ROYAL CANADIAN ARMY CADETS

RED STAR

INSTRUCTIONAL GUIDE

SECTION 5

EO M224.05 – PREPARE, LIGHT, MAINTAIN, AND EXTINGUISH A FIRE

Total Time: 90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-702/PG-001, Chapter 4. Specific uses for said resources are identified throughout the Instructional Guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

Prior to this lesson select a site to construct a fire and construct the following fires:

- tepee;
- crossbed; and
- crisscross/pyramid.

Have examples of fuel types as training aids.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to introduce fire safety for preparing, lighting, maintaining, and extinguishing a fire.

Demonstration was chosen for TP3 as it allows the instructor to explain and demonstrate preparing, lighting, maintaining and extinguishing a fire.

A practical activity was chosen for TP4 as it is an interactive way to introduce cadets to preparing, lighting, maintaining, and extinguishing a fire, while allowing the cadets to experience this activity in a safe and controlled environment.

INTRODUCTION

REVIEW

N/A.

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OBJECTIVES

By the end of this lesson the cadet shall be expected to prepare, light, maintain, and extinguish a fire.

IMPORTANCE

It is important for cadets to prepare, light, maintain and extinguish fires because, as one of the elements of survival, fire provides heat, a means to cook food and can be a signal for rescuers if the cadet becomes lost.

Teaching point 1 — **Discuss Fire Safety and the Steps to Follow When Lighting a Fire**

Time: 10 min — Method: Interactive Lecture



Discuss how the Fire Weather Index and the Canadian Forest Fire Danger Rating System (CFFDRS) measures the possibility of forest fires.

Some cadets may have already experienced lighting a fire with other organizations.

Pay particular attention to any individuals who may exhibit bad habits when dealing with fire and work to correct their bad habits.

Safety is paramount when lighting a fire. Be sure fire safety equipment is available when lighting fires.

Fire has a strong, positive, psychological impact upon an individual in a survival situation. Fire is the most important survival tool after personal wilderness knowledge and is the fourth element to survival.

Lighting fires in the wilderness requires responsibility. Before planning to light a fire, whether in a survival situation or a weekend bivouac FTX, consideration must be given to the condition of the environment. Check with the appropriate authorities to obtain and review the fire regulations and restrictions for the training area.

FIRE WEATHER INDEX



Before conducting training in provincial or national parks, one must confirm that fires are allowed. Open fires are normally only allowed in designated areas. Open fires are fires that are not contained in a structure or housing that ensures the fire will not spread (e.g. barrel or fireplace).

Each park will clearly state their fire regulations and restrictions.

Parks commonly follow the Fire Weather Index, which provides an assessment of relative fire potential that is based solely on weather observations. Check with park administration for rules and regulations when planning to light fires within the park boundaries.

CANADIAN FOREST FIRE DANGER RATING SYSTEM (CFFDRS)

The CFFDRS is Canada’s national system for rating forest fire danger. The system evaluates and integrates data to help managers predict woodland fire potential.

The CFFDRS provides an index (shown below) on how easy it is to ignite vegetation, how difficult a fire may be to control, and how much damage a fire may do.

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BLUE	GREEN	YELLOW	ORANGE	RED
LOW	MODERATE	HIGH	VERY HIGH	EXTREME

D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 1 Fire Index

Low. Low chance of fires occurring. Fires that do occur are likely to be self-extinguishing and new ignitions are unlikely.

Moderate. Moderate chance of fires starting. These fires are creeping or gentle surface fires. They are easily contained by ground crews with water pumps.

High. High chance of fire starting. These fires are challenging for ground crews to handle and heavy equipment (tanker trucks and aircraft) are often required to contain the fire.

Very High. Very high chance of a fire starting. These fires are fast spreading and are of high intensity. They are hard to control and require aircraft support.

Extreme. The environment is very dry and chances of fire are extreme. These fires are fast spreading, of high intensity and very difficult to control.



Advise cadets they can review this information for themselves by looking up the CFFDRS on the internet for their area at https://nofc1.cfsnet.nfis.org/mapserver/cwfis/index.phtml.

MAINTAINING A SAFE FIRE SITE

Prior to starting a fire, some simple guidelines must be followed. Ensure fire safety equipment is available before starting a fire.

Shovel. A shovel provides a means to smother the fire. Shovelling dirt, gravel or sand on a fire reduces oxygen, thus extinguishing the fire.

Rake. A rake allows one to disperse burning material away from the fire. A rake can also be used to smother the fire by raking dirt, gravel, or sand onto the fire.

Pail Filled With Sand or Water. A pail of water or sand can be immediately thrown over a fire if it starts to get out of control. This item can also be refilled as many times as required.

Fire Extinguisher. A fire extinguisher is designed to tackle a fire for a short duration. It is very effective in extinguishing a small fire that is getting out of control.

CHOOSING A SAFE FIRE LOCATION

Before beginning to build a fire, think about the location. It should be placed for maximum warmth and convenience without sacrificing safety. Consider the following when choosing a safe fire location:

- The fire site should be high and dry.
- The area should be sheltered and away from windy areas to reduce flare ups.
- The site should be clear of over-hanging boughs and branches.
- All combustible materials shall be cleared from the fire site.
- The site should be four to six feet from the shelter entrance.

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PREPARING A FIRE BARRIER

A fire ring or pit is a safety barrier that contains a fire within its boundaries and retains heat. By retaining heat one reduces the fire's ability to spread outside the barrier.

Before constructing a fire ring or pit one must determine how big the fire will be. A small fire is much easier to control and also saves fuel. If the fire pit is dug and walled properly, it can produce as much heat as a large one. The fire ring or pit needs to be prepared carefully. Choose a site that meets fire and location considerations.

Fire Ring

A fire ring can be made of rocks. The rocks used should be small in size; however they should still be able to contain a small fire. Place the rocks side by side in a circle to complete the ring. The ring will contain the fire. Water-logged rocks should not be used as the moisture contained inside the rocks will expand and cause the rocks to explode with tremendous force.



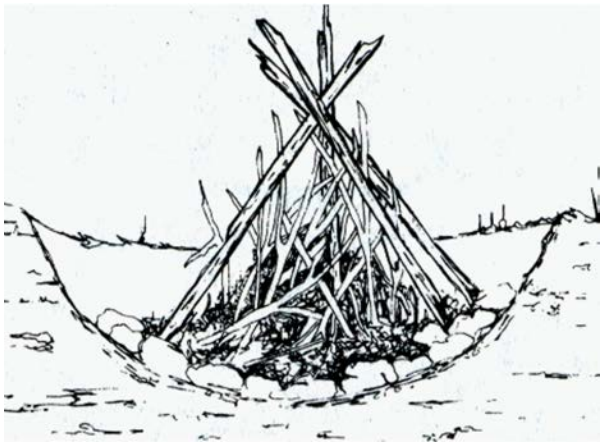
A-CR-CCP-107/PT-001, Royal Canadian Army Cadets Course Training Plan Corps Training Program Winter Adventure Training Manual (p. 3-20)

Figure 2 Fire Ring

Fire Pit

A fire can also be placed in a pit if no rocks are present. A pit is a dish-shaped hole with gently sloping sides, from six to twelve inches deep, depending on the width of the fire. This depression cradles the fire, grouping its coals toward the centre to help them burn longer and hotter. Be careful not to make the pit too deep, or the heat may not reach the person making the fire.

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Brown, T., Jr. and Morgan, B., Tom Brown's Field Guide: Wilderness Survival, The Berkley Publishing Group. (p. 62)

Figure 3 Fire Pit

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What do the colours of the CFFDRS indicate?

Q2. What factors should be considered when choosing a safe fire location?

Q3. How can a fire barrier be made ?

ANTICIPATED ANSWERS

A1. The colours of the CFFDRS indicate:

- Blue – Low;
- Green – Moderate;
- Yellow – High;
- Orange – Very High; and
- Red – Extreme.

A2. A fire location should be:

- high and dry,
- in an area that is sheltered away from windy areas to reduce flare ups;
- clear of over-hanging boughs and branches;
- away from all combustible materials; and
- four to six feet from the shelter entrance.

A3. A fire barrier can be made by building a fire ring or a fire pit.

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Teaching point 2 **Identify Characteristics of Fire**

Time: 10 min Method: Interactive Lecture



Discuss the fire triangle explaining the three elements and the effect the elements have on a fire if one is removed.

Fire may be the difference between living and dying. It will not only heat food for cooking but also keeps a person warm. For a body to produce heat it must burn calories. The warmth of a fire reduces the burden of the body to produce heat.

Fire has a great benefit to a cadet in the field. It can dry clothes, provide comfort and scare away dangerous animals. Its smoke also keeps away insects and pests.

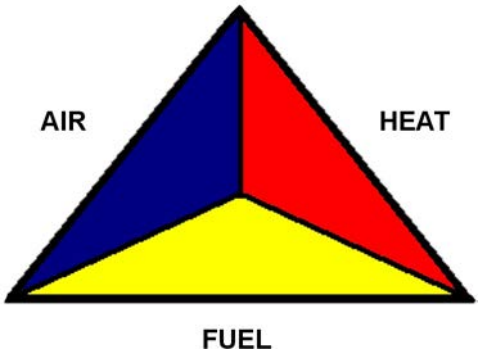
THE FIRE TRIANGLE

Fire is a chemical reaction in which energy in the form of heat is produced. When forest fuels burn there is a chemical combination between the air (oxygen), fuel (wood) and heat that allows a fire to be produced. The sides of the fire triangle represent air, heat, and fuel. If any one of these sides is removed, the fire triangle collapses and the fire goes out.



For fire to take place there must be:

- air (oxygen);
- fuel to burn; and
- heat to start and continue the combustion process.



D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 4 Fire Triangle

TYPES OF FUEL

Fire requires fuel to burn. When preparing to light a fire it is important to find enough fuel to supply the fire for a determined period of time. When selecting fuel, there is one key rule – it must be dry.

The driest wood is found high up, away from water sources and on south-facing hillsides with open exposure to the sun. Avoid collecting fire-starting material from the ground, as it may be very damp—especially during

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wet weather. Gather dead, dry vegetation from standing trees and plants. Be sure to collect enough fuel to sustain the fire for the duration it is required.

Tinder. Tinder is any kind of material that takes the minimum of heat to light. Good tinder needs only a spark to ignite. Tinder can be:

- bat droppings;
- birch bark;
- cotton fluff;
- dried fungi;
- dried grasses;
- dryer lint;
- fine wood shavings;
- pine needles;
- the insides of a bird's nest; or
- waxed paper.

Material used for tinder must be dry.

It is always a good idea to carry some tinder in a waterproof container when going into the field.

Kindling. Kindling is the next type of fuel required to raise the flames from the tinder so that larger and less combustible materials can be burned. The best kindling is composed of tiny twigs or slivers that range from the thickness of a pencil lead to that of a pencil itself. The softer woods are preferable because they flare up quickly.

In the case of wet weather or if experiencing difficulty establishing a fire, "feather sticks" can be made (see Figure 5). Feather sticks increase the chance of catching the fuel on fire because they are thinner.

Follow these steps to build a feather stick.

- Find a small dry stick.
- Slice partial shavings leaving the shaving attached to the stick.
- Shave using small thin cuts.



A-CR-CCP-107/PT-001 (p. 3-20)

Figure 5 Feather Sticks

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Wood Fuel. Wood fuel is thicker and longer than kindling – from pencil to wrist size in diameter. This wood allows a cadet to build a stronger fire that eventually will be able to burn bulk firewood.

Bulk Firewood. Bulk firewood is too-big-to-break fuel that is added to a fire only after the fire is burning well. This wood does not necessarily have to be dry. By the time kindling and wood fuel are burning well, the fire should be hot enough to burn even green and damp wood.

TYPES OF FIRE



Making use of one of the constructed fires, explain to the cadets the type of fuel that is required. Break down the materials displaying tinder, kindling, wood fuel and bulk firewood.

Point out what can be used as tinder. It is especially important to be able to locate dry tinder in a wet environment.

There are many different structural forms for a fire. When building a fire, construct it from the ground up, with room for air to enter. Build it loose with spaces between sticks and wood, allowing it to burn freely.

Tepee Fire. This is one of the most convenient configurations for a fire; it is made with kindling on its end forming a cone. This fire starts easily, burns efficiently, and throws out large quantities of heat and light. Furthermore, most of the smoke and sparks are channelled straight up. The slanting walls and resulting high flames help the fire hold up even in rain and snowstorms.

Follow these steps to build a tepee fire:

1. Line the ground or fire pit with dried bark or grass to prevent moisture from wicking into the fuel.

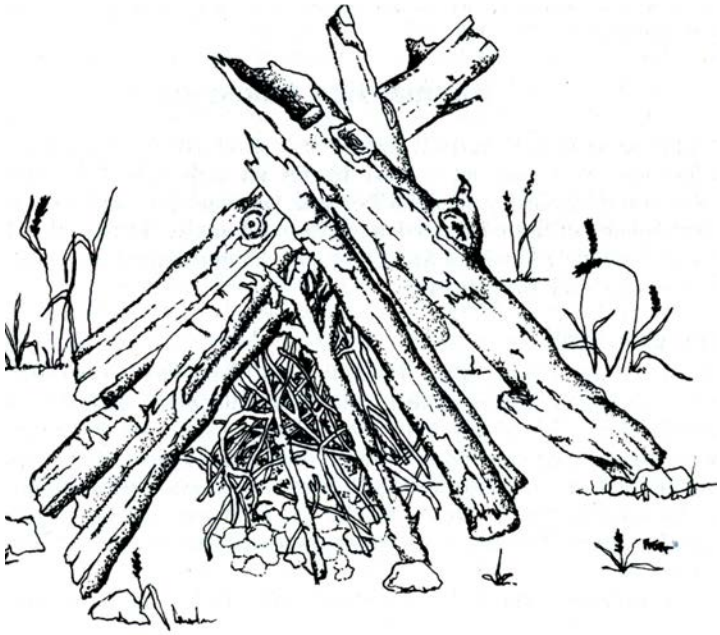
2. Make a small cone out of the kindling by propping the smallest sticks against one another, tepee fashion.

3. Leave enough room between the twigs for air to get through and leave an opening to apply the tinder inside.

4. Face the opening toward the wind to help drive the flames up through the fuel.

5. As the fire lights, add thicker sticks until the fire can maintain itself for short periods of time.

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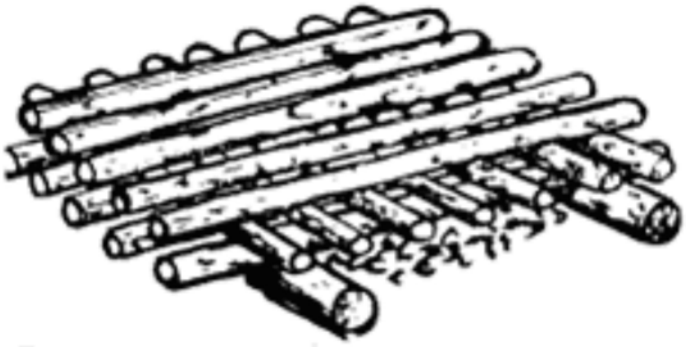
Brown, T., Jr. and Morgan, B., Tom Brown's Field Guide: Wilderness Survival, The Berkley Publishing Group (p. 65)

Figure 6 Tepee Fire

Crossbed Fire. This fire is good if a bed of hot coals for cooking is required. When lit, the whole structure will burn rapidly, leaving a bed of hot coals, excellent for roasting meat or fish.

Follow these steps to build a crossbed fire:

1. Lay two sticks about a foot apart.
2. Place tinder between the two sticks.
3. Place a layer of fuel at right angles to the original two sticks.
4. Leave space between the pieces.
5. Build up several layers in the same fashion, leaving air spaces.
6. Place each layer at right angles to the layer before it.
7. Light the tinder.



A-CR-CCP-107/PT-001 (p. 3-19)

Figure 7 Crossbed Fire

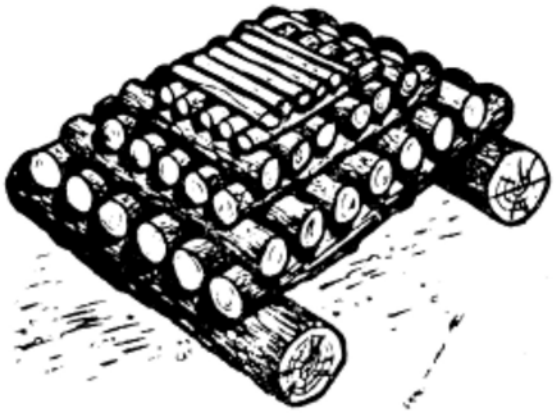
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Crisscross Fire/pyramid. This fire burns from the top downward. It is useful when going to sleep for the night, as it requires little attention and burns slowly.

Follow these steps to build a crisscross/pyramid fire:

1. Place two small logs or branches parallel on the ground.
2. Place a solid layer of small logs across the parallel logs.
3. Add three or four more layers of logs or branches,
4. Each layer shall be smaller and laid at right angles to the layer below it.
5. Make a starter fire on top of the crisscross/pyramid fire.
6. As the fire burns it will ignite the logs below it.



A-CR-CCP-107/PT-001 (p. 3-20)

Figure 8 Crisscross/Pyramid Fire

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What elements make up the fire triangle?

Q2. If air is removed from the fire triangle, what happens to the fire?

Q3. Name three types of fire.

ANTICIPATED ANSWERS

A1. The elements that make up the fire triangle are air, fuel and heat.

A2. The fire will go out.

A3. Three types of fires are the tepee, crossbed and crisscross/pyramid.

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Teaching point 3 **Demonstrate Preparing, Lighting, Maintaining and Extinguishing a Fire**

Time: 10 min Method: Demonstration



Conduct this TP as a demonstration of lighting a fire. Go through the steps of preparing, lighting, maintaining and extinguishing a fire.

PREPARING A FIRE

To prepare a fire, build it step by step. Start by laying out fuel in organized piles of kindling, tinder and larger burnable fuels by:

1. **Preparing Tinder.** Place a small handful of tinder in the selected location.

2. **Preparing Kindling.** Place kindling in a style that suits the type of fire that is being constructed (e.g. tepee style).

3. **Preparing Fuel.** Have wood fuel prepared to apply to the fire once it is established. Adding larger fuel may smother the fire if the fire is not ready to burn larger fuel.

4. **Ensuring Ventilation.** Allow for air to reach the kindling and tinder. Do not apply too much fuel at once as the fire may be starved of air prior to ignition. Air should naturally be able to flow, without additional assistance, to encourage growth of the fire.

LIGHTING A FIRE

To light a fire using a match, light the kindling and monitor the fire. Apply more kindling as required to maintain a burning fire.

MAINTAINING A FIRE

Maintaining a fire requires a constant source of fuel. Fuel that maintains a fire is usually of larger material considered to be bulk firewood. This fuel will not be consumed by the fire very quickly. It will continue to burn for long periods of time.

When maintaining a fire:

1. **Apply Fuel.** Once the fire has a strong base of hot coals, (coals are red hot) apply bulk fire wood.



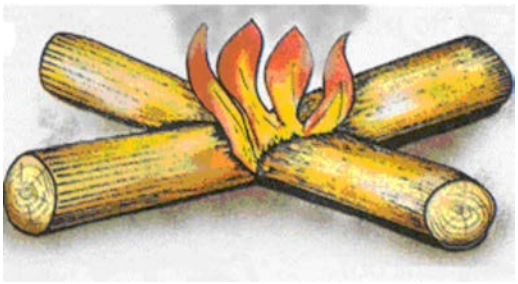
Tawrell, P., Camping and Wilderness Survival, Leonard Paul Tawrell (p. 433)

Figure 9 Fire With Developed Coals

2. **Ensure Ventilation.** Applying bulk firewood may smother the fire. Place bulk firewood so air is able to circulate. Bulk firewood can be placed in any of the fire types (tepee, crossbed, or crisscross/pyramid) by laying

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the log with one end into the centre of the fire and the other end extending out to the edge of the fire. Continue this process around the fire. Leave spaces between the bulk firewood for air to circulate.



Tawrell, P., Camping and Wilderness Survival, Leonard Paul Tawrell (p. 433)

Figure 10 Star Fire

3. **Maintain Fire Size.** Fires can easily be over fuelled. To maintain the correct size, limit the amount of fuel used until desired size and warmth is achieved. If the fire is for cooking, hot coals and less fuel is sufficient.

EXTINGUISH A FIRE

As the fire burns, plan ahead to extinguish it. Stop feeding the fire long before (time enough to let the remaining fuel burn off) it must be extinguished. Collect and pile the remaining chunks of burning wood so they are consumed by the flames, leaving only ashes and coals to dispose of when the fire has finished burning.

Once the fire has burned itself down to white ash, douse it thoroughly with water. Pour water over the ashes, stirring them occasionally to ensure the coals are completely extinguished. Replace or fill the fire pit with wet earth or sand to ensure no flare ups will occur.

If this is a new campfire site, scatter the ashes and replace the sod or decomposing material from the forest floor, returning the site to its original condition.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What are the two types of fuel used to start a fire?

Q2. If it is hard to start a fire or the fuel is wet, what can you do to a stick to increase the chances of it catching fire?

Q3. How do you extinguish a fire?

ANTICIPATED ANSWERS

A1. Tinder and kindling.

A2. You can make a feather stick.

A3. Once the fire has burned itself down to white ash, douse it thoroughly with water. Pour water over the ashes, stirring them occasionally to ensure that they are completely extinguished. Replace or fill the fire pit with wet earth or sand to ensure no flare ups occur.

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Teaching point 4 **Prepare, Light, Maintain and Extinguish a Fire**

Time: 50 min Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to allow cadets to practice preparing, lighting, maintaining and extinguishing a fire.

RESOURCES

Matches.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide cadets into groups of four.
2. Assign each group a type of fire to construct.
3. Fires shall be constructed and lit within 20 minutes.
4. Each fire must be maintained for 10 minutes.
5. All fires must be extinguished, ensuring no smouldering coals are present.
6. Ensure fire sites are cleaned up and returned to their original state within 20 minutes.

SAFETY

Supervisory staff shall have fire safety equipment available in case of an emergency.

CONFIRMATION OF TEACHING POINT 4

The cadets' participation in the activity in TP4 will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in the activity in TP4 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

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CLOSING STATEMENT

Cadets, having learned to prepare, light, maintain and extinguish a fire can now construct the type of fire to meet their needs. Emergency situations present constantly changing conditions. The ability to construct a specific fire is essential to increasing the chances of survival.

INSTRUCTOR NOTES/REMARKS

N/A.

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