

S-130 Unit 11: Firing Devices

Summary:

Firing can often be a very complex or intuitive tactic to implement. This unit is intended to introduce the basic firing devices and principles used for firing operations.

Incident Position Description (IPD) Alignment:

This unit aligns with the following FFT2 IPD specific duties (https://www.nwcg.gov/positions/fft2/position-ipd):

- Perform wildland fire and prescribed fire duties including suppression, preparation, ignition, monitoring, holding, and mopup.
- Use standard firefighting tools such as pulaskis, shovels, McLeods, chainsaws, drip torches, and fusees.
- Provide for health, safety, and welfare for self and those around you.

Objectives:

Students will be able to:

- Identify commonly used firing devices.
- Describe situations where the use of firing devices may be used.
- Discuss advantages and disadvantages of the different firing devices.
- Describe hazards associated with use of common firing devices.
- Demonstrate safe use and storage of firing devices.
- Identify alternative devices for igniting fuels.



Instructor Guide

Unit at a Glance:

Topics	Method	Duration
Firing Device PPE	Field Presentation	5 minutes
Common Devices	Field Presentation	35 Minutes
Alternative Devices	Field Presentation	5 Minutes
Purpose of Firing Operations	Field Presentation	10 Minutes
Other Firing Purposes	Field Presentation	5 Minutes
Total Unit Duration		1 Hour

Materials:

- Incident Response Pocket Guide (IRPG), PMS 461, <u>https://www.nwcg.gov/publications/461</u>.
- *NWCG Glossary of Wildland Fire*, PMS 205, <u>https://www.nwcg.gov/glossary/a-z.</u>
- *NWCG Standards for Ground Ignition Equipment*, PMS 443, <u>https://www.nwcg.gov/publications/443</u>.
- The tools and equipment presented in the unit, as well as local area specific tools and equipment.
- Required fireline PPE.
- Notebook for participants.
- S-130 Student Evaluation Task Sheet.
- Ability to display images and video on large screen (if field presentation not possible).
- White board or easel access for group breakout (if field presentation not possible).

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Note to Instructor

- This unit is intended to be taught as a hands-on presentation in the field.
- The tools and equipment referenced should be available as props for instructors and hands on implements for students.
- If field presentation is not possible, the unit can be taught via the PowerPoint in a classroom, utilizing the tools and equipment as reference.
- Detailed information to aid instructor preparation and facilitation is available in the NWCG Standards for Ground Ignition Equipment, PMS 443, <u>https://www.nwcg.gov/publications/443</u>.

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□ Review unit objectives.

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□ Review unit objectives.

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Discuss required PPE:

- \circ Hardhat.
- Flame resistant pants.
- Flame resistant shirt, sleeves rolled down.
- Leather gloves.
- Approved boots.
- Eye protection.



- Discuss the drip torch and its use:
 - $\circ~$ A handheld device used for igniting fires in any fuel type.
 - Drips flaming liquid fuel on the materials to be burned.
 - Fuel used is generally a mixture of diesel and gasoline at a ratio of 4 parts Diesel fuel and 1-part gasoline.
 - Common in areas with limited access.
 - \circ For burning small areas where hand ignition is the preferred method.
 - For burning out along control lines.
- Discuss advantages:
 - Inexpensive, easy to use, and portable.
 - Suitable for terrain where other ground ignition equipment cannot be used.
 - Requires little setup time.
 - Effective in most fuel types.
- Discuss disadvantages:
 - \circ Exposes the operator to the flammable gas/diesel mixture.
 - Require a larger crew working longer to complete a burn (increasing the exposure to hazards during burning) when compared to other forms of ground ignition.
 - Can become tiring to carry.
 - Having the ability to re-fuel the torch may be difficult depending on the location of the fuel supply.
 - A lot of times lighters will choose to carry two torches depending on how far they progress from a refueling source and how remote the terrain may be.



- Discuss parts of the drip torch fully assembled for operation:
 - o Igniter (wick).
 - Nozzle and nozzle bore.
 - Discharge spout.
 - Vent cap and breather tube.
 - \circ Handle.
 - Tank cover lock ring (gasket location).
 - o Tank.



- Discuss drip torch spout components:
 - \circ Tank cover.
 - Discharge plug.
 - \circ $\;$ Discharge plug (parked) when fuel outlet is open for flow.
 - Discharge plug (transport position) when fuel outlet is plugged.



- Discuss additional recommended PPE, specific to drip torch use:
 - Over the calf, wool blended socks.
 - Full water bottle or small fire extinguisher (in case fuel ignites on clothing).
 - Nomex neck and face shroud.
- Discuss the responsibility of an operator to implement safety or emergency procedures related to drip torch use:
 - Clothing catching on fire.
 - Replacing fuel-soaked clothing as soon as possible.
 - Burning fuel is on clothing.
 - \circ Torch catching on fire.
 - Handling a major fuel spill (more than 5 gallons).



- □ Discuss the steps taken when mixing fuel.
- Discuss how to refuel a torch during operations.
- □ Reference *NWCG Standards for Ground Ignition Equipment*, PMS 443, <u>https://www.nwcg.gov/sites/default/files/publications/pms443.pdf</u>.
- Burn mix ratio may vary depending on fuel type, load, moisture and time of year, RH, and temperature. *NWCG Standards for Ground Ignition Equipment* generally recommends a 4:1 ratio for drip torches.



- Demonstrate the steps to prepare a drip torch for use.
- Demonstrate the steps required to ignite the torch.
- Demonstrate the procedures for using the drip torch.
- Demonstrate how to extinguish the torch.
- Demonstrate how to prepare the torch for transportation and storage after operations.

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- Describe functional issues a drip torch may have and how to fix them if possible:
- Tank cover leaks:
 - Make sure that the lock ring is tight.
 - Make sure that the gasket is not missing, damaged, or defective
- Advise participants that burn injuries have occurred due to lock rings detaching from a full drip torch:
 - Potential exist due to lock ring and drip torch tank being from different manufactures or a result of common wear.
 - \circ Ensure that lock ring engages thread for at least 1-1/2 full turns.
 - Any less than 1-1/2 full turns may indicate inadequate thread engagement and lead to possible detachment.
 - If lock ring becomes tight with less than one full turn, assume that the components are mismatched as a result of different manufactures; do not use.
 - Reference the *ETC-SA-2021-01: Drip Torch Lock Rings Detaching,* <u>https://www.nwcg.gov/sites/default/files/committee/docs/etc-sa-2021-01.pdf.</u>

Note to Instructor

Additional information regarding this issue is also available through the Wildland Fire Lessons Learned Center, *Clear Creek RX Drip Torch Leg Burn (2021)*: <u>https://www.wildfirelessons.net/orphans/viewincident?DocumentKey=bea5d059-3437-4fb3-a7c6-5f4a321a3574etc-sa-2021-01.pdf</u>.

Consider providing participants with a copy of one or both of these incident summary documents.

- Fuel does not pour from torch:
 - Make sure that you have removed the discharge closure plug.

- Check for an obstruction in the fuel spout.
- Make sure the breather valve is open and unobstructed.
- Torch is difficult to light:
 - Make sure that the wick is saturated with fuel.
 - Wick may need replaced.
 - Check the fuel mixture it may have too much diesel.
 - Fuel Burns up Before Reaching the Vegetation:
 - Check the fuel mixture it may have too much gasoline.
- \Box Describe steps to make sure the drip torch is in working order for the next use:
 - Cleaning and repair:
 - Note any leakage.
 - Clean the drip torch as recommended by the manufacturer.
 - Tag damaged parts.
 - Replace any defective seals or other damaged parts.
- Discuss storing the torch and fuel:
 - Fuel should be stored only in drip torches that meet DOT specifications.
 - All standard drip torches, whether full or empty, should be stored with the:
 - Fuel spout and wick assembly stowed inside the fuel tank (does not apply to the Panama torch, used in some geographic areas, due to the length of the spout).
 - Lock ring hand tightened.
 - Closure plug installed and hand tightened.
 - Breather valve closed.



- Discuss fusees and their use:
 - Handheld disposable ground ignition device with a self-contained ignition system widely used to ignite backfires and other prescribed fires.
 - Used when burning grass, pine needles, leaves, brush, and similar dry fuels that ignite readily and radiate enough heat to sustain combustion.
 - Used to create emergency safety zones.
- Discuss Advantages:
 - Obtainable from most fire caches.
 - Inexpensive, easy to use, portable.
 - Effective in all continuous fuel types.
 - Lightweight and have a weather resistant wax coating.
 - Used from a utility vehicle or while walking.
 - Used to light other ignition devices.
 - Carried in fireline packs.
 - \circ Burn up to 10 minutes.
 - Can be connected to other fusees or a stick to keep the burning fusee away from your body.
 - Safe and stable to store, require little storage space.
- Discuss Disadvantages:
 - Not effective in wet or non-continuous fuels.
 - Will not function if the fusee becomes wet.
 - Cannot be transported on airlines.

- Special transportation requirements exist for hazardous material, fusees require disclosure to helicopter pilots if transported in helicopters.
- Burn at temperatures higher than 1,400 °F.
- \circ Emit noxious fumes.
- Drip and splatter molten material that can burn through protective clothing.
- \circ Hard to extinguish once they are ignited but may extinguish when thrown if they are not fully burning.



- Describe the components of a fusee and their functions:
 - o Ferrule.
 - o Body.
 - Protective striker cap.
 - \circ Striker cap tape.
 - \circ Wax coating.



- □ Describe the components of a fusee and their function:
 - \circ Scratch tip.
 - \circ Striker compound.
 - Striker cap.



- Demonstrate how to ignite and operate a fusee.
- Discuss fusee safety precautions and requirements.
- □ Discuss method for extinguishing fusee.



- **D** Explain the purpose of a hand-launched flare and situations where it would be used:
 - \circ Increase depth by providing enough heat and fire behavior to manipulate the fires intensity.
 - Influence spread direction on or near the control line by causing the backfire to pull deeper into the main fire.
- □ Explain that hand-launched flares work best when:
 - Burning grass, pine needles, leaves, brush, and similar dry fuels will ignite readily and radiate enough heat to sustain combustion.
 - Fuse time delay (20 to 30 seconds) allows for safe short-distance throwing of flare.



- Discuss that unlike the drip torch or fusee, a FFT2 does not commonly operate this device until they have gained more experience in fire behavior and launcher operation; however, it is a tool that they may encounter being used during firing operations.
- Discuss the use of hearing protection as additional required PPE.
- Discuss the purpose of the flare launcher:
 - Create depth.
 - Increase heat and fire behavior.
 - Manipulate spread direction on or near the control line during burnout and backfiring operations causing the backfire to pull deeper into the main body of the fire.
- Discuss that flares and flare launchers work best when:
 - Burning dry, light, continuous ground fuels.
 - Igniting fuels at a greater distance, across a water barrier, or in terrain that is steep, hazardous, or inaccessible.
 - Igniting fuels to draw flames away from the fireline.
- Discuss advantages:
 - Easy to obtain.
 - Lightweight and compact.
 - Allow remote ignition in steep or inaccessible terrain.
 - Easy to use and operate with minimum training.
 - Allow firefighters to ignite fuels quickly while minimizing exposure in hazardous terrain.
- Discuss disadvantages:
 - Some launchers are not designed for repeated firing.

- Firing pins bend on some brands.
- Frames may develop cracks.
- Very loud, can cause hearing damage if hearing protection is not worn.
- Flares for launchers can be costly.



- Discuss how to properly care for, maintain, and store flare devices:
 - \circ Store in a clean, dry place at temperatures from 40 to 90 °F.
 - Never store near an ignition source (such as sparks or flames).
 - Keep away from oil and water and out of direct sunlight.
 - Rotate the stock to keep a fresh supply.
 - Do not stack heavy items on flares.
 - \circ When possible, store in the plastic bag or in the original box.
 - o If body is damaged, punctured, or worn, dispose of it.

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Question: Select the statement that depicts appropriate storage and maintenance of a fusee.

Answer: Never store fusees near an ignition source.

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- Discuss alternative firing devices such as:
 - o Terra Torch.
 - Propane torches.
 - Plastic sphere launchers (PyroShot launcher).
 - o Sling shots.
 - o Gel blivets.
 - Matches.

Note to Instructor

Detailed information to aid instructor preparation and facilitation is available in the *NWCG Standards* for Ground Ignition Equipment, PMS 443, <u>https://www.nwcg.gov/publications/443</u>.

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Discuss the purpose of a backfire:

- A fire set along the inner edge of a fireline to consume the fuel in the path of a wildfire or change the direction of force of the fire's convection column.
- Large scale burn.
- Used to limit impacts to values in the path of a large wildfire.
- Enhance the integrity of the control line when direct attack is not feasible due to extreme fire behavior.
- Reference the NWCG Glossary of Wildland Fire, PMS 205, <u>https://www.nwcg.gov/glossary/a-z.</u>

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Discuss the purpose of a burn out:

- Setting fire inside a control line to consume fuel between the edge of the fire and the control line.
- Small scale burn.
- Used for cleaning up pockets of unburned fuel and islands as well as maintaining a consistent black edge next to the control line, improving line integrity and safety.
- Reference the NWCG Glossary of Wildland Fire, PMS 205, <u>https://www.nwcg.gov/glossary/a-z</u>.



- Discuss jackpot burning and its purpose:
 - Used to deliberately burn natural or modified concentrations (jackpots) of wildland fuels under specified environmental conditions, which allows the fire to be confined to a predetermined area and produces the fireline intensity and rate of spread required to attain planned resource management objectives.
- Reference the NWCG Glossary of Wildland Fire, PMS 205, <u>https://www.nwcg.gov/glossary/a-z</u>.

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Discuss the purpose for bone piling:

- Stacking burning 1,000-hour fuels interior of the control line where they can be fully consumed more rapidly.
- \circ Creates less mop up and reduces the potential for fire spread by spot fires due to blowing embers near the control line.



- Discuss the purpose of using firing operations to protect values at risk:
 - Pre-planned.
 - Proactive and defensive tactics to reduce the impact a wildfire would normally have on specific values at risk.
- Discuss values at risk protected by the use of firing operations:
 - Life of fire personnel and civilians.
 - o Structures.
 - Archeological and cultural sites.
 - Critical wildlife habitat.
 - o Infrastructure.

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Question: What kind of firing operation, described below, requires firing devices?

Answer: Backfiring

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Discuss the purpose of pile burning:

- Slash piles are formed by the process of thinning to reduce threat of large fire growth and extreme fire behavior, as well as maintaining a specific fuel characteristic that is historical to the landscape.
- Slash piles can be formed by hand or mechanical thinning.
- Drip torches and fusees are the preferred ignition tool for this operation.

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Describe broadcast burning and its purpose:

- Broadcast burning is a prescribed burning activity where fire is applied generally to most or all of an area within well-defined boundaries for reduction of fuel hazards, as a resource management treatment, or both.
- Reference the NWCG Glossary of Wildland Fire, PMS 205, <u>https://www.nwcg.gov/glossary/a-z</u>.

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□ Review unit objectives.

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