1 : Troubleshooting of tools and equipment defects**

Definitions:

1) Troubleshooting:

is a form of problem solving, often applied to repair failed products or processes on a machine or a system. It is a logical, systematic search for the source of a problem in order to solve it, and make the product or process operational again. **Troubleshooting** is needed to identify the symptoms.

Troubleshooting: is a systematic approach to problem solving that is often used to find and correct issues with complex machines, electronics, computers and software systems.
The first step in troubleshooting is gathering information on the issue, such as an undesired behavior or a lack of expected functionality. Other important information includes related symptoms and special circumstances that may be required to reproduce the issue.

Once the issue and how to reproduce it are understood, the next step might be to eliminate unnecessary components in the system and verify that the issue persists, to rule out incompatibility and third-party causes. Continuing, assuming the issue remains, one might next check common causes. Depending on the particular issue and the troubleshooter's experience, they may have some ideas.

After common causes are ruled out, the troubleshooter may resort to the more systematic and logical process of verifying the expected function of parts of a system. One common method is the split-half troubleshooting approach: With a problem resulting from a number of possible parts in series, one tests half-way down the line of components. If the middle component works, one goes to the middle of the remaining parts, approaching the end. If the test finds a problem at the mid-point, one does a split towards the start of the line until the problem part is found. The split-half process can save time in systems that depend on many components.

Once the problem part is identified, it may be adjusted, repaired or replaced as needed. Evidence of effective troubleshooting is indicated when the issue is no longer reproducible and function is restored one.

The success of troubleshooting often depends on the thoroughness and experience of the troubleshooter. That said, the majority of those who develop tech savvy are likely to have friends, coworkers and family who call on them for help.

Troubleshooting of pipes.

Figure1

Figure 2

Figure3

TROUBLESHOOTING CHECKLIST

- ☐ Run both taps in the bathtub. While the water is running, turn on the tap in the sink. If the water running in the bathtub slows down, there is a water pressure problem that could be the result of blocked pipes.

- ☐ If the water runs reddish, rust corrosion is present.

- ☐ If the water is used often, and there is no discoloration, try one of the following methods to determine if rust is present:

  - Flush the toilet. If rust particles settle on the bottom of the bowl, the corrosion problem is in the cold pipes.

  - Fill the sink with hot water. If particles settle at the drain, the corrosion is on the hot water side.

- ☐ Check for soft areas or flaking on the outside of the pipes.

- **Content/Topic 2 : DEFECTIVE TOOLS**

It can cause serious and painful injuries. If a tool is defective in some way, do not use it. If tools and equipment are defective, attach an Out of Service tag with signature and date. Upon proof of repairs (a receipt), the tag will be removed and attached to the invoice for continuous monitoring of repairs dates completed.

HAND TOOLS

Watch for problems like:

- Chisels and wedges with mushroomed heads.
- Split or cracked handles.
- Chipped or broken drill bits.
- Wrenches with worn out jaws.
- Tools that is not complete, such as files without handles.

A) To ensure safe use of hand tools, do not use a defective tool, inspect tools prior to use and verify that tools are repaired. AIR, GAS OR ELECTRIC POWER TOOLS

Watch for problems like:

- Broken or inoperative guards.
- Insufficient or improper grounding due to damage on double insulated tools.
- No ground wire (on plug) or cords of standard tools.
- The on / off switch not in good working order.
- Tool blade is cracked.
- The wrong grinder wheel is being used. The guard has been wedged back on a power saw.

B) From leaking taps to blocked pipes, plumbing mishaps can wreak havoc on your home. Before you reach for the phone, try our handy toolkit of DIY fixes

There's nothing that strikes dread into a homeowner's heart like a leaking pipe or a mystery pool of water on the floor.

Plumbing issues can seem scary, with emergency call-out fees racking up staggering bills, but there are a number of steps you can take to solve the problem before you call in the professionals.

Here's what to do if you encounter one of these common household plumbing problems in your property...

C) First things first

As with any kind of DIY work, the key is to prepare rather than panic, which is easier said than done when faced with unwanted water.

If water is coming into your home from a suspected burst pipe or another mystery source, the first thing you must do is turn off the electricity supply at the fuse box.

Next, you'll need to turn off the mains water supply. Shut-off valves are usually located in the basement,

near the water meter or on an outside wall where the water supply enters your house.

Next, equip yourself with a decent set of tools, which should include a basin wrench, pipe wrench, cranked spanner, pipe repair clamp, plunger and drain rods.

Wear something you don't mind getting wet or dirty and make sure you have the contact details of an emergency plumber to hand, just in case.

D) How to fix a blocked drain

If you're having issues flushing the toilet, your bath just won't drain or water is coming back up into the sink, you may have a blocked drain on your hands.

In the most straightforward cases, simply cleaning the problem area and removing any obvious obstructions may help, but the issue may well be somewhere you can't see. Investigate the issue further by lifting manhole covers or probing external drain pipes – also known as gullies.

This might be a dirty job so wear rubber gloves and equip yourself with a drain rod with a plunger at the end to help you dislodge whatever is causing the blockage.

Be sure to turn your rod clockwise as you work – if you turn it anticlockwise, it may unscrew and get caught in the drain, which can lead to another problem you don't need.

Push against the obstruction before attempting to remove it a little with the plunger. If this doesn't work, take the plunger off the end of your rod and put a corkscrew attachment on instead to break up the obstruction.

Finish the clearance by directing a hosepipe down the drain to flush any debris out or fill the sink or bath and release the water in one go.

E) How to fix a leaking pipe

If a pipe has burst, you can use a pipe repair clamp as a temporary solution. The clamp can either be screwed on or simply clamped over the burst area.

Alternatively, you could apply self-fusing repair tape. To do this, remove any grime or dirt from the pipe, cut around 20cm of tape and remove its backing.

Stretch it to around double its length and wrap around the pipe as quickly as possible, making sure you leave the hole in the pipe open initially, wrapping the tape around either side of it first, before finally covering it.

For a long-term solution, you could try burst pipe coupling, provided the damaged section is no longer than 50mm or a push-fit pipe repair kit which requires no specialist tools.

Failing that, you may need to insert a new section of pipe – a task best left to the professionals if you're a novice.

F) How to unblock a toilet

If water is taking a while to drain from the toilet bowl or the water level rises when you flush, you know you've got a blockage.

While this is the one job we'd all rather not have to sort out, once you know how, it's much easier to remedy than you might think. Arm yourself with a few essentials: rubber gloves, a plunger, bleach or drain unblocker and old newspaper to place around the toilet for any mess.

Next, you need to locate the blockage and remove it. This could be as simple as reaching in with your rubber gloves and removing something that may have fallen in, or getting the plunger out.

It's a good idea to run the plunger under hot water first to soften it up and then place it over the outlet in the bowl so water can't pass. If you don't have a plunger, you can use a wire coat hanger instead. Unwind it, push it into the toilet and, hopefully, you can break up the obstruction. Don't attempt this if you have a flexible flush pipe as you could seriously damage it.

Specialist drain rods can be used to dislodge blockages in pipes, but if you still have no luck it might be time to call in a drainage company.

G) How to stop a dripping tap

Excruciating on the ear as well as your water bill, dripping taps can cause erosion in baths and sinks, and even lead to damp.

How to fix your tap depends on whether it uses washers or ceramic discs. Not sure? Give your tap a turn, if it only turns a quarter or a half, it's probably got a ceramic fitting inside, while if it turns further, you're most likely dealing with washers.

Once you have a replacement washer or ceramic disc, you'll need to take the taps apart. Before you do so, put the plug in the sink to prevent screws or other parts from falling down the sink.

You'll need to loosen the screws to replace the worn parts – they're usually hidden underneath the decorative hot and cold caps on top of the tap, or under the hot and cold indicator on single-lever taps, and you'll need to lift off the tap head too. With the tap disassembled, loosen the valve with a spanner and replace the washer or ceramic disc and then put it all back together.

If after all that there's still a leak, check the O-ring seal for signs of wear and tear as this may need replacing.

H) How to improve low water pressure

When you experience sudden low water pressure, you should check whether there have been any incidents in your area or if any of your neighbors are having problems. If not, you know it has something to do with the plumbing inside your home.

Sometimes it can be as straightforward as making sure the shut-off valves near the water meter are fully open, but you might want to check for frozen pipes or blocked drains too.

If the problem is ongoing you can ask your water supplier to do a water pressure test. Or a pressure gauge from a DIY shop will let you check it yourself – as a measure, an average residential reading is between 30 to 60 psi.

If it’s simply a case of the way the plumbing in your home is designed, you could consider getting a water pressure booster system.

I) How to fix a running toilet

If water continues to run into your toilet bowl after flushing, the first thing you should do is lift the lid off the cistern and examine what the issue may be.

Firstly, with the lid off, flush the toilet and check the water level. If it’s below the water line then check the water valve is turned fully on.

If that’s not the issue, is the flapper valve sticking open and not covering the valve? If this is the case, simply reach into the tank and close it to solve the issue.

Still not found the problem? Locate the fill/float valve and lower it. This should lower the water level in the cistern, preventing it from getting too high and consequently stopping that running toilet.

J) Preventing future plumbing problems

Once your plumbing problems have been resolved, double-check that nearby sockets, switches and electric equipment are dry. Don’t turn the power back on until they are completely dry.

Make sure everyone in your home knows where the valves for your plumbing system are and check them every couple of months to ensure they can be turned on and off with ease. If not, apply a little penetrating oil to the valve to loosen it up.

To help deter problems in the future, it's a good idea to get into the habit of regularly cleaning drains to prevent blockages. It's also useful to make a note of your water usage – if it seems exceedingly high, there could be a leak.

Finally, ensure you have a well-stocked toolbox that's easily accessible in case something goes awry.

LO 1.2 – Draw up maintenance schedule for the tools and equipment

Content/Topic 1: Basic maintenance for tools and equipment

Definitions:

A) Equipment maintenance:

Is any process used to keep a business's **equipment** in reliable working order. It may include routine upkeep as well as corrective **repair** work. **Equipment** may include mechanical assets, **tools**, heavy off-road vehicles, and computer systems.

Every Machine, equipment, or appliance, domestic or industrial contains a maintenance schedule to follow to ensure efficient working.

The **maintenance checklist** is an important document that requires preventive maintenance management. It includes a list of all the functionally and structurally significant items of a particular machine or appliance key performance indicators that have to break down potential.

B) Maintenance checklist:

A maintenance checklist is a document that involves some objects to be checked or reviewed for maintenance. Such checklists help us to avoid reviewing the same items more than one time that has already reviewed. Basically, it's an itemized list of distinct maintenance tasks that have been made by the constructor of the asset.

The checklist also contains several items such as date of maintenance, detail of every item, the direction of how to conduct maintenance check, and much more. Checklists are the fundamental constituents of a maintenance program.

C) Maintenance checklist templates help in checking and reviewing all the maintenance of significant items (MSIs') of a single machine or complete system.

The maintenance checklist is used by the maintenance team to make sure which MSIs have been inspected, which are left, and what part required to be maintained. It eliminates the ignorance of any crucial factor as well as nullifies the possibility of repetition.

D) The preventive maintenance checklist

A preventive or preventative checklist is a set of written tasks that gives instruction to the worker through PM since it can be closed. A preventive maintenance point out the regular maintenance that keeps the instruments running and lessen the chance of its failure. It needs sensitive planning and scheduling of maintenance on the instrument by containing the record of past inspections and servicing reports.

A checklist includes all the instructions and information and provides it into the hands of experienced workers/technicians by systematizing PMs in your Computerized Maintenance Management System (CMMS).

E) The types of maintenance

There are almost 5 different types of maintenance that companies used to enhance the uptime of their assets. Companies used one or more types depending upon their budget, a number of resources, and maintenance aim.

F) Here is the list of the types of maintenance;

1) Corrective maintenance
2) Preventive maintenance
3) Condition-based maintenance
4) Predictive maintenance
5) Predetermined maintenance

G) Maintenance tools:

Periodic maintenance Tools: Those maintenance tools are also referred to as **Time** Based Maintenance Tools. They consist of a series of elementary tasks such as data collections, visual inspections, cleaning, lubricating, and tightening **screws**.

The Different Maintenance Tools

Tools are designed to make a job easier and enable you to work more efficiently. However, if they are not correctly used and taken care of, their advantages to you are lost. Regardless of the type of work to be done, one ought to choose the correct tools for quick, accurate, safe, and effective practice.

H) Generally, there are **five common types of maintenance tools** which are differentiated by the nature of tasks they are used for as expounded below:

1. **Corrective maintenance tools**:

This set of maintenance tools are meant to correct the defects found in the various equipment. The maintenance departments recommend most corrective maintenance tools.

2. **Preventive Maintenance Tools**:

These tools are intended to maintain a certain level of service of equipment. That is, they are programmed to solve the intervention of any vulnerabilities of the equipment in the most opportune time. Preventive maintenance is a routine that is carried regardless of whether there are signs of problems or not.

3. **Predictive Maintenance Tools**:

   This set of maintenance tools pursues to assess and report the status of the operational capacity of the installed systems. This maintenance identifies physical variables such as temperature, vibration, or even power consumption. This maintenance routine is most technical since it requires advanced technological resources. Moreover, mathematical, physical, or even technical knowledge might be necessary.

4. **Periodic maintenance Tools**:

   Those maintenance tools are also referred to as Time Based Maintenance Tools. They consist of a series of elementary tasks such as data collections, visual inspections, cleaning, lubricating, and tightening screws.

Content/Topic 2 : Sectors and Professions Where the Above Maintenance Tools Are Applicable

The heavy machinery, especially in the mining, industrial, or even farming require constant maintenance to keep it in sound working condition. Conversely, poor maintenance protocols make the equipment run inefficiently.

Below are a few tips for essential machinery maintenance:

1. **Carry out Machinery Operator training**.

   Of course, many large pieces of machinery have multiple operators. Hence, having an ongoing inspection to oversee the correct operation of equipment is worthwhile. Remember: upon purchasing large machinery, it is important to inspect it. How about training the operators to keep them up to date with the machine operations?

2. **Adding and testing lubricants**.

   All moving parts require oils to reduce friction. Scheduling a good lubrication routine extends the life of large machinery. Lubrication is one of the first and most crucial maintenance checks to carry out.

3. **Check for signs of Wear**.

   For you to understand the repair work to carry out for equipment, one can check out for signs of wear and tear. Vibrations, shocks, high temperature, and friction are among the critical factors for massive machinery breakdown.

Among the fields using heavy machinery is the mining industry. Of course, some mines continue to have decreased profit levels, mainly because their maintenance team may not understand the maintenance specifications of the rock crushers.

Hence, the maintenance department ought to know when to carry out preventive, predictive, and reactive maintenance programs using correct tools.

Content/Topic 3: The maintenance schedule

Basically, a maintenance schedule shows the daily services and inspections that are to be done on the plant product. It contains several intervals that involve a service or inspection procedure.

1) How To create a preventive maintenance checklist

You need 6 things to develop/create a preventive maintenance checklist. Let us discuss them one-by-one;

a) Select the knowledgeable people for your maintenance team. The people who have command on data processing, accounting, craftsmen, and the members of production control.
b) Set specific goals by keeping some factors in the mind such as operations, resources, and industry for the preventive maintenance project.
c) Gather the whole information about all the existing pieces of equipment because it is necessary to become familiar with them before the initiation of the preventive maintenance checklist.
d) After completing the above process you have to make a decision that what equipment pieces are included in the PM program.
e) The next step is to create a preventive maintenance schedule. Different types of PM schedules are created by CMMS depending on the maintenance history, worker availability, inspection times, etc.
f) The last step is to monitor the expenses, performance, and other key performance indicators (KIPs). The maintenance manager also has the authority to adjust the PMs if needed having the aim of improving all the operations efficiency.

2) The importance of a preventive maintenance checklist

The Preventive maintenance checklist assures you that it doesn't matter who is working because the work is getting done in the same way. In this way, it builds a standard that everyone can follow. This can make work faster and more standardized.

a) Important and Benefits of Maintenance Checklist Template

The maintenance checklist plays an important role in the implementation of a preventive maintenance approach. There are different types of checklists developed on a different basis such as time period, machines, systems, significant items.

Maintenance checklist templates are used in every type of industry for maintenance planning and management. The maintenance management preventive approach uses a checklist to inspect ensures, manage, and review every significant item of the machine for potential damages and period changes. It helps in the effective implementation of the maintenance approach and allows the system to reduce errors by recording every vital aspect of the maintenance of significant items.

b) The main Elements of Maintenance Checklist Template

Maintenance checklists are purpose-aligned documents, include all essential information required to inspect and analyze to check the working performance of any part, assembly, machine, equipment, or appliance.

Normally daily maintenance checklists are used in industrial by each department. It includes a list of all machines with potential maintenance points to be inspected that functionally and significantly important for the normal working. Maintenance officers inspect and note particular data about each parameter on their daily maintenance checklist drill.

Basic maintenance checklists include machines, a list of structurally and functionally significant items, potential inspect points related to significant items, space to jot down the value of each parameter after

inspection, 3 point assessment scale to mark the maintenance requirement, and comments about any damage or problem.

3) The common causes of equipment failure

i. Improper operation
ii. Failure to perform preventive maintenance
iii. Too much preventive maintenance
iv. Failure to continuously monitor equipment
v. Bad (or no!) reliability culture

I) Improper operation

There are a whole bunch of people who might be in and around equipment on a daily basis who could have a significant impact on its overall operating condition.

Equipment operators are one such group. They typically receive in-depth training on appropriate operating procedures, basic troubleshooting, and best practices for safe equipment use relevant to the machines they'll be working with. However, the day might come when an operator ends up working on a machine they haven't been adequately trained for. Sometimes this situation arises as a result of short staffing or unexpected absences. Other times emergencies come up that require quick remediation with available staff who might not necessarily have the level of expertise that your most experienced operators have.

One solution to these problems is to ensure that you have enough trained operators to allow for some flexibility and a contingency plan for staff shortage emergencies. If possible, all of your operators should have some training on every piece of equipment—even assets they don't typically work with.

Most importantly, never allow an operator to use equipment they are not qualified to run. Not only will this help to reduce operational errors, but in some industries, it's imperative for regulatory compliance. The Occupational Safety and Health Administration (OSHA) sets regulations for operator training requirements for certain types of equipment and for general occupational safety. It's up to you, however, to know the regulations applicable to your industry and ensure that you have adequate compliance procedures in place.

II) Failure to perform preventive maintenance

Most equipment requires regular maintenance for optimal performance, but too often, preventive maintenance is the first task to go when you're short-staffed and overwhelmed. It's easy to brush off regular maintenance when things seem to be running just fine, and many companies work under the assumption that experienced workers will identify impending trouble before equipment fails entirely.
That said, many of the subtle signs of slowing performance or the early stages of failure aren't easily detectable and often go unnoticed. In other cases, companies simply lack efficient planning methods for ensuring that ongoing maintenance is performed.

Tracking equipment and machinery with asset tags can help to keep maintenance schedules on track and equipment operating at maximum operational efficiency.
Preventive maintenance is one ongoing function that should never be allowed to fall by the wayside.
Taking care of your equipment with regular tune-ups will extend the usable life of your equipment, ultimately giving you more for every dollar. Additionally, preventive maintenance can identify small problems with inexpensive solutions before they become major, costly breakdowns. When you use effective inventory control strategies to ensure that you have the right spare parts in supply for the most common maintenance tasks and malfunctions, downtime for routine maintenance and repairs is minimal.

In fact, the U.S. Department of Energy estimates that preventive maintenance results in:

- Up to a 30% reduction in energy and maintenance costs
- 35% to 45% fewer breakdowns
- Reductions in downtime by up to 75%

III) Too much preventive maintenance

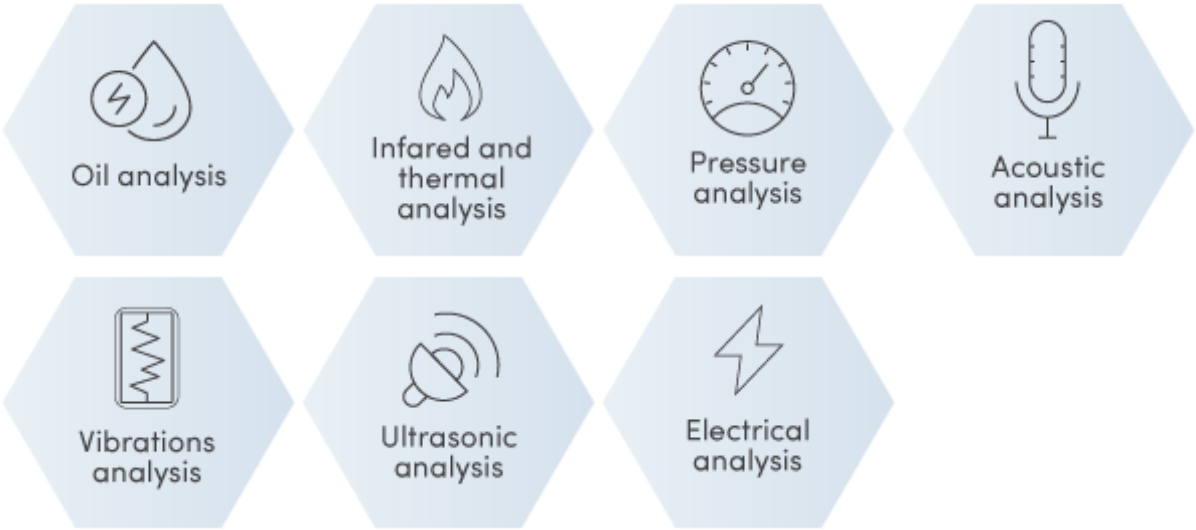
"Surely this is a mistake," you're thinking. "You just told me that NOT doing preventive maintenance will cause things to break." It's true— there's a bit of a Goldilocks situation going on when it comes to preventive maintenance. Not enough can be problematic for the reasons we outlined above, but too much is also a major cause for concern.

IV) Failure to continuously monitor equipment

How to find the right balance of preventive maintenance

The cure here is simple in concept but a bit more complex in execution: condition-based maintenance.
This is maintenance that's done based on the operating condition of a piece of equipment, instead of just a 'set it and forget it' schedule. It takes a lot of things into account, from manufacturer information equipment history to real-time data like vibration analysis.
Continuous monitoring relies on sensor data to establish a baseline for what good equipment condition looks like in order to detect subtle changes, which can be used to predict breakdowns and failures. This allows more time for contingency planning and scheduling downtime to minimize production interruptions. This type of monitoring and the data that's collected in the process can

help companies identify the causes of increased stress on machinery and adjust workloads and schedules to lessen the load on equipment showing early indicators of impending failure.



The catch here is that this is actually really hard to do if you're managing maintenance with pen and paper or Excel. If this is where you want your maintenance operations to go, it might be time to consider moving to a digital maintenance solution.

V) Bad (or no!) reliability culture

Everyone has been there— major pressure from the top means there's not a second to spare if you have any hope of hitting your production goals. In these circumstances, it can be so tempting (and so easy) for an operator or maintenance worker to notice something's not working at 100%, slap a band-aid solution on it and say, "I'll figure this out when things calm down". The problem is that realistically, things never calm down to the extent where you'll have time to revisit that work. Which means that band-aid solution becomes a semi-permanent solution until it stops working and becomes and full-fledged failure.

A really good example of this is Boeing. You're probably familiar with the two deadly crashes involving the company's 737 Max aircraft, which raised questions about whether Boeing's rush to get the plane through production led the company to take safety risks that ultimately resulted in the crashes.

But the quieter story concerns a different plane model— the 787 Dreamliner. Several whistleblowers have come forward to raise the alarm about the Dreamliners, which were manufactured in 2009 at a then-new plant near Charleston, South Carolina. From the beginning, sloppy production was an issue which was consistently swept under the rug in favour of aggressive production schedules.

4) **The bottom line: Trained operators, a solid PM schedule and a focus on reliability culture are your tickets to a failure-free future (or at least fewer failures)**

Equipment can be unpredictable, and failure happens. People make mistakes, parts get old, and sometimes preventive maintenance is just the one thing too many in an already busy day. But by ensuring adequate operator training, running preventive or condition-based maintenance at the right time, and working towards a better overall culture, you'll have a much better shot at keeping your equipment running in tip-top shape.

LO 1.3 – Maximize life expectancy for tools and equipment

- **Content /Topic1: Cleaning tools and equipment**

Plumbing tools disinfection and cleaning Plumbing tools and personal protective equipment Plumbing snakes, augers, equipment and personal protective equipment used to repair and maintain drains and sewers may become contaminated with harmful bacteria.

Always wear PPE such as nitrile gloves; thick drain cleaning gloves; safety glasses or face shields; and protective clothing to prevent the spread of harmful bacteria. Wearing PPE protects the plumber and prevents cross contamination to other individuals, surfaces or the environment.

1. **Cleaning and disinfecting after the job's done**

Thoroughly wash your hands, wrists, arms or any part of the body which may have been exposed after cleaning your equipment. Also, decontaminate any reusable PPE and consider using disposable PPE where appropriate. Laundering in hot water is recommended for all washable clothing. Another safety precaution is to thoroughly clean and disinfect all tools, equipment and reusable PPE after use. Cleaning, disinfecting and proper maintenance and storage may prolong the life of the tools and PPE.

2. How to clean and disinfect

2.1 To clean larger tools and equipment, use a spray disinfectant between regular cleanings.

A. Wear appropriate PPE and remove debris.
B. Spray the recommended disinfectant onto the surfaces of the cable and in the inside surfaces of the cable drum. A one-gallon garden sprayer may be the most effective delivery system for larger surfaces.
C. Wait for the recommended contact time.
D. Wipe off any excess disinfectant with a disposable towel or cloth to avoid drips. Discard the towel or cloth in the trash.
E. Follow up with regular cleaning and oiling as recommended by the manufacturer or shop maintenance schedule.

2.2 To clean hand tools and reusable PPE, use disinfectant wipes immediately after work in drains or sewers.

a. Wear appropriate PPE and remove debris.
b. Wipe all of the surfaces with the recommended disinfectant wipe. A second wipe may be used in cases where harmful microbes may be suspected.
c. Discard wipes in the trash.
d. Follow up with regular cleaning and oiling as recommended by the manufacturer or shop maintenance schedule.

3 . What to use

Any disinfectant specific for blood borne pathogens may be used.

ASU uses CaviCide as a liquid disinfectant for sprayers or CaviWipes as a pre-moistened wipe.

It is a convenient, ready-to-use, intermediate-level surface disinfectant that is effective against TB, HIV, HBV, HCV, viruses (hydrophilic and lipophilic), bacteria (including MRSA and VRE) and fungi. When used as directed, it will also effectively clean and decontaminate specialty tools and equipment.

Content /Topic2: The Lifespan of Different Plumbing Systems and Appliances in Your Home

With a range of appliances working hard day and night, your home truly has a life of its own. Your plumbing system provides you with clean water at a moment's notice, while your dishwasher, laundry machines and other appliances help you keep your home running smoothly week after week. Consider just how many individual appliances you rely on to accomplish your daily routine:

A) Water heater

B) Toilets
C) Sinks
D) Garbage disposals
E) Dishwashers
F) Washing machines
G) Pipes
H) Sewer lines
I) Septic systems
J) Leach fields

There's no denying that the appliances and systems in your home help you live comfortably from day to day. As a homeowner, you want to get the most out of every investment you make in your home. Being aware of the appliance lifespans and performing preventative maintenance on these units can help you extend their life cycles, spare you from needless inconveniences and reduce potential repair or replacement costs.

1) The Life Expectancy of Appliances and Plumbing Systems in Your Home

Life expectancy refers to the estimated length of time an appliance should continue to function properly without needing to be replaced. Nearly every aspect of your home, from the cabinets and caulking to the flooring and framing, has an average life expectancy. While elements like your concrete foundation and countertops may last for a lifetime, many of your home appliances may only have a life expectancy of 20 years or less. Knowing the right time to replace these machines can save you time, money and hassle.

2) **Appliance Lifespans**

Here is a look at some common appliances and their lifespans:

A. Water Heater

Average Lifespan: Water heaters can be separated into two categories: tank and tankless. The most common are conventional water heaters that have tanks capable of holding between 30 and 80 gallons of water. A typical water heater's life expectancy is about eight to 12 years. Because tankless heaters provide hot water on demand, unlike tanks that continuously function, they may last for 20 years or longer. Electric pump heaters should last as long as a conventional tank, while a solar-powered heater should last as long as a tankless.

Symptoms of a Malfunctioning Unit: There's always a chance that your water heater may show signs of wear and tear as time passes. Some symptoms of an aging water heater you should be aware of are:

- Rumbling or bumping noises coming from the unit.
- Discolored hot water coming from any water faucet.
- A significant drop in hot water temperature.
- A pool of water found at the base of the unit.

When You Should Replace Your Water Heater: Think about all of the ways you utilize hot water in your home — taking showers, washing hands, cleaning dishes and doing laundry are just some of the many reasons you need reliable hot water available at all times. Should you replace your water heater before it fails? Ideally, yes. Consider replacing your water heater two years prior to the anticipated end of its lifespan. This means roughly at the eight to 10-year mark for tanks and the 15 to 18-year mark for tankless heaters.

Mr. Rooter's Tips: No one wants to go without hot water in their home. Thankfully, there are ways you can help increase the longevity and efficiency of your hot water unit. You can drain or flush your water heater once a year to wash away the mineral deposits that build up. You can also lower the temperature on the tank when you go on vacation and make sure your tank and pipes are insulated throughout the year.

Annual maintenance inspections will also keep you aware of any problems that may develop.

B. Toilets

Average Lifespan: Do toilets wear out? Most are built for the long haul, having a lengthy lifespan that's virtually unlimited. While the seat and structure itself may last, though, the other components like the flapper, handle and fill valve may require attention every few years. Luckily, these are often quick and easy repairs.

Symptoms of a Malfunctioning Unit: Make no mistake — while hot water is important, a working toilet is perhaps one of the most essential facilities in your home. When a toilet is out of commission, it's an immediate problem that inconveniences the entire household. While small clogs are inevitable, there are a few other common signs of a bad toilet you should stay aware of, including:

- Cracked porcelain.
- Frequent clogging.
- Constant water running in the tank.
- Water leakage from the tank or base.

When You Should Replace Your Toilet: Of course, no one wants to replace their toilet if they don't need to. However, if the repairs are becoming too costly or too frequent, it may be more affordable to replace the toilet entirely. If you're having to excessively unclog or perform other maintenance functions on the toilet, a new purchase may be worth the time and repair expenses saved. Most importantly, if you see cracks in the porcelain, even small hairline cracks, immediately replace it to avoid a complete breakdown.

Mr. Rooter's Tips: With proper maintenance, you can help keep your toilet in working condition. Occasionally inspect the items inside the tank, like the flapper and fill valve. If these parts look damaged or don't seem to be functioning correctly, replace them. It's also imperative to monitor the toilet for internal or external leaks as they could cause serious problems like flooding or mold growth. If you believe you have a serious leak issue, let Mr. Rooter Plumbing assess the problem.

C. Sinks and Faucets

Average Lifespan: Expect your kitchen sink to last for around 50 years if made from acrylic. Vessel sinks made from copper, porcelain, glass or store could last more than 20 years, while enameled steel kitchen sinks may only last over a decade. Soapstone sinks, however, could last for over a century. How long do

kitchen faucets last? You should expect to them to last for at least 15 to 20 years unless damaged by events outside of regular wear and tear.

Symptoms of a Malfunctioning Unit: Some homeowners may not think that a leaky faucet is a big deal, but that constant dripping you hear could increase your water bill. For example, a home with three faucets that each leak one drip per minute would be wasting an entire liter of water per day. That means the homeowner would be paying for 104 gallons of unused water per year. Don't let your budget spiral down the drain. Be aware of potential sink or faucet issues, including:

- Squeaking noises when the water is on.
- Clanking noises as the water flows.
- Inconsistent water streams.
- Leaking water.

When You Should Replace Your Sink or Faucet: The largest issue you'll likely face is a leak, which is commonly attributed to problems with old or worn components, fittings, pipes or seals. These items can be easily and affordably replaced. Regular cleaning will also keep your sink free of scratches, stains and mineral buildup. Many sinks will function efficiently with general maintenance and cleaning. However, if you're at the end of the sink's estimated lifespan or if it is structurally damaged, you may want to consider a replacement.

Mr. Rooter's Tips: There are plenty of ways you can save money and be more environmentally friendly by becoming aware of faucet and sink problems. Although noises coming from the faucet when it is running or a slowly dripping faucet may not be issues you consider critical, you should always place a priority on investigating any potential problems related to your water supply. Leaks and burst pipes can lead to thousands of dollars in damage.

D. Garbage Disposals

Average Lifespan: A garbage disposal lasts for an average of 12 years under normal usage. Normal usage is considered to be any use of the disposal that is not neglectful, excessive or abusive. For instance, allowing all of your food scraps to go straight into the disposal instead of the trash is a quick way to damage the device. However, devoting proper weekly care to the disposal by using items like citrus, ice, soapy water and baking soda to clean the drain and guards can keep it functioning for years.

Symptoms of a Malfunctioning Unit: Even though its job is to dispose of small and soft food particles, some homeowners may forget that this appliance needs the same regular attention that a sink, water heater or any other home appliance would require. One significant problem is the failure of the motor or a crack in the disposal. Be aware of the following symptoms that will help identify a defective garbage disposal or motor:

- Leaks are coming from the bottom of the device.
- There's a noticeable decrease in performance.
- It stops turning on.
- It clogs constantly.

When You Should Replace Your Garbage Disposal: If you follow the instructions for maintenance and cleaning procedures found in the garbage disposal's user manual, you should be able to replace your garbage disposal toward the end of the estimated average life cycle. If you are utilizing your disposal in the most responsible ways possible and you still experience the symptoms above, it may be time to consider a new unit.

Mr. Rooter's Tips: Make an effort to ensure no items fall into the disposal unless they're able to be disposed of properly. Even by accident, some items may find their way into the disposal and harm the blades or motor when it's turned on. These items include metal or plastic utensils, vegetables that can bind the blades, potatoes, corn husks, pepper stems, rinds, grease and oils, pits and seeds, coffee beans and grinds, bones, shells, pasta and rice, dough and marshmallows.

E. Dishwashers

Average Lifespan: Though dishwashers were once considered a luxury or an add-on, many homeowners now find them to be essential items in their kitchens. One of the many appliances that take care of your chores for you, the dishwasher is a trusty device that has a relatively long lifespan. On average, you should be able to rely on your dishwasher for at least seven to 12 years, with 10 years being a reasonable estimate. However, factors like brand and usage could impact longevity.

Symptoms of a Malfunctioning Unit: Few would appreciate the hassle of loading a dishwasher full of plates, cups and cutlery only to find out it's stopped working properly. Unfortunately, every appliance has the potential to break down over time. Before your machine gets too damaged to repair, learn how to recognize the symptoms of a dishwasher that may need expert attention.

You should consider repair or replacement if:

- The door won't open, close, latch or seal properly.
- It won't drain or fill adequately.
- Unfamiliar noises begin to occur during use.
- It still completes wash cycles but it isn't heating.

When You Should Replace Your Dishwasher: Though repairing a dishwasher is a hassle, some issues can be fixed relatively inexpensively. There are some problems, however, that are too cumbersome, expensive or important to justify simply repairing the machine. You may need to replace your dishwasher if it's aged more than 10 years, if the control board is inoperable, if the machine fails to deliver a proper wash cycle or if any repairs will cost more than half of a new unit's purchase price.

Mr. Rooter's Tips: Both residential and commercial dishwasher owners can benefit from the consistent practice of preventative maintenance. Check regularly for any buildup of rust, lime or molds inside the dishwasher. Make sure there are not any leaks outside of the unit or excess dripping inside the unit after the cycle has completed. Examine all of the drains, pumps and nozzles to make sure they are free of clogs or mold. Also, make sure the machine consistently performs a successful cleaning cycle under normal circumstances.

F. Washing Machines

Average Lifespan: When you've got an empty closet and a hamper full of clothes, you're going to want to be confident that your washing machine is ready to refresh your wardrobe. Thankfully, a washing machine should last an average of 14 years. This applies to most top or front-loader machines that average one wash cycle per day. Of course, large families that may require double-digit loads per week may cause this length of time to be shortened. Refer to the cycle rating for your specific washing machine for more accurate estimates.

Symptoms of a Malfunctioning Unit: When an individual is overloaded with more work than they can reasonably handle, they experience stress. A washing machine is no different. Although they are rated to perform efficiently for an estimated number of cycles, this rate can be instantly reduced if the machine is forced to endure oversized loads. This stress places a hardship on all components of the machine and can contribute to a shorter lifespan. Wash only appropriately-sized loads and look for the following identifiers of performance issues:

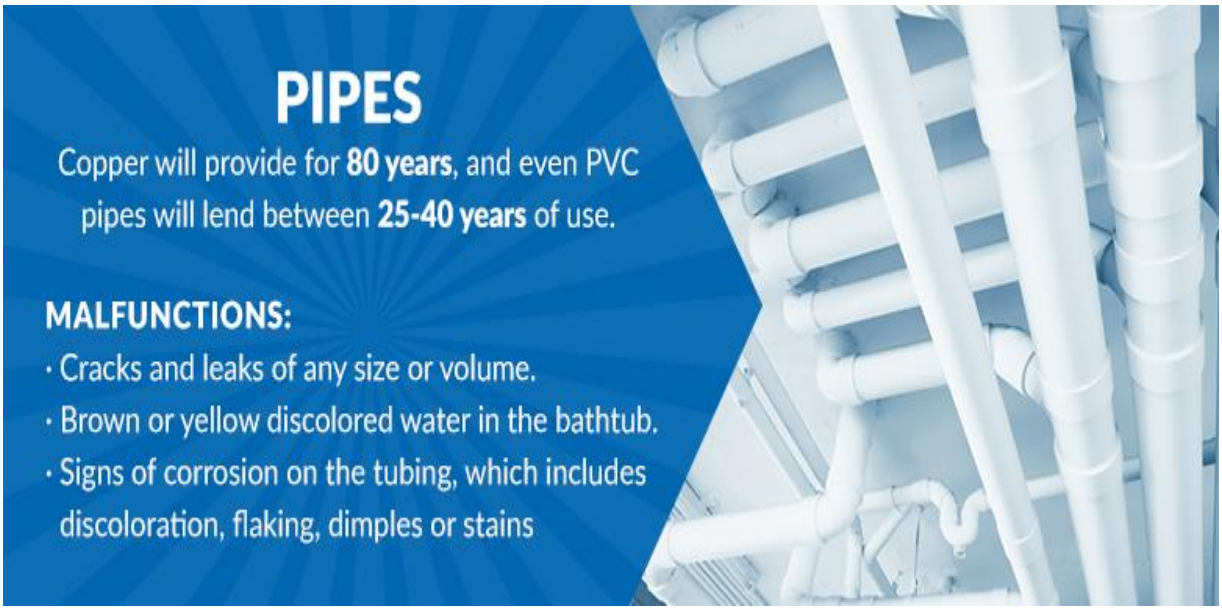
- Excessive noise during a cycle.
- Water does not fill the drum entirely or remains in the drum after the cycle.
- The drum stops turning during the cycle.
- The electrical panels no longer function.

When You Should Replace Your Washing Machine or Dryer: Many people purchase washing machines and dryers simultaneously so that their complementary cycles can work in-tandem to meet specific needs. Unfortunately, either device could reach an early end to its life cycle due to mechanical issues. You may need to replace the appliance if it leaks, has a crack in the tub, and contains an odor that won't dissipate, makes loud noises or has ceased to provide an efficient wash cycle.

Mr. Rooter's Tips: First and foremost, be responsible when loading each cycle. Though you may want to cut down on the number of loads you create by combining two into one, this may put damaging stress on the unit. Place a drip pan beneath the machine to catch any water leaks and make sure the machine is level and at least four inches away from a wall. Also, clean the tub periodically to prevent buildups of mold and odor as well.

G. Pipes

Average Lifespan: Whether you can see them or not, the pipes running throughout your home are some of the most important aspects of your living space. Your plumbing system includes the piping and drains that successfully bring clean water into the home and swiftly remove used water. Fortunately, many piping materials have long lifespans. You'll receive nearly a century of longevity with brass, galvanized steel and cast-iron pipes. Copper will provide for 80 years, and even PVC pipes will lend between 25-40 years of use.



Symptoms of a Malfunctioning Unit: Your home's system of pipes may not be readily observed, but it's important to make an effort to inspect any and all exposed pipes annually. It doesn't matter if your home was constructed last year or last century — diligent checkups on your pipes help you identify and rectify problems as soon as possible. Make sure you look for the following during your yearly inspections:

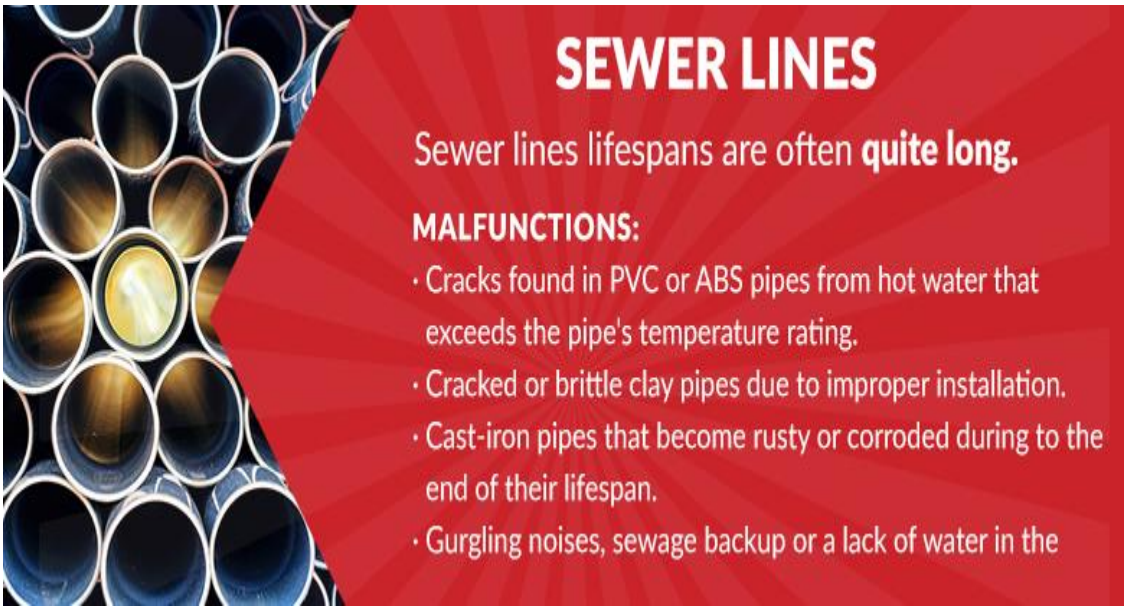
- Cracks and leaks of any size or volume.
- Brown or yellow discolored water in the bathtub.
- Signs of corrosion on the tubing, which includes discoloration, flaking, dimples or stains.

When You Should Replace Your Pipes: Repairing or replacing the plumbing system of your home is not a job for amateurs. This project will require the skill and knowledge of an experienced plumber. They'll be able to effectively assess your situation and determine if a repair or replacement of piping is necessary.

Mr. Rooter's Tips: Although there's only so much you can do to prevent a problem with your plumbing system's pipes, proactively inspecting the visible or accessible pipes in your home will help you stay aware of any potential problems. If you notice any leaks around the piping or water spots appearing on the ceiling, floor or walls, call Mr. Rooter Plumbing. We're available 24/7 to assess and fix all of your plumbing system's problems.

H. Sewer Lines

Average Lifespan: Sewer lines are the unsung heroes of the home, whisking away dirty water with the flush of a toilet, but they eventually wear down. Fortunately, their lifespans are often quite long. Clay was a commonly-used material for a long time, and there are some that are still in existence from more than 100 years ago. Still, they will need to be replaced at some point.



Symptoms of a Malfunctioning Sewer Line: A broken sewer line stinks — literally. Unfortunately, there are a number of reasons why a pipe may burst. Preventative maintenance can help alleviate these chances, but simple factors like aging, improper installation, debris buildup, environmental impacts or city sewer line backups can cause a pipe to burst or crack. It's important to contact Mr. Rooter Plumbing immediately if you notice any of the following:

- Cracks found in PVC or ABS pipes from hot water that exceeds the pipe's temperature rating.
- Cracked or brittle clay pipes due to improper installation.
- Cast-iron pipes that become rusty or corroded during to the end of their lifespan.
- Gurgling noises, sewage backup or a lack of water in the toilet.
- Foul odors around your property.

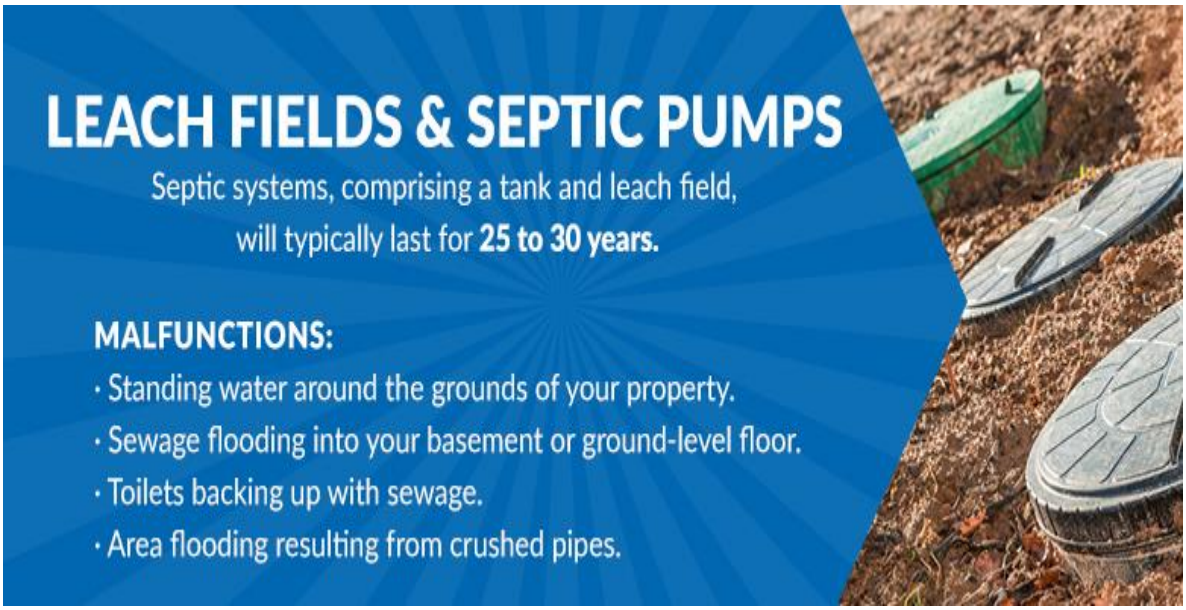
When You Should Replace Your Sewer Lines: If you have a cracked, brittle or burst sewer line, it's imperative that you get a trained professional to repair or replace the line as soon as possible.

Mr. Rooter's Tips: Even though there are factors well beyond your control, you can still attempt to preserve the integrity of your sewer lines by performing preventative maintenance. Enlist the help of a plumbing specialist who will periodically clean your drains and inspect the lines to ensure that all buildups, clogs and cracks are tended to as soon as possible. If you

If you do find yourself needing sewer line repair or replacement, trenchless options such as pipe bursting offer minimal disruption to your property and often faster repair times.

I. Leach Fields and Septic Pumps

Average Lifespan: Septic systems, comprising of a tank and leach field, will typically last for 25 to 30 years. The leach field itself should last for at least 20 years. This estimate is assuming that the septic system receives regular maintenance and was properly installed.



Symptoms of a Malfunctioning Unit: Not unlike sewer lines, the telltale signs of a leach field or pump problem will often be readily apparent in appearance and smell. Some obvious signs that your drain field is experiencing a serious issue include:

- Standing water around the grounds of your property.
- Sewage flooding into your basement or ground-level floor.
- Toilets backing up with sewage.
- Area flooding resulting from crushed pipes.

When You Should Replace Your Leach Fields and Septic Pumps: Clogged drain fields caused by septic pumps are often expensive to repair. Once the field becomes severely clogged, it requires a replacement. It's important that you replace it as soon as possible to avoid contaminating groundwater and well water and to prevent the spread of bacteria and disease to humans, animals and plant life.

Mr. Rooter's Tips: Like many other systems in your home, performing consistent preventative maintenance is one way to attempt to prevent a septic failure. Be mindful of what you flush down your drains and toilets and do not overuse your water supply. Have your septic system inspected annually and pump the system every few years.

- Content/Topic 3 **:Storage of tools and equipment**

2.1. Top tips for maintaining your plumbing tools

Storage for Plumbers and Contractors

A) Self-storage: is a great storage solution for many types of businesses from retail to construction to sales representatives who work from home or on the road.

B) A self-storage unit can be used to store retail inventory overstock, office equipment and business documents. But where do construction contractors, plumbers, electricians and painters store their tools and equipment? Many store tools of the trade at a self-storage facility! EzStorage makes it easy for contractors, painters and plumbers to store their equipment with our **construction storage** solutions.

C) Plumbing Equipment Storage

D) Plumbers are trained to do a variety of jobs including fixing a clogged toilet, installing or fixing home heating systems or hot water tanks, installing air conditioning units, fitting bathrooms and kitchens and responding to emergency calls. Plumbers use a variety of tools during the course of the day. They require a variety of tools and materials such as pipes, Teflon tape, plungers and augers of all types. A self-storage unit is a convenient place for storing plumbing tools and equipment.

E) Contractors, plumbers and painters usually work out of their vans, trucks or their homes; most do not have “brick and mortar” locations or buildings to store their equipment. The cost of renting a storage unit is much lower than paying for rent and utilities for a storefront or a warehouse. Using a self-storage unit for plumbing tools and equipment storage helps contractors keep their overhead low and their budget in check. Storing plumbing equipment at a self-storage facility is a cost-effective solution for plumbers to easily keep their tools, equipment and piping all in one place and allow their vans or trucks to be less cluttered.

F) Storing Plumbing Equipment in Self Storage

G) Self-storage facilities have computerized gate access hours typically from 6am to 9pm for contractors, painters and plumbers to access their tools before they need to be on the job site. Some self-storage facilities offer 24 hour gated-access so plumbers can access their storage units at any time in the day. **Safety and security** measures such as video surveillance, individual storage unit alarms and keypad entry gates and building entry gives plumbers' peace-of-mind that their equipment will be safe while in storage.

H) As a professional plumber, your job is to fix the day-to-day problems that households and businesses have, no matter how minor or major the project. So, the last thing you want is for your tools to let you down. An important part of this is to ensure that you always keep them well-maintained, and to help you with this, I'm going to give you my top tips for keeping everything in your arsenal in working order. Read on to find out more.

3) **Store your plumbing tools with care**

a) Make sure each tool type has a separate compartment in your toolbox, as this will help to stop them coming into contact with others that could damage them. Some tools may even have their own special storage instructions — like torque wrenches, which need to be loosened at the spring to prevent weakening — so be sure to abide by these.

b) Enclosed storage spaces, like garages and basements, can have humidity issues that might cause wear to your kit. If you must keep them in this type of environment, invest in a dehumidifier, silica gel packs, or rust collectors and anti-rust liners.

Clean your plumbing tools after every use

c) While most of your kit will only require a quick wipe down, most hand tools which look a bit dirty can be cleaned in minutes by dunking them in a bowl of hot soapy water followed by a thorough dry. However, some will need a little extra TLC. Hand and power tools with adjustable parts will need lubricating for storage to maintain their optimum level of performance and to help fight rust development, so check your tool's instruction manual to see if a specific oil is recommended. However, spraying a light coat of WD-40 onto them straight after use can be just as effective — just be sure to leave a thin layer of it on.

d) For tools like toilet plungers, create a mix of detergent and bleach in the toilet bowl and swirl the plunger round for a minute or two. Do keep this separate from the rest of your tools though as there's no guarantee that all of the bacteria will be gone after this regime.

4) **Inspect your plumbing tools frequently**

Inspecting your tools regularly can also help to prolong them if done thoroughly and frequently enough. Generally, plumbers are encouraged to check their tools for any signs of damage after every use to ensure their work is made easier, safer and of a high-standard. Caring properly for your tools increases the likelihood of them lasting longer, making it essential.

Hand Tools

5) Use the daily cleaning time as an opportunity to inspect these thoroughly for any damage. Handles that are cracked, or blades that are blunt will need replacing or repairing, depending on the extent of damage and the cost to fix it.

6) You should also check hand tools used for repeated striking for signs of mushrooming, where the edges of the metal head begin to curl. You can keep this issue at bay by regularly shaving the metal sides off with a powered grinder.

7) **Power Tools**

Keep an eye on frayed or exposed power cords as these can cause electric shocks or fires. Don't forget to check the cord's prongs because, if they are bent, they'll also need replacing or repairing.

Any battery-powered tools will need regular battery checks and changes to keep them working efficiently. Generally, it's recommended to fully charge and then discharge their power once every couple of weeks and to use batteries once every two weeks rather than letting them sit unused for prolonged periods. If you've got spare batteries laying around, make sure you store these away in a dry, clean and cool place.

8) **Pick quality tools initially**

With three different grades of tools available — professional, intermediate, and consumer-grade — most skilled plumbers will opt for the first type, which are higher-quality and often more expensive. When choosing the best quality tools, go for materials like tool steel — which refers to a mix of carbon and alloy steels — for both your hand tools and power tools. This metal is highly suitable for plumbing work due to its durable nature, as well as its good shock and corrosion resistance. When considering brands for the best tools, ones that offer long-term or lifelong warranties are mainly the best option. Not only does it help reassure you about a product's reliability, but it also gives you peace of mind when they're on the more expensive side of the spectrum.

Caring for your tools properly can save you a lot of time and money in the long run, and will help to ensure you're able to do your job to the best of your abilities. So, make sure you're not scrimping on any maintenance time! For more information about maintaining your plumbing tools please

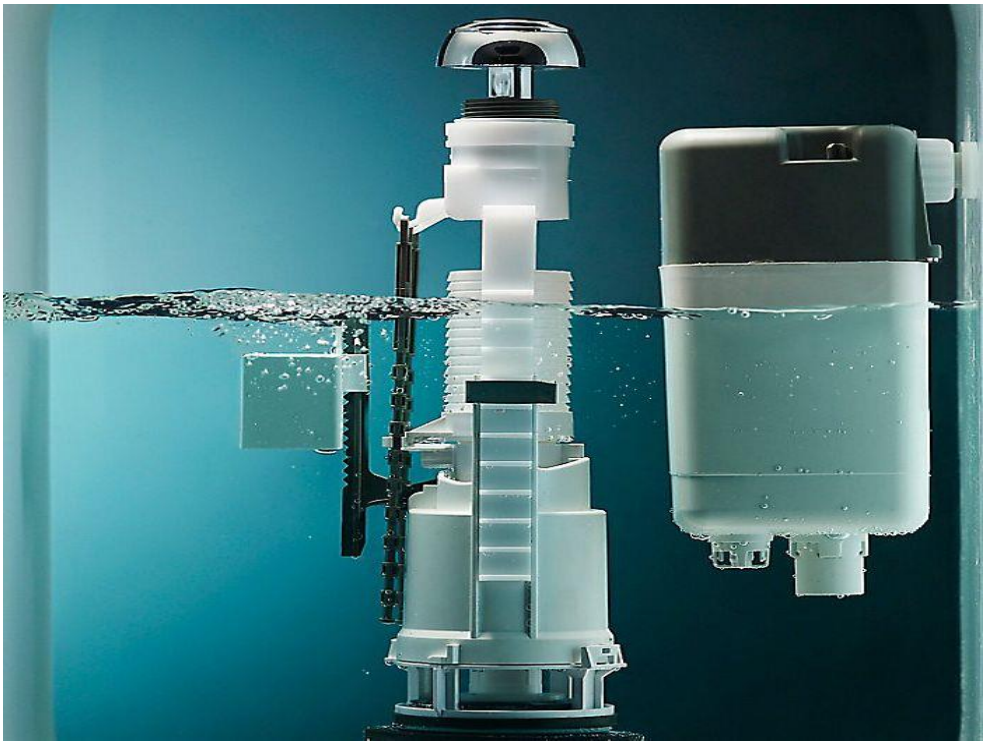
Learning Unit 2 –: Maintain domestic plumbing appliances and equipment

LO 2.1 – Repair flushing cistern

Content/Topic 1: Troubleshooting of manual operated flushing cistern

A) Fixing a toilet flush

Keeping your toilet flush in good working order makes environmental and economic sense because it saves you water and money. Toilet flushing accounts for 20% of domestic water consumption, so a simple leak soon becomes a bottomless pit for your hard-earned wedge. That's why you need to act quickly if your flush develops a fault. The job is within anyone's ability. Just follow our advice to identify the cause and solve the problem.



A toilet flushing system

The toilet flushing system is made up of two separate and independent parts:

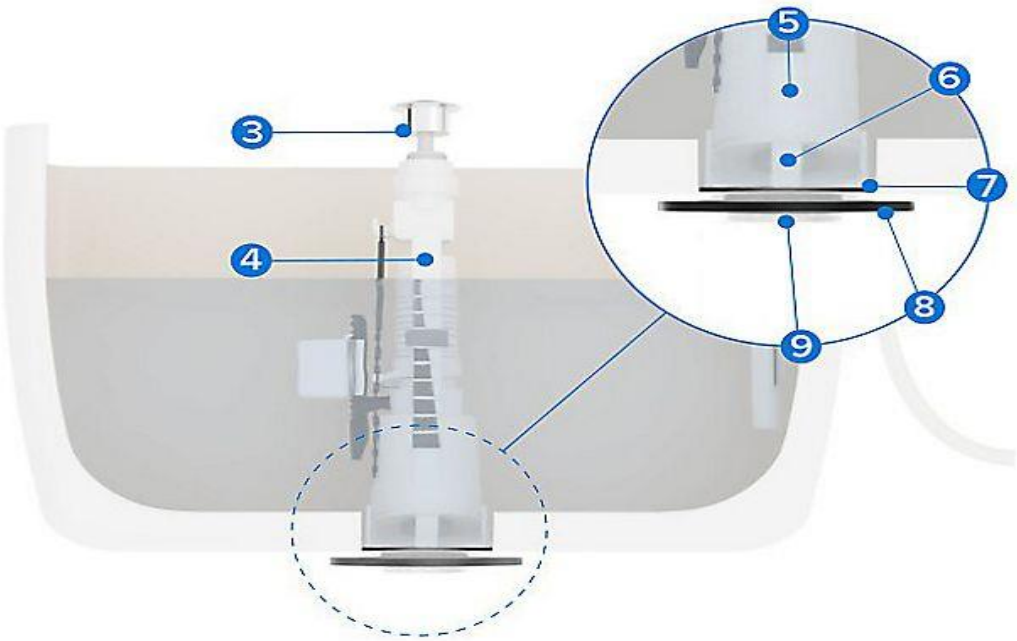
B) A filling mechanism comprising:

1. **A shut-off valve**: This allows you to turn the water off if you need to make repairs.
2. **A float valve:** This controls the level of water in the cistern. The float valve shuts off the water when the cistern is filled to the desired level. The water level can be adjusted by means of an

adjustment rack or the float rod. Lowering the float position lowers the level to which the cistern is filled.

A flushing mechanism comprising:

1. A flushing control: A push-down button or a pull-up knob that releases the flush.
2. An overflow: If the float valve malfunctions, the overflow directs excess water from the cistern into the toilet bowl to avoid flooding the floor.
3. A flushing bell, flushing valve or plug: This part is located at the bottom of the cistern and is operated by the flushing control. When it is raised, the water contained in the cistern is free to flush into the toilet bowl.
4. A flushing valve seat and seal: The bottom part of the flushing bell or plug. The seal forms a watertight barrier between the flushing mechanism and the cistern.
5. A plug seal: This keeps the cistern watertight when the plug is closed.
6. A bowl seal: The largest of all the seals, located under the cistern. This seal provides a watertight join between the cistern and the toilet bowl.
7. A flushing mechanism fixing ring: Located at the bottom of the cistern, this consists of a pressed-in bottom part and an outer ring that screws on to it.



C) When The toilet flush is not working

The most common cause for this **problem**, and the one that's easiest to **fix**, is a poorly seated flapper, aka a **running toilet**. The flapper is that part of the **toilet** tank that opens to let water flow into the **toilet** bowl, and then flaps down over the **opening** to allow the tank to refill.

D) How to you fix a cistern flush

1. Step 1: Check for leaks. Remove the **cistern** lid. ...
2. Step 2: Lower the float arm. If the **cistern** overfills and flows continuously into the bowl, adjust the float arm down so the ball sits lower in the **cistern**, shutting the inlet valve off earlier. ...
3. Step 3: Adjust the float levels.

E) How the push button toilet flush mechanism work

The **flush valve's job** is to rush water from the **cistern** into the **toilet** bowl to wash away waste. ... So simply put, you **push** the **flush button**, the connecting cable pulls up the **flush valve**, the water is forced out of the **cistern** and into the **toilet** bowl, and then the **valve** drops back down.

F) How to fix a flush valve

With this pair of problems a **flush** can send a bolus of water and waste down the drain, compressing air in the drain piping; but as the compressed air and sewage meet a blockage the air pressure sends the waste **back** to the toilet. How quickly **does** the waste **return**.

G) Toilet Not Flushing

If your **cistern is constantly filling** the most common problem **is** a faulty float valve or a poorly adjusted float arm. ... If the overflow **is** running from this tank, you will need to shut off the water supply and change the washer in the float valve.

H) Toilet Troubleshooting

The water level in the tank is controlled by an adjustable float. A float that's set too low produces a weak flush; if it's set too high, water spills into the **toilet** overflow tube and the fill valve won't shut off. The **toilet keeps running**. ... Flush the **toilet** after each adjustment.

I) How to open a wall mounted flush

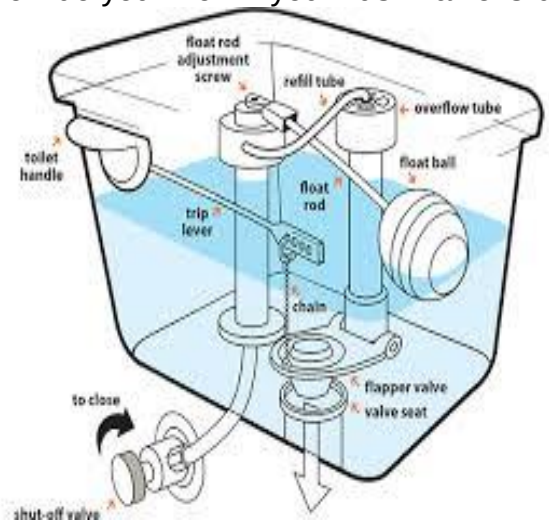
Most of the time **you press** the smaller, pointy, **button** for the smaller amount of water. One firm **press** and a short hold should do it. The bigger, half-moon shaped, **button** alone or **both buttons** in combination should give **you** the bigger **flush**. ... **If** it still holds water, **pushing both buttons** will give more water.

J) How the dual flush button works

The **toilet** has two **buttons** on the cistern rather than the single-**flush** one; one **button** delivers 3 litres and the other 6 litres. The lesser quantity is designed to **flush** liquid waste and the larger is designed to **flush** solid waste.

K) What causes weak flush

A clog in the trap, sewer pipe or vent pipe all will slow the flow of water in some part of the toilet, leading to a **weak flush**. A buildup of calcium or other minerals in the rim feed holes is often the **cause** of a partial clog and **weak flush**. This can happen in older toilets or in old houses. How do you know if your flush valve is bad?



L) 3 Ways to Tell if You Have a Faulty Fill Valve

1 – **Toilet** Runs Constantly. This is **a** common signal that **a toilet's fill valve** is broken. ...

2 – **Toilet** won't **flush** or **the Flush** is Weak. **A** weak **flush** or no **flush** at all **when the** handle is depressed may mean that **the toilet** tank is not being filled with water properly. ...

3 – It Takes **a** Long Time For **the** Tank to Refill.

M) The difference between a flush valve and a fill valve

There are really only two main toilet tank **parts**: The toilet **flush valve**, which lets water gush into the bowl during the **flush**, and the **fill valve**, which lets water **refill** the tank after the **flush**. ... If the water level is below the top of the tube, the **flush valve** is leaking, letting water trickle into the bowl.

N) When a flush valve should be replaced

The clearest sign that a **flush valve** needs to be replaced is when the toilet continues to run, even after the flapper and other possible causes have been addressed. The reason the toilet continues to run is that the **valve** seat may be worn or cracked, which prevents the flapper from making a tight seal

Learning Outcome 2.2: Maintain automatic water system

Content/Topic 1: Servicing of ball valves, taps and valves

MAINTENANCE OF IRRIGATION SYSTEMS


Maintenance of irrigation systems involves the following actions:

- Before starting up the system it is necessary to insert an appropriate new battery in the control unit – the controller. If the controller is unplugged it should be plugged in. Program the desired watering regime.
- If there is a valve to drain the water from the irrigation system it should be closed, as well as the valves in the zones, if they are open.
- Make sure that by any chance some of the sprinklers and other parts of the irrigation system are not damaged. Replace damaged sprinklers, nozzles and other parts of the system.

- Clean the valves, filters and nozzles from dirt and lime scale, if it is not done when the system disconnected for the winter.
- Try how all parts of the irrigation systems functions and put it into work.
- During the watering season, if necessary, adjust the watering regime to the weather and other environmental conditions.
- At the end of the season the irrigation system should be prepared for the winter. The command unit – you can turn off the controller, the battery for maintaining the controller memory should be removed and replaced with a new in the spring. Close the main valve on the pipe that supply the system with water and empty the pipeline from water by opening the drain valve. Automatic drain valves make this job much easier. The pipeline can also be emptied by blowing through it with the help of a compressor. The rain sensor should be protected from the destructive influence of ice. Clean the filter, valves, sprinkler and nozzles from dirt and lime scale.

Content /Topic 2: Automatic plant watering system

This **system** consists of a soil moisture sensor, a **water** pump, **water** flow sensor and an **automated system**. ... The Soil Moisture Sensor will detect moisture level in soil and once the soil is dry it will **automatically** pump 100 ML **water** to **Plant**.

1) A self-watering system

Self-watering containers work on a reservoir **system**. There is a **water** storage tank, usually at the bottom of the container, which you fill. ... The soil soaks up the **water** from the bottom, so as long as you keep the reservoir filled, your plants get a consistent level of moisture, delivered directly to their roots.

9) The 4 types of irrigation

Some common types of irrigation systems include:

- Surface **irrigation**. Water is distributed over and across land by gravity, no mechanical pump involved.
- Localized **irrigation**. ...
- Drip **irrigation**. ...
- Sprinkler **irrigation**. ...
- Center pivot **irrigation**. ...
- Lateral move **irrigation**. ...
- Sub-**irrigation**. ...
- Manual **irrigation**.

3) An automatic watering system work

The **sprinkler** timer tells each valve to open at a specified time, run for a specified time, and then close. Some **sprinkler** timers can be connected to smart devices which automatically calculate when and how long the **system** should run and shut the **system** off when it is raining.

a. A smart irrigation system

Smart irrigation systems are a combination of an advanced technology of sprinklers with nozzles that improve coverage and **irrigation** controllers that are **watering** and water conservation **systems** that monitor moisture-related conditions on your property and automatically adjust **watering** to optimal levels.

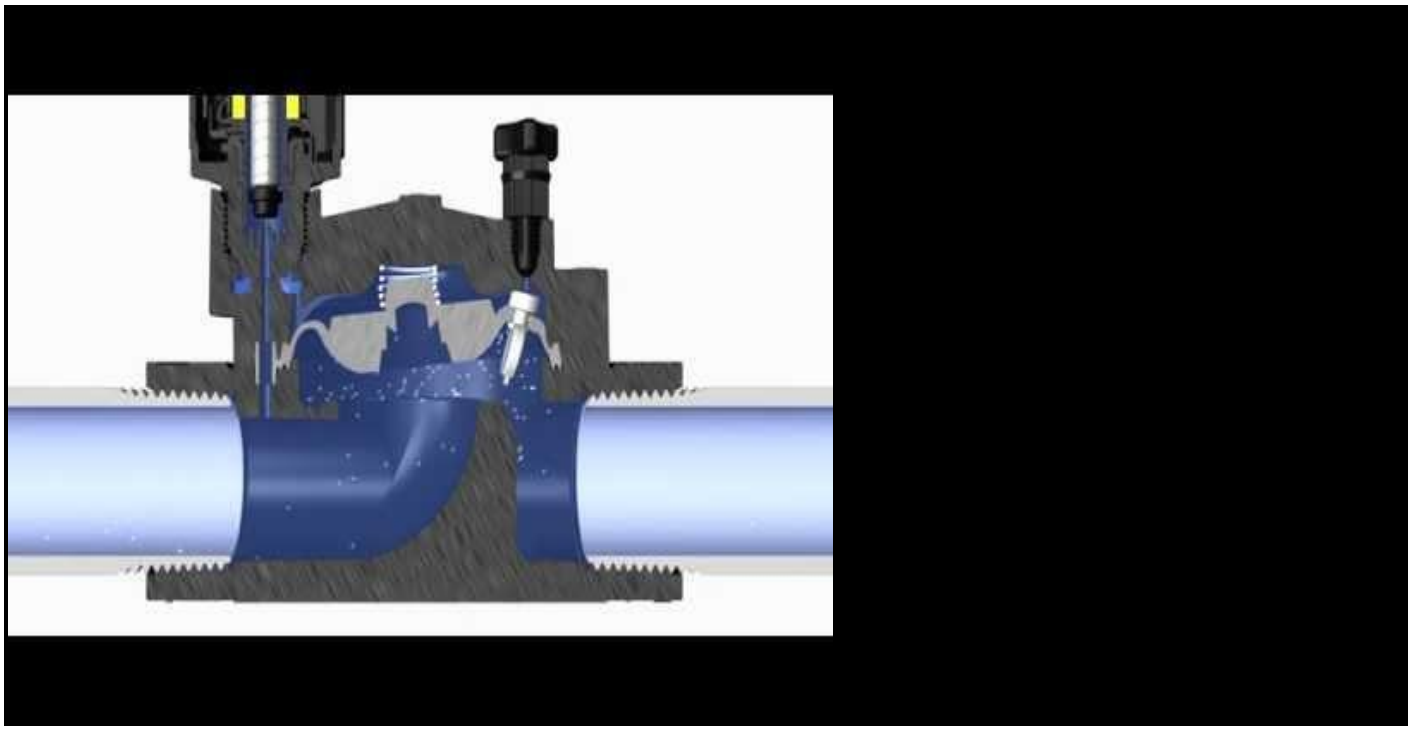
4) The irrigation method is most efficient

A) Drip irrigation

For watering large areas of farmland, **drip irrigation** is the most efficient irrigation system for reducing water and fertilizer loss. By filtering the water down through the soil and into the root system, some of the water percolates down into the groundwater system to be reused for irrigating in future years.

B) The two methods of irrigation which conserve water

Water is allowed to flow through main pipe under pressure, which escapes from the rotating nozzles. In this way **water** gets sprinkled on the crop. (**ii**) Drip **irrigation**: This system is used to save **water** as it allows the **water** to flow drop by drop at the roots of the plants.



C) The benefits of irrigation system

Irrigation can benefit your landscaping efforts by providing artificial water to your lawn or soil. In warmer climates or during periods of drought or little rainfall in more temperate areas, irrigation can be a **cost**-efficient way to ensure the sustainability and diversity of your landscaping.

D) How do you make an automatic irrigation system with a soil sensor?

The circuit comprises an Arduino UNO board, a **soil moisture sensor**, a 5V motor pump, a Motor driver L293D (IC1), motor driver IC to run the water pump. You can power the Arduino board **using** a 5V to 9V wall wart or plug- in adaptor or solar panel. You need a separate 5V to 9v battery for the pump motor.

E) Why do we need smart irrigation?

1) Smart irrigation

Systems can optimize water levels based on things such as soil moisture and weather predictions. ... The **smart irrigation** system will help you have better control of your landscape and **irrigation needs** as well as peace of mind that the **smart** system can make decisions independently if you are away.

2) Can plants recover from overwatering?

There is never a guarantee that your **plant can** bounce back from **overwatering**. If your **plant** is going to survive, you **will** see results within a week or so. At this point, you **can** move your **plant** back to its original location and resume watering it as normal.

F) The difference between overwatering and underwatering

Symptoms of both over and **under-watering** can look very similar. Leaves turn brown and wilt. Often times, when leaves turn brown and wilt due to **under-watering**, those dead leaves will be crispy and dry. While with **over-watering**, those leaves may still be soft and limp.

G) How do you tell if Underwatering vs overwatering?

When plants have too little water, leaves turn brown and wilt. This also occurs **when** plants have too much water. The biggest difference between the two is that too little water will result in your plant's leaves feeling dry and crispy to the touch while too much water results in soft and limp leaves.

H) flood irrigation

Surface or **flood irrigation** is the least efficient manner of irrigation. When a field is flooded, more water than is needed by the plant is applied to the field and water evaporates, seeps into the ground and percolates down to the groundwater, where it can be out of reach of the plant's roots.

1) The two methods of irrigating crops

The three main methods of irrigation are surface, sprinkler and drip/micro. Water flows over the **soil** by gravity for surface irrigation. Sprinkler irrigation applies water to **soil** by sprinkling or spraying water droplets from fixed or moving systems.

2) The negative impacts of irrigation

There are many positive **impacts of irrigation** on the environment. Among the **negative impacts** which appear in the mentioned spheres prevalent **impacts** is the danger of waterlogging and salinization of soils and waters, rise in groundwater table, spread of water born diseases, pollution of waters and many others

3) The disadvantages of irrigation

Water stays in the root zone, and foliage stays dry. **Drawbacks** to surface **irrigation** include potential overwatering and wasteful runoff. If soil lacks proper sloping or doesn't absorb readily, water can't move through the garden. Standing water damages plants and reduces yields for edible crops.

4) An automatic plant irrigation system

With **automatic irrigation system** senses the moisture content of the soil and. **automatically** switches the pump when the power is on. In this **project** an. automation of farm **irrigation** and soil moisture control by Arduino using soil. Moisture sensor and L293D module.

5) Why is it better to irrigate at night instead of daytime?

Many bacterial and fungal diseases rely on wet foliage for reproduction and to spread. If you **water** lawn at **night** in summer, the lack of evaporation provides time for the pathogens to

infiltrate your grass. Morning watering allows time for evaporation and soil absorption, keeping foliage dry overnight.

I) The Best Water Leak Detection Tool

The most effective **tool to detect** these types of **water leaks** is professional sound **detection** equipment. Using headphones and a microphone, a highly skilled technician will be able to listen for the sound of running **water** underground as it travels through the pipes.

1. The causes of underground water leaks

Leaks in **underground plumbing** can be **caused** by many different factors, including rusting through from age or from stray electric currents from other **underground** utilities that can prematurely rust metallic piping, driving over piping with heavy trucks or equipment, poor initial installation, freezing and thawing of a ...

2. The How to fix an underground water leak

Instructions:

1. Determine If You Have a **Leak**. Some common indicators of a **leak** in your **underground water** line include: ...
2. Locate the **Leak**. ...
3. Turn Off **Water** to the House and at the Street. ...
4. Dig the Trench. ...
5. Drain **Water** From the Trench. ...
6. **Repair** the **Water** Line. ...
7. Test the **Repair**. ...
8. Fill the Trench.

3. What does overwatering look like?

The most obvious sign of **overwatering** is wilting. As stated above, leaves will turn yellow and wilted – not crisp and green. Wilting can also occur throughout the plant, including the stem, buds and flowers. You will also notice the plant growing especially slow.

4. The 4 types of irrigation techniques

Some common types of irrigation systems include:

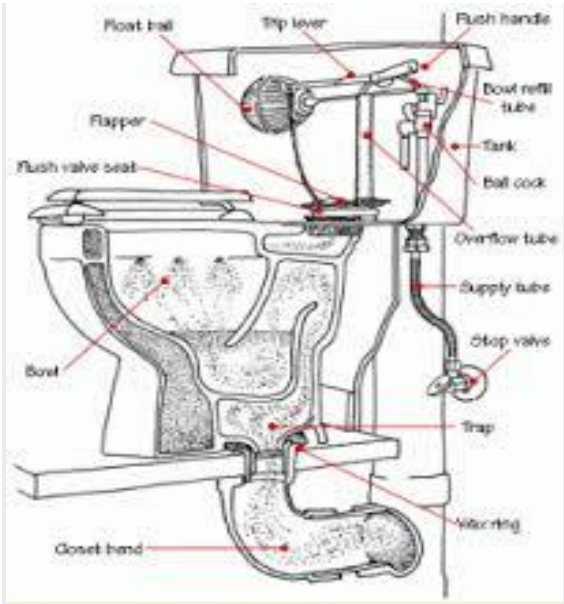
- Surface irrigation. Water is distributed over and across land by gravity, no mechanical pump involved.
- Localized irrigation. ...
- **Drip irrigation**. ...
- Sprinkler irrigation. ...
- Center pivot irrigation. ...
- Lateral move irrigation. ...

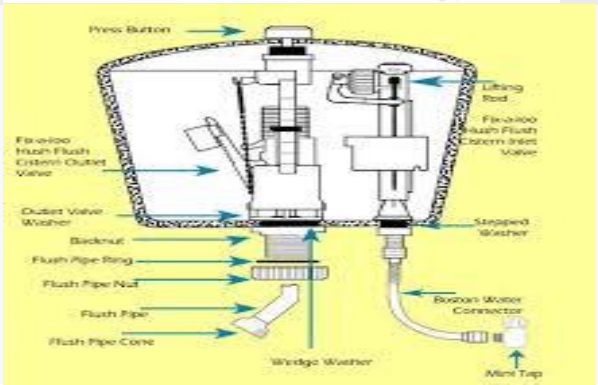
- Sub-irrigation. ...
- Manual irrigation.

5. What is the best type of irrigation system?

Drip Irrigation

This **system** is good for a small yard or for **watering** individual plants. Drip **irrigation** is highly effective at supplying one to four gallons of water per hour directly to the soil. The advantage of drip **irrigation** over **sprinklers** is that there is little water loss due to evaporation or runoff.





LO 2.3 – Maintain water and drainage system

Content/Topic 1: Blockage of drainage and fixtures

Unblocking pipes and fixtures

1. Common blockage materials

Toilets and toilet pipes get blocked when people put the wrong things down the toilet. Some of the things which should never be put down the toilet are food scraps, paper, rags, cans, bottles, grease and fat.

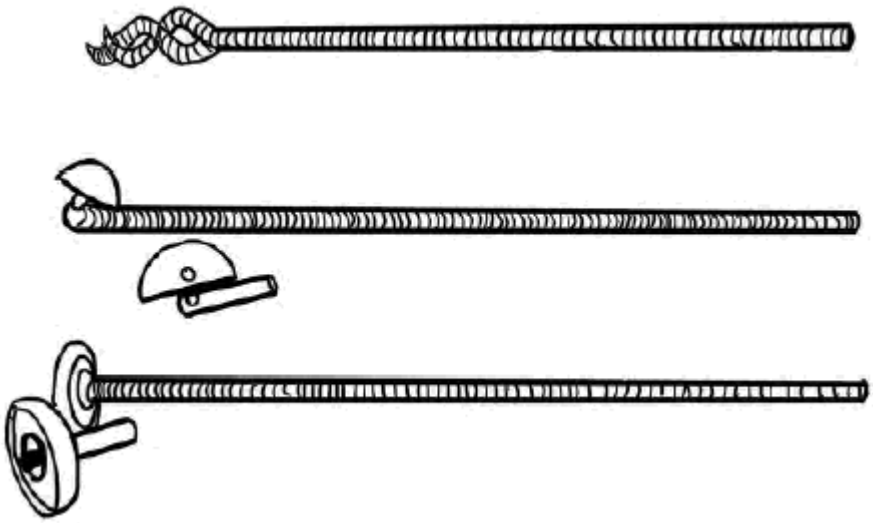
Wastewater pipes from sinks, basins and laundry tubs can get blocked if people put food waste, especially tea leaves, hot fat and other rubbish down them. If hot fat is poured down an outlet pipe, it will set in the pipe when it cools and cause a blockage.

In addition to blockages caused by these materials, main sewer pipes can get blocked in other ways, for example, tree roots growing into the pipe joints and soil blocking the pipe when it is broken by vehicle traffic.

2. Plumbing rods

Plumbing rods are pieces of equipment used to remove most blockages from sewer pipes. However, when sewer pipes are broken plumbing rods are not effective and the damaged pipe must be replaced.

The rods screw together so that they can be made as long as needed. They have different kinds of endings to help remove the blocking objects.



Plumbing rods.

To unblock the sewer pipe it is important to find an inspection opening (IO) **below** the blockage and push the rods **up** the pipe to the blockage.

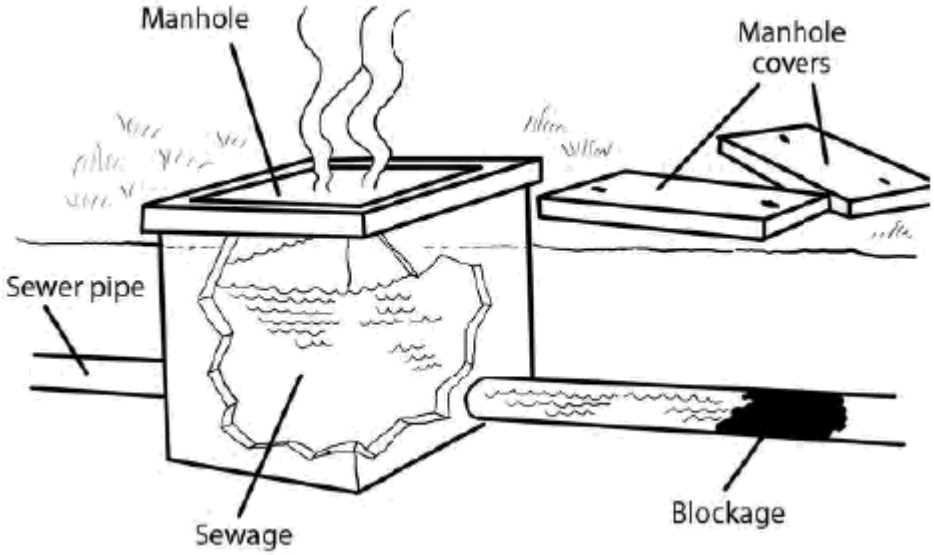
Always remember which way the rods and endings have been screwed together and always twist the rods in the same direction.

If this is not done, the rods are likely to become unscrewed and be left in the sewer pipe. This will create a worse problem because the rods will also block the pipe. If this happens it will probably be necessary to dig up the sewer pipe and break it to unblock the pipe and get the rods back. This would have to be done by a licensed plumber.

3. Unblocking sewer pipes

The larger sewer pipes have manholes set in them allowing access to the pipe. They are often about a metre underground and are large boxes which usually have walls made of concrete. The pipe opens into the box on one side and starts again on another side.

The lids, which are made of metal, can be lifted to allow someone to look down into the sewer to see if there is evidence of a blockage, for example, wastewater build-up in the manhole.



A blockage in the sewer pipe can cause the wastewater to build-up in the manhole.

4. Extreme care must be taken when opening the lids of sewer pipes as poisonous and explosive gases can build up in these pipes.

Before attempting to unblock a sewer pipe it is important to remember:

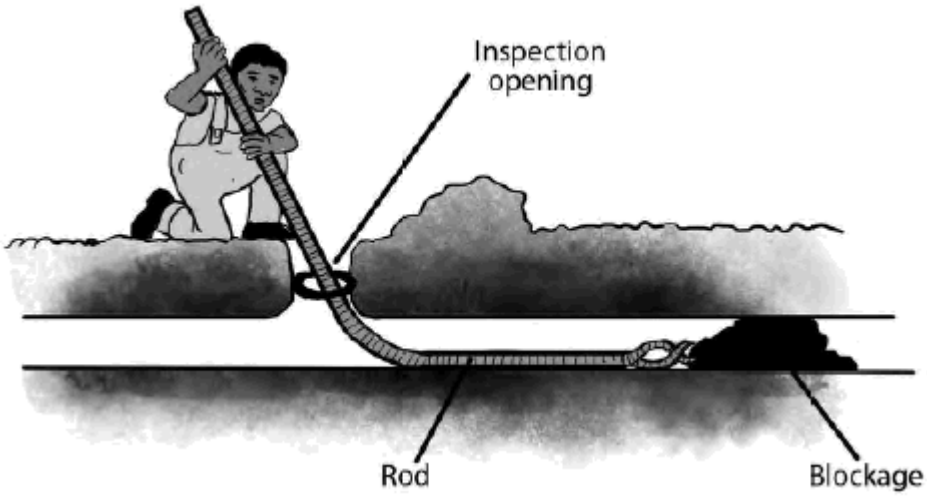
- Before making an inspection, always wait several minutes to allow any poisonous or explosive gases to escape
- Never smoke while doing this work
- Never do this work alone
- Never enter a manhole without proper safety measures. It may be necessary to wear breathing equipment or to ventilate (add fresh air) to the manhole and sewer pipe.

The gases in it can kill.

It is always safest to check with the Water Authority, the local government EHO or supervisor before opening the lid or entering the manhole.

If there are no manholes, then there will be IOs with cement or plastic caps on the pipes. There may be a concrete box around the inspection opening. Sometimes these are below the ground and are not easy to find. It may be necessary to dig to find them.

It is a good idea to get the sewer pipe plans for your community so that you can refer to the plans before starting to dig.



Unblocking a sewer pipe.

5. Unblocking fixtures

For the plumbing system to work, the pipes must be free of blockages. If the pipes are blocked, the toilet, shower, laundry tubs and/or the kitchen sink will not carry the wastewater away properly.

If a fixture is blocked, the wastewater may flow onto the floor of the house. If the sewer pipe is blocked, the wastewater may flow from the DT onto the ground outside. Contact with this wastewater may cause disease.

To unblock a sink, shower recess or any tubs, first remove any larger pieces of rubbish and then try using a **plunger** or a mop to finish unblocking the pipe. Pipes from sinks, basins and tubs and the small waste pipes leading to the larger sewage pipes outside the building will have small IOs.

These may be sealed with a screw plug, either close to the fixture or on a bend. The plugs on these IOs can be removed to allow access to blockages.

A plunger consists of a heavy rubber cup which is attached to a handle on the closed side. It is used by placing it over the opening to the blocked outlet pipe and then thrusting it up and down quickly over the hole. The suction caused by this action will help to move the blockage.

A mop can be used to unblock a pipe in the same way. It is best to use a mop to unblock a toilet pan.

If using a plunger or a mop does not work, the pipes will need to be examined through IOs or a manhole to find the blockage. This can then be removed with plumbing rods. If these are not available, a hose may work.

Unblocking fixtures.

Content/Topic 2 :Leakage of water supply

1) **The leakage**

Leakage occurs in all distribution networks - the degree of leakage varying widely from one country to another, and between the regions of a country. It is important to distinguish between total water loss (sometimes referred to as 'unaccounted-for water' (UFW)) and leakage. **Total water loss** describes the difference between the amount of water produced and the amount which is billed or consumed.

2) **Leakage** : is one of the components of the total water lost in a network, and comprises the physical losses from pipes, joints and fittings, and also from overflowing service reservoirs. These losses can be severe, and may be undetected for months or even years. The larger losses are usually from burst pipes, or from the sudden rupture of a joint, whereas smaller losses are from leaking or "weeping" joints, fittings, service pipes, and connections. The volume lost will depend largely on the pressure in the system, and on the "awareness" time, i.e. how quickly the loss is noticed and dealt with. This in turn depends on whether the soil type allows water to be visible at the surface. It also depends on the leak detection and repair policy of the water supply company. The other components of total water loss are non-physical losses, e.g. meter under-registration, illegal connections, and illegal or

unknown use. The components of total water loss are dealt with in detail in section 3.1.

3) **Waste and leakage**

Waste and leakage can be differentiated as follows:

• Deliberate ***waste***, e.g. standpipe vandalism, taps left "open" permanently in areas of intermittent supply in order to fill vessels when the supply returns, which then overflows.

• Household losses caused by bad plumbing, tanks overflowing - this is also *waste*, and can be influenced by an effective policy of household metering (a study in the United Kingdom showed a 10% reduction in demand following metering).

4) A set of slides shows the range of ***leak*** types and their causes, such as:
- Leaking lead service pipe;
- leaking joint or connection;
- internal corrosion producing a hole;
- longitudinal split in the PVC pipe.

Content/Topic 3: **Factors influencing leakage**

How much leakage is allowed to occur in a system is directly attributable to the company's policy, and the influencing factors can be grouped under four policy categories.

4 factors, which should be illustrated on a slide, are listed below:

A. *Resources*: financial - staffing - water.
B. *Infrastructure condition*: materials - renewal policy - pressure.
C. *Institutional attitude*: structure - regulation - politics.
D. *Leakage control policy*: activity - perception - technical expertise.

1) The availability of resources is clearly crucial to the volume of leakage. Where water is plentiful, leakage is viewed and tolerated differently to where it is scarce. Financial resources and manpower resources are also significant factors.

2) The condition of the infrastructure, and the renewal or rehabilitation policy, is perhaps one of the main reasons for the variation in leakage across the world. The choice and quality of materials, and their laying techniques, particularly in aggressive soils, influence the life-span of the network. Although the age of the network itself is not always a factor, it almost certainly becomes one when combined with the other factors. It follows that a company's policy for replacing or rehabilitating the pipe network is a major influence on the condition of the infrastructure and therefore leakage

.

5) **The institutional policy** largely centres on the perception of, and attitudes to, leakage. These in turn affect the capital and staffing that are applied to controlling it.

The attitude of governments, national and local agencies, municipal authorities and the community all influence the organization and the operation of the network. Political influences can also be significant - serving the community by developing a new source or building a new treatment works is more “high profile” than initiating a leak detection policy.

6) **Finally, the leakage control policy** itself determines the level of activity and the level of leakage in a network. Policies can range from those of very low activity, like repairing visible leaks only, to those which depend on monitoring flows into discrete zones to pick out areas of high leakage.

7) ***Significance and perception.*** The relative significance of leakage is shown by the contrast between areas of abundant supply (e.g. upland catchments) and areas of scarce supply. Countries of the Middle East, for example, depend on expensive desalination plants for their supply. Many Greek islands have to be supplied by tanker. Hong Kong is dependent on water bought from China. The scarcity of water will influence the way in which leakage is viewed.

8) **Leakage is perceived in different ways by:**

A) *Governments and other agencies* are subject to political influences, local elections, etc. In a Karachi (Pakistan) pilot study, for example, in order to demonstrate leakage monitoring in a district it was necessary to provide a 24-hour supply; consumers in neighbouring districts were envious and complained to the local mayor; as a local election was approaching, the study was not allowed.

B) Water engineers and managers sometimes give low priority to leakage in favour of capital programmes; another argument is that the leaked water returns to groundwater and so is not lost, or that it is very cheap.

C) Awareness of the public and consumers increases in proportion to water shortage and drought, and media coverage. There are clear links here with demand management and water conservation techniques, and with public/consumer education programmes (e.g. water conservation practice in the USA).

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Content/Topic 4: Effects of leakage

It is appropriate first to examine the effects of leakage and waste, which are well-documented. Leakage can lead to:

- - *consumer inconvenience*, by reducing pressure at taps, appliances and showers, etc.;

- - *damage to infrastructure*, by creating voids which can lead to collapse of highways and buildings;
- - *excessive costs*, not only from compensation payments and from repairs to damaged structures, but also production costs (if leakage is 50% of production, energy and treatment costs have been doubled);
- - *increased loading on sewers* due to infiltration, leading to the need to over-design sewer capacity;
- - *introduction of air into the distribution network* if the water supply is intermittent, causing damage to meters, and leading to over-measurement of the true consumption and errors in water bills;
- - *Health risks*, in low pressure systems or where the supply is intermittent, by allowing infiltration of sewage and other pollutants into the pipe network.

A) <u>The effects of leakage, about which a collection of slides could be made, are:</u>

- Damage to infrastructure
- Consumer problems
- financial losses
- Health risks.

B) ***<u>Damage to highways, sewers and other utilities by subsidence and voids</u>***

Although leakage control programmes cannot greatly influence the catastrophic bursts which occur from time to time and can cause considerable damage to highways and sewers, there is a lower level of leakage which can cause similar damage over a period of time - such as leaking joints and fittings, and defective mains which have not completely failed. This leakage can continue undetected for considerable periods of time, before finally causing the collapse of, for example, a highway or footpath. A systematic leakage detection policy is able to control such leakage and avoid extensive damage by carrying out repairs quickly.

C) ***<u>Effect on consumers</u>***

The most common effect of leakage on a consumer is when the supply fails, or the pressure becomes unacceptably low. This leads to complaints - often the first indication of leakage in a system.

Pressure may be reduced or completely lost in some parts of a demand zone (extremities or high points). Lavatory cisterns and storage cisterns will not fill as rapidly, and showers, washing machines, and other domestic appliance fed from the direct water supply may not work. These factors lead to consumer dissatisfaction. Obviously, the effect is greater if the mains pressure is low and where supply is already in deficit. In addition, just as leakage can cause infrastructure damage it can also cause damage to buildings, resulting in weakened foundations and cracked walls.

D) ***Financial losses***

Apart from the financial implications of repairing the infrastructure and damaged plant, as well as compensation payments, there is an obvious direct cost associated with leakage. Increased pumping costs and electricity charges, and unnecessary capital costs of new sources and mains extensions can all be attributed to leakage. This is obviously one of the major savings to be gained by leakage control.

There are also financial implications in administration costs to deal with a larger number of consumers' complaints, and arising from a deterioration of the water company's public image. In addition, the public and media show an increasing interest in the activities of water companies, especially in times of drought or when new capital schemes are planned. It is at such times that it is difficult to justify high water losses.

E) ***Health risks***

In systems where pressures are very low and supplies are intermittent, there is a high risk of contamination to the water supply from the sewerage system and other sources entering through damaged joints, pipes and fittings (back-siphonage).

Content/Topic 5: Factors affecting leakage

1) Several factors contributing to leakage are:

A) **Pressure** can affect system losses in a number of ways:

(a) **The rate of leakage** from leaking pipes or faulty joints will increase with a rise in pressure. (b) In a similar way, especially in older systems, an increase in pressure even by a few metres, can result in a large number of bursts occurring in a relatively short space of time. Conversely, pressure reduction can reduce the rate at which bursts occur.

B) **Leak location** - high pressure will increase the rate at which water escapes through a hole and may thus temporarily aid leak location by:

(i) **Causing the leak** to appear sooner; and
(ii) increasing the noise level of the leak so that it is picked up more easily by sounding methods.
Conversely, in systems with poor pressures and intermittent supply, leakage and burst rates are reduced but leak location is more difficult.

C**) Pressure surge -** this can happen when a pump is switched on too quickly, or a valve is opened or closed too quickly. The sudden surge in pressure can cause the pipe to fracture, or

can move thrust blocks, or damage the socket. There is also some evidence that surge can cause pipes to flex and move against rocks, resulting in local stress concentrations, and sometimes pipe failure (especially PVC pipes).

D) **Pressure cycling** - there may be a problem of fatigue in plastic pipelines, which is due to bad design of the system (e.g. booster pumps switching on and off frequently) or badly designed and maintained pressure-reducing valves (PRVs), caused by cycling the pressure between high and low values. Fatigue is also caused by UV degradation weakening the pipe, caused by bad storage practice.

A) **Soil movement is caused by:**

- Changes in moisture content, particularly in clays, causing shrinkage (transverse failure of cast iron mains has been recorded).

- Changes in temperature.

- Heavy frost.

- Subsidence, e.g. mining, earthquake.

- All these soil movement factors can cause a pipeline to break, joints to move, or result in localised stress concentrations within the pipe leading to failure.

B) Pipe condition

The most serious problem in this category is the corrosion of metallic pipes.

(a) Internal corrosion is usually more severe in soft (acidic) waters from upland sources. In the case of iron pipes, tubercles develop on the wall of the pipe, and these are associated with pitting and localized areas of metal attack. The pipe wall thickness is reduced so that the pipe loses its ability to withstand pressure, leading to eventual penetration and failure of the pipe wall, and obviously leakage.

(b) External corrosion can arise from a number of causes - aggressive soils may cause damage because of differing levels of dissolved salts, oxygen, moisture, pH, and bacterial activity, leading to corrosion currents in the metal. The corrosion effects are similar to internal corrosion.

(c) Asbestos cement or concrete pipes can be corroded by high levels of sulfates in the soil or water.

C) Poor quality materials, fittings and workmanship

In this category are numerous fittings and apparatus, both on the consumers' and the water company's premises. Faulty tap washers, ball valves and poor seals are some of the main causes of waste and leakage on the consumer side, and badly adjusted automatic flushing cisterns in commercial and industrial premises. Repairs are often difficult to enforce on consumers' fittings, so that leakage continues for longer.

1) More attention is now being paid to the quality effectiveness and suitability of water fittings and materials.
2) Particular attention is given to internal and external protection (linings on the inside, sleeving on the outside of steel mains) and research is continuing into durability of uPVC and polyethylene pipe materials.
3) There is also a great variation in the suitability of service and supply pipe materials. Lead, galvanized iron, copper and polythene have all been used over the years. These pipes can all suffer from failure, metal fatigue, corrosion, chemical attack and faulty laying, as well as from damage by other utilities and their contractors, and by poor quality backfilling. The choice of material, however, is often influenced by local conditions such as availability of local materials and manufacturing, and company or government budgeting policy.
4) A series of slides should be collected to illustrate corrosion and damage to a range of pipe materials.

Content/Topic 6: Soil characteristics

This is an important factor, as it affects the length of time a leak is allowed to continue, i.e. the type of soil and its permeability. In some soils (like clay), water from underground leaks may show on the surface fairly quickly, whereas similar leaks in chalk or sandy soil can continue indefinitely without showing.

- 1) **Traffic loading.** The effects of vibration and high loading caused by heavy lorries is thought to be a major factor affecting buried pipelines and leading to pipe failure.

- 2) **Age.** Many of the factors just described are age-dependent - their effect will be greater with time. Consequently, the age of a pipeline can appear to be the most significant factor affecting the likelihood of leakage, but on its own, age is not necessarily a factor.

- 3) **Leakage control method.** Finally, the chosen method of leakage control, whether a passive or active (metering) method, will determine the level of leakage in a water undertaking, and this is of course completely within the company's control, as is the speed of repair. This factor is discussed in more detail in the modules of Section 6.

Reference(s):

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