



**NATURAL RESOURCES CONSERVATION AND
DEVELOPMENT**

Level-II

Learning Guide-67

Unit of Competence: Assist Operation and

Maintenance of Irrigation and Drainage

Module Title: Assisting Operation and Maintenance

Of Irrigation and Drainage

LG Code: AGR NRC2 M15 L03-LG-67

TTLM Code: AGR NRC2 M15 TTLM 0919v1

LO3: Install irrigation components

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Undertaking Work
- Assembling and connecting Components
- Maintaining clean and safe work area
- Restore site and removing waste material

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to:**

- Undertake Work
- Assemble and connecting Components
- Maintain clean and safe work area
- Restore site and removing waste material

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4” **in page -3, 11, 13 and 15** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page -16**.
6. Do the “LAP test” **in page – 17** (if you are ready).

Information Sheet-1	Undertaking Work
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1.1 Undertaking Work

The work consists of installing a complete underground sprinkler system as specified hereafter. When performing the work, you should furnish all labor, equipment, materials and permits necessary for the completion of the system. For example, the construction of the sprinkler system shall include furnishing, installing and testing of all pipe, fittings, valves, sprinkler devices, controllers, backflow preventers, inlet and discharge piping, manual drain valves, valve boxes, water meters, and all other components pertinent to the plans and specifications of this system. You should perform all trenching, excavating, boring, backfilling, concrete installation, electrical work, and any other work necessary for the completion of the project.

For example, if the work is drainage, it involves the construction, installation, replacement, repair, alteration, maintenance, relining, testing or commissioning of any part of:

- a. below-ground sanitary drainage system from the above-ground sewage or waste pipes to and including:
 - i. the land application system
 - ii. the connection to a holding tank; or
 - iii. the connection with the discharge reticulation system exclusively vested in an authority that has a sewerage district
- b. a below ground storm water drainage system from the above-ground storm water pipes to the point of discharge
- c. Any design work that is incidental to, or associated with

Typical Drainage and irrigation work

Drainage plumbing removes sanitary waste or storm water from a site. Experienced Drainage plumbers typically do the following work (and more):

- ✓ prepare trenches for installing irrigation pipes and laying of storm water and sanitary drains
- ✓ installing, connecting and testing underground sewerage treatments systems such as septic tanks and pressurized treatment systems
- ✓ installing grease traps

- ✓ installing drains, while ensuring the use of adequate support systems
- ✓ cutting and sealing disused underground drains
- ✓ repairing and replacing below ground drains and irrigation systems
- ✓ installing onsite disposal systems such as mulchers, neutralizer tanks, above ground grease interceptors and septic tanks
- ✓ installing overflow provisions, including overflow relief gullies and reflux valves
- ✓ installing drainage vents and inspection shafts
- ✓ Locating and clearing blockages in underground drains.

Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the typical drainage and irrigation work?(5pts)

Note: Satisfactory rating 5 points

Unsatisfactory - below 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Information Sheet-2	Assembling and connecting Components
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2.1 Assembling and connecting Components

An irrigation system comprises many components, each one of them playing an important part in the operation of the system.

For example, a drip irrigation system comprises many components, each one of them playing an important part in the operation of the system.

2.1.1 Assembling Components

Assembly is a Process by which part samples (belonging to the same assembly standard [RFC]) are connected to one another. Assembling two basic parts always results in a new, larger composite part that can be used in future assemblies.

Assemble PVC piping consists of:

- Apply PTFE (Teflon) tape to the threaded (male) pipe end.

Teflon® tape (polytetrafluoroethylene, or PTFE), is a thin film used to seal pipe threads. Too much tape is as bad as too little. It will prevent a good seal. With the proper amount the pipe should thread together smoothly, sealing all gaps in the thread.

- Glue the PVC pipes:
 - ✓ Clean the pipe end and the inside wall of the connector collar.
 - ✓ Apply PVC primer to the ends, both inside and out.
 - ✓ Apply PVC cement everywhere primer was applied. The primer and cement combine to weld the pieces of PVC together.
 - ✓ Insert the pipe end into the connector using a twisting motion and hold the assembly in place for at least 30 seconds.
 - ✓ Wipe off any excess solvent.
 - ✓ Allow the pipe to dry for at least 15 minutes before allowing water to pass through.
- Assemble polypropylene piping:
 - ✓ Slide stainless steel adjustable clamps over the ends of the pipes to be connected.
 - ✓ Connect the pipes.
 - ✓ Tighten the adjustable clamps.

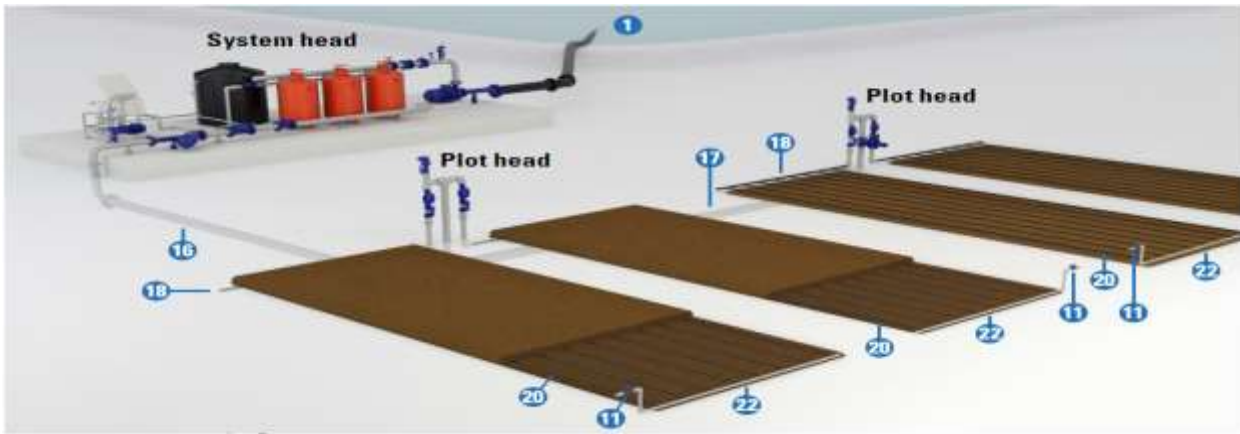
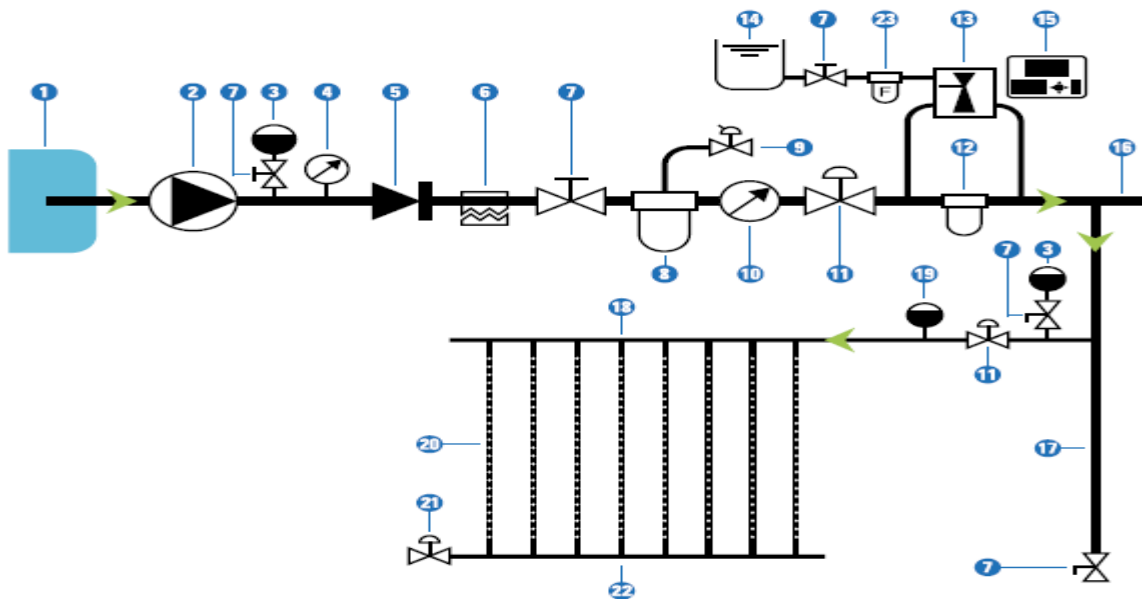


Fig. 1 Structure of the drip irrigation system



Fig.2 System head



- | | | |
|------------------------|--|-----------------------------------|
| 1 Water source | 9 Main filtration automatic drainage valve | 17 Sub main line |
| 2 Pumping station | 10 Water meter | 18 Distribution line |
| 3 Air valve | 11 Hydraulic valve | 19 Kinetic valve (vacuum breaker) |
| 4 Pressure gauge | 12 Secondary filtration unit | 20 Dripperline |
| 5 Check valve | 13 Dosing unit | 21 Flushing valve |
| 6 Shock absorber | 14 Fertilizer tank | 22 Flushing manifold |
| 7 Manual valve | 15 Irrigation controller | 23 Fertilizer filter |
| 8 Main filtration unit | 16 Main line | |

Head Assembly for 1/2" Tubing



Fig.3 assembling of drip irrigation

2.1.2 Connecting components

A standard domestic irrigation system may contain one or more of the following components:

Emitters: this may include popup sprinklers, micro emitters, drip emitters, swivel emitters, gear driven emitters or impact driven emitters. Depending on the design specifications, size, and landscape conditions, there could up to 20 or more emitters in any one system.



Fig.4 Emitters

PVC pipe: this is available in various sizes and class categories from 20mm up to 200mm. Most pipes are six meters in length (generally). PVC pipe is an integral part of the irrigation

system and supplies (carries) water to all of the various parts of the system: be it valves or emitters. There could be up to 30 or more PVC pipes in a standard irrigation system.



Fig.5 PVC pipe

PVC fittings: PVC fittings are used to join PVC pipes together. They are available in many different sizes and configurations and specific purpose PVC fittings are also available if required. When installing a system most fittings are slip joint fittings and require priming fluid and PVC cement to enable joining.



Fig.6 PVC fittings

Low Density (LD) pipe: (commonly known as poly pipe) for domestic purposes LD pipe is available in 13mm, 19mm and 25mm sizes. It is available in various lengths from 25 meters to 200 meter rolls. It is important not to exceed the manufacturers' specifications when using LD pipe as most applications are for small garden beds only with either micro sprays or drip irrigation.



Fig.7 Low Density (LD) pipe

Low Density (LD) fittings (commonly known as poly fittings): are the most common fittings available at specialized irrigation shops, department stores and most hardware outlets. They come in a range of different sizes and configurations to suit individual applications. LD fittings must always be secured with suitable clamps so that the LD pipes do not break apart.



_____Fig.8 Low Density (LD) fittings

Electric valves (also known as solenoids): electric valves are available in a range of sizes and are commonly used to automatically control the water sent to various outlets. 25mm threaded valves are often used for domestic purposes and offer the benefits of size and price. Sometimes they have large water flow paths depending on the models. Always check manufacturers specifications for further information.



Fig.9 Electric valves

Master valves: master valves are required to ensure that at the end of the watering cycle the water is turned off at a central valve, which is normally located close to the water meter.

This ensures that:

- ✓ The water in the rest of the system is at rest and not under pressure.
- ✓ If, for some reason (e.g. faulty fittings/components, damage, or faulty workmanship), there is a leak in the irrigation system, the mains water will not leak continuously into the ground and be wasted.



Fig.10 Electric valves

Control unit: 'Control units are used to set and control the amount of time that an emitter is on or off. A control panel is used to set the:

- ✓ days to be watered
- ✓ time to be watered
- ✓ Watering duration.

Most control units offer these basic features and more.



Fig.11 Control unit

Electrical wiring: Most control units transmit 24 Volt current to the solenoid via copper wire which is available in many colors and gauges. Generally, for domestic purposes 0.5mm multi-strand wire is used rather than single core. Single core is not as flexible and can break easily. A run of 0.5mm gauge controller wire should not exceed 100m as electrical conductivity is reduced.

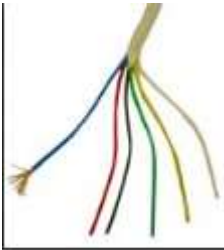


Fig.11 Electrical wiring

Manual valves: manual valves in a domestic irrigation system are usually of a gate valve type or a ball valve type. Manual valves are required to ensure that the maintenance of the system can be carried out with the water turned off. It is also used for throttling the amount of water passing through the system. There are many manual valves to suit the various density and size pipes the market place has to offer.



Fig.11 Manual valves

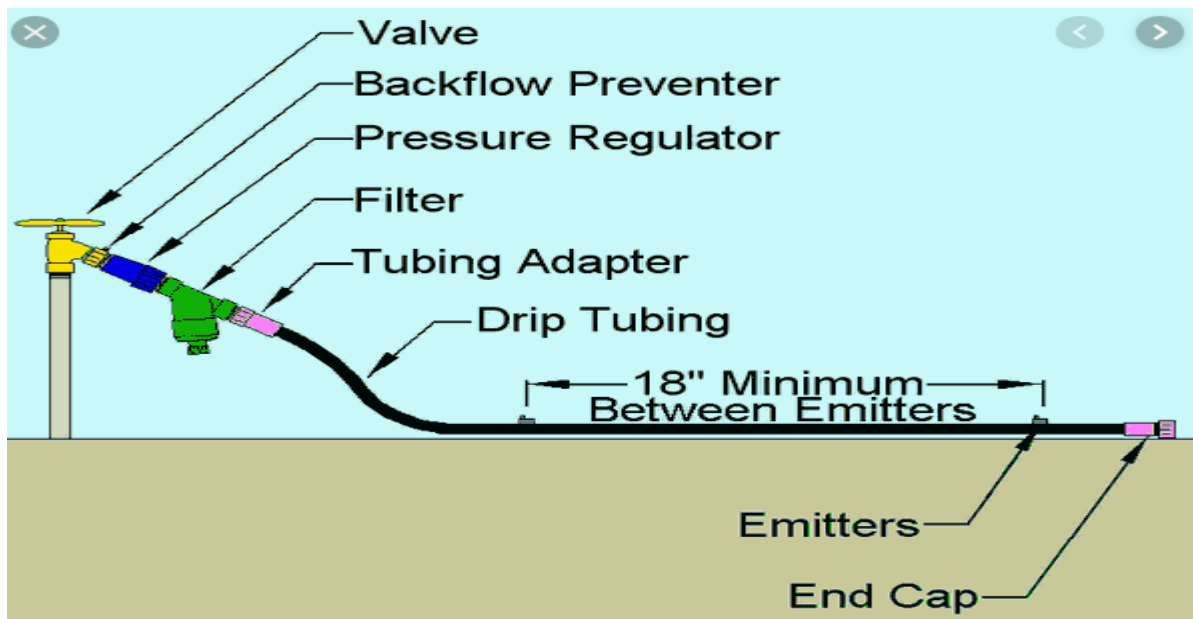


Fig. 12 Drip irrigation system that shows how to connect

What if there is a Leak after connected?

Of course, if you turn on your system and see that water is leaking out of a connection point, then go ahead and give that spot a little more torque to seal up the leak. Again, before cranking down on any leaking area, you will want to make sure that the washer has not fallen out and that it is still in good working order. Missing washers are by far the largest reason for leaking parts.

While we are talking about head assembly parts and leaks, it is a good time to talk about backflow preventers. We also get a lot of emails saying that their backflow preventer leaks but only when the system turns off. The backflow preventer is designed to release water when the system shuts down. The reason for a backflow preventer is to keep water in the case of drip irrigation system from getting back into the main water supply. Once the system is turned off and the pressure begins to drop, the backflow preventer, otherwise known as ‘check valve’, opens up and releases any water trying to flow backwards due to the back pressure in the line. So the backflow preventer will release water after the system is turned off. If you see this, rest assured that your system is working as it should be.

One last note on head assemblies and leaking is the head assembly components for drip irrigation are not designed to be under constant pressure. The maximum amount of time these parts are designed to be pressurized is 12 hours. Never install them above a timer. If they are left under constant pressure they will fail.

Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down A standard domestic irrigation system components (10pts).

Note: Satisfactory rating 5 points Unsatisfactory - below 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Information Sheet-3	Maintaining clean and safe work area
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Maintaining clean and safe work area

- ✓ The job site shall be kept in a neat, clean, and orderly condition at all times during the installation process.
- ✓ All scrap and excess materials are to be regularly removed from the site and not buried in trenches.
- ✓ Trenching, laying pipe and backfilling shall be continuous so that the amount of open trench at the end of each work day is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility flagging tape.

Irrigation work sites are expected to be clean, tidy, comfortable, good and well maintained to create conducive environment for work.

Cleanliness is the most essential elements in maintaining a healthy and safe work environment. Not only does a clean workplace reflect the professionalism of a business or facility and help motivate employees, it also promotes a healthy workforce as a clean environment prevents accidents and the spread of germs.

Many office managers strive to maintain a clear work site policy, few succeed. However, each employee

Like Health & Safety, maintaining a clean work environment is the responsibility of everyone. However, there is only so much cleaning the team can do during each shift and in such cost conscious times it makes sense for employees to adopt some simple good housekeeping practices and allow the cleaning team to concentrate on hygiene and deep cleaning tasks.

Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the importance of Maintaining clean and safe work area?(5pts.)

Note: Satisfactory rating - 5 points

Unsatisfactory - 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Information Sheet-4	Restoring site and removing waste material
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4.1 Restoring site and removing waste material

Restoring site and removing waste material is using wastes as an input material to create valuable products as new outputs. The aim is to reduce the amount of waste generated, thereby reducing the need for landfill space, and optimizing the values created from waste. Restoring site delays the need to use raw materials in the manufacturing process. Materials found in municipal solid waste, construction and demolition waste, commercial waste and industrial wastes can be used to recover resources for the manufacturing of new materials and products. Plastic, paper, aluminum, glass and metal are examples of where value can be found in waste.

Restoring site and removing waste material goes further than just the management of waste. Restoring site and removing waste is part of a circular economy, in which the extraction of natural resources and generation of wastes are minimized, and in which materials and products are designed more sustainably for durability, reuse, repairability, remanufacturing and recycling. Life-cycle analysis (LCA) can be used to compare the resource recovery potential of different treatment technologies. Restoring site and removing waste can be enabled by changes in government policy and regulation, circular economy infrastructure such as improved 'infrastructure' to promote source separation and waste collection, reuse and recycling, innovative circular business models, and valuing materials and products in terms of their economic but also their social and environmental costs and benefits. For example, organic materials can be treated by composting and anaerobic digestion and turned into energy, compost or fertilizer. Similarly, wastes currently stored in industrial landfills and around old mines can be treated with bioleaching and engineered nanoparticles to recover metals such as Lithium, Cobalt and Vanadium for use in low-carbon technologies such as electric vehicles and wind turbines.

Self-Check - 4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the aim of restoring site and removing waste material?(5pts.)

Note: Satisfactory rating - 3 and 5 points

Unsatisfactory - below 3 and 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Methods to connecting Components:

Step 1- Identify irrigation system

Step 2- identify each component

Step 3- Assemble the components

Step 4- connect it

LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour.

Task 1- Assemble and connect irrigation components

Reference

1. [https://en.wikipedia.org › wiki › Thread seal tape](https://en.wikipedia.org/wiki/Thread_seal_tape)
2. <https://www.techbelt.com>
3. [https://www.wikihow.com › Home and Garden › DIY › Plumbing › Piping](https://www.wikihow.com/Home_and_Garden/DIY/Plumbing/Piping)
4. <https://www.chemours.com>
5. [https://www.rona.ca › Home › Workshop](https://www.rona.ca/Home/Workshop)