Fire Inspector I

CHAPTER TEN

PORTABLE FIRE EXTINGUISHERS

Slide 1	Welcome to Chapter 10 Portable Fire Extinguishers.
Slide 2	In this chapter, we will discuss: • The importance and purpose of portable fire extinguishers • The five classes of fires • The selection of the appropriate type of fire extinguisher • How fire extinguishers are classified and rated • Fire extinguisher placement • NFPA 10 "Standard for Portable Fire Extinguishers" • The types of extinguishing agents contained in fire extinguishers • The advantages and disadvantages of each type • The capabilities and limitations of portable fire extinguishers • Specific fire risks in a room or space • The information you need to assess the operational readiness of fire extinguishers
Slide 3	Portable fire extinguishers are the most common item you will encounter during your building inspections. You must be familiar with the requirements for, and the types of, portable fire extinguishers available, so you can determine the level of protection they provide, and you can answer questions posed by the building owner or occupants. Most jurisdictions and Fire Codes require the installation of portable fire extinguishers in all buildings except dwelling units. A dwelling unit is defined by the National Fire Code as meaning "a suite operated as a housekeeping unit, used, or intended to be used by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities. So, an individual suite in an apartment building, or duplex, or a single-family dwelling are all examples of dwelling units where portable fire extinguishers are not required. This Chapter deals with the selection, installation, inspection, testing and maintenance of portable fire extinguishers in accordance with NFPA 10. Portable fire extinguishers cannot be sold or installed in Canada unless they meet the appropriate ULC Standard and have a minimum of a 2 "A" rating. Reference: NFC 2.1.5.1
Slide 4	In order for a fire to develop, there must be the presence of fuel, heat and oxygen to burn. In the past, these three factors became known as the fire triangle. But the mere presence of all three sides of the fire triangle does not mean that a fire will develop. A chemical chain reaction must also occur to sustain combustion. For example, there must be enough heat generated to cause the surface of the fuel to begin a physical chemical

	process called pyrolysis. When this occurs, the fuel emits ignitable vapours as it breaks down from exposure to the heat. As the fuel continues to burn, the process of pyrolysis continues, and the fire becomes self-sustaining. This chemical chain reaction has been added to the fire triangle concept and is referred to as the fire tetrahedron. Portable fire extinguishers accomplish fire extinguishment by removing one or more sides of the fire triangle or interrupting the chemical chain reaction. The fire inspector must be aware of what class of fire is most likely to occur in any given area and what type of fire extinguishers should be present.
Slide 5	Portable fire extinguishers have one primary use: to extinguish incipient fires that have not spread beyond the point at which they started. Portable fire extinguishers are not meant to replace a permanent fire suppression system. Fire extinguishers are located in many places throughout a building so if a small fire occurs, like a fire in a wastebasket, a trained individual could safely attempt to extinguish the fire. No one should attempt to fight a fire if the fire has spread beyond the point of origin or if the fire is larger than they are. If the fire has grown to an appreciable size, occupants should exit the building, alert others, and call 9-1-1.
Slide 6	Portable fire extinguishers are also used to control fires that cannot be extinguished by traditional means such as water. In fact, water application to certain types of fireplaces the user in extreme danger. For example, putting water on an energized appliance or piece of equipment could result in electrocution of the user. The water may conduct electricity from the energized equipment through the water stream to the user. Water applied to fires involving flammable liquids, such as hot cooking oil, can create an explosive effect. When water penetrates the surface of the hot cooking oil, it expands into steam and causes the grease to erupt and splatter. Later in this Chapter we will discuss fire extinguishers that are specifically designed and appropriate to use on flammable liquids and gases as well as electrical fires.
Slide 7	There are five basic types or classes of fire extinguishers, each of which extinguishes specific types of fire. Newer fire extinguishers use a picture/labeling system to demonstrate which types of fires they are effective on so users can quickly identify which extinguisher to use. Older fire extinguishers are labeled with colored geometrical shapes with letter designations. Class A fires consist of ordinary combustibles such as wood, paper, fabric, plastic, and most kinds of trash. Class A fires are usually suppressed by cooling with water or smothering with multi-purpose dry chemical type

	extinguishers. Class B fires involve flammable or combustible liquids or gases. These fires follow the same basic principles as ordinary combustible fires, except that the fuel in question is a flammable liquid such as grease, oil, or gasoline. A water- based extinguisher should never be used to extinguish this type of fire because it can cause the fuel to scatter, spreading the flames. The most effective way to extinguish a flammable liquid or gas fueled fire is by removing the oxygen and inhibiting the chemical chain reaction of the fire, which is usually done with dry chemical or CO2 extinguishing agents.
Slide 8	Class C fires involve potentially energized electrical equipment. Electrical fires may be caused by a short-circuit, electrical overload or worn-out electrical equipment. These fires can pose a severe hazard to firefighters using water or other conductive agents because electricity may be conducted from the fire, through water, to the person fighting the fire. When the fire is, or possibly could be, electrically energized it should only be fought with a CO2 or dry chemical extinguisher rated for Class C or multi-purpose ABC type of fires. Once electricity is shut off to the equipment involved, the fire becomes a Class A ordinary combustible fire, and a Class A extinguisher can be used. This photo shows the point of origin of an electrical fire. A nail had been driven through the electrical wire which cause a short circuit igniting a house fire that claimed one life. Investigators cut the beam out and ran it through a wood planer to carefully remove the charred wood exposing the nail hole. They then returned the beam to its original location which showed the relationship to the electrical wires.
Slide 9	Class D fires involve combustible metals such as magnesium, titanium, potassium and lithium. Metal fires represent a unique hazard because most people are unaware of the characteristics of these fires and are not properly prepared to fight them. lass D fires burn very hot and the flames can be white in appearance. Class D fires most often occur in industrial occupancies, such as repair shops, and in motor vehicle accidents. Combustible metals are frequently used to make automotive parts because they are strong and light weight. In recent years, a number of Class D fires involving lithium batteries were reported. In 2006 millions of lithium-ion battery packs made by Sony were replaced after several hundred overheated and a few caught fire. These batteries were used in laptop computers produced by several different manufacturers. Since then, production processes have improved, and fires remain relatively rare.

	It is important to use the appropriate fire extinguishing agent on combustible metal fires. Traditional water application can react violently when it contacts the burning metal. These fires are very stubborn and difficult to extinguish. Therefore, even a small metal fire can spread and become a larger fire involving surrounding combustible materials. Only D rated extinguishers filled with dry powder should be used to extinguish a metal fire.
Slide 10	Class K fires involve cooking oils located in commercial kitchens. The special characteristics of these types of fires and the need for compatibility with built- in fire suppression systems means special wet chemicals are required. Class K fires involve cooking fat and oils, that can spread quickly, causing damage and potential injury. Class K fires are technically a subclass of class B fires, since they involve flammable liquids but because of the unique characteristics related to this type of fire, it was designated separately and requires a distinct extinguishing agent. It is critical that the right type and size of fire extinguisher be selected for the type of fire most likely to occur.
Slide 11	One way to help remember the classes of fire is: Class A is for Ash – when class A materials burn the leave a residue of Ash. Class B is for Boil – flammable liquids boil when heated Class C is for Charged and can be used on electrical fires Class D is for Detonate as metal fire become volatile if water is applied Class K is for kitchen where cooking oils are on fire.
Slide 12	Some portable fire extinguishers are obsolete and may be dangerous. Examples include soda-acid, Carbon Dioxide extinguishers with metal horns, and copper or brass shelled extinguishers that are soldered or riveted together. Carbon Tetrachloride extinguishers are commonly referred to as “fire grenades”. The contents are extremely toxic and are a known carcinogen. Any extinguisher that needs to be inverted to operate and any extinguisher that can no longer be serviced in accordance with the manufacturer's maintenance manual is considered obsolete and should be removed from service. In most cases, extinguishers that are charged or full of chemical agent can be taken to the local hazardous material waste disposal facility who will process them in a safe manner.
Slide 13	Portable fire extinguishers are approved and labeled for a certain class of fire. Class A and B extinguishers have numerical rating in addition to the Class rating that indicates the size of fire they can extinguish. Class C, D and K do not. The ratings on class A and B extinguishers are an indication of how much fire the extinguisher will SAFELY extinguish. In this example the letters A,

	B, and C represent the class of fire for which the extinguisher has been approved. The number in front of the A rating indicates how much water the extinguisher is equal to and represents 1.25 gallons (US) of water for every unit of one. For example, this 4-A rated extinguisher would be equal to 5 (4 x 1.25) gallons of water. The number 80 in front of the B rating represents the area in square feet of class B fire that a non-expert user should be able to extinguish. Using this example the 80-B:C should be capable of extinguishing 80 square feet of coverage. The bigger the numbers in the unit label, the bigger the fire the unit can handle. For example, a unit labeled 2A can handle a fire twice as big as a 1A unit. A 4A unit can handle a fire twice as big as a 2A unit.
Slide 14	Class K fire extinguishers have the letter "K" on the label, come in a standard size with 6 litres of wet chemical agent, but they do not have a number rating. Class K hazards vary greatly depending on the size and use of the kitchen. The number of Class K extinguishers required in a kitchen is based on a maximum travel distance of 9.1m or 30 feet from the hazard to the extinguisher. Large kitchen operations may require multiple class K extinguishers. In researching this material, we consulted with a technical representative from Amerex Fire a major manufacturer of portable fire extinguishers and was told that their K class extinguishers are also approved for use on ordinary combustibles and have a 2A-K rating. The ratings can be found on the technical information plate on the back of the extinguisher along with the date of manufacture and maintenance details. Only the K appears on the front of the extinguisher because that is the main purpose of the unit. He said he could not speak about other manufacturers extinguishers.
Slide 15	Underwriters Laboratories Inc. (UL) is an independent, non-profit organization that conducts testing of commercial products to ensure they meet safety standards in a global setting. Commercial products are vigorously researched and tested before they can be put on the market for resale. UL has a specific division for fire safety science, testing and analysis of data. Once a product passes safety standard testing, it is considered as a “listed” product with UL. These products bear the UL mark on the product label. UL has a number of international associations, including Underwriters Laboratories Inc. Canada known as CAN-ULC. Fire extinguishers must have the ULC marking on the label, or the combined marking depicting UL CAN-US that you see on this slide. This means that the product meets Canadian safety standards which may be different than in the US. A UL only mark would indicate that the product

	has not been tested to meet the applicable Canadian safety standard and therefore, must be removed from service. You should record this in your inspection report as a violation. There is fire extinguishing or suppressing products on the market that have not be rated, listed or approved for use in Canada. They do not bear the ULC marking. You may encounter these products while on inspections. These should also be recorded as a violation and be removed from service.
Slide 16	For many years a lettering system has been used to label a fire extinguisher's characteristics and capabilities. You will still find these labels on some portable fire extinguishers during your inspections. This system places transposed letters representing each class of fire onto geometric shapes. Extinguishers suitable for a Class A fires are identified with the letter "A" on a solid green triangle. B class fire were identified by a red square, and C class fire extinguishers were identified with a blue circle with the letter C. Class D extinguishers were identified by a yellow star. Because the Class-K fire classification is relatively new it does not have a traditional-system alphabet graphic.
Slide 17	More recently, a universal pictogram system has been developed which does not require the user to be familiar with alphabetic codes for the different classes of fires. In the pictogram system, symbols replace the former letter representation of each class of fire. These symbols represent a visual graphic of the fuel involved in the fire. The symbols appear in a square icon box. For example, in the case of a C-Class fire the symbol is an electrical plug and socket with fire around the two images.
Slide 18	Under the pictogram system, the appearance icons on a fire extinguisher label indicates that the extinguisher will be effective for the types of fires depicted in the square icon. Many fire extinguishers will have two or more square icons. For example, a regular multi-purpose dry chemical fire extinguisher will have three icons displayed on the fire extinguisher – one with a burning trash can, one with a burning fuel container and an icon showing an electrical plug and socket on fire. These should be displayed in a horizontal sequence. The symbols may vary by manufacturer. The NFPA 10, Standard for Portable Fire Extinguishers (2013), recommended marking system uses pictograms in Annex B, Figure B.1.1. It notes that the traditional lettering system is the previously recommended marking system.
Slide 19	Under the pictogram system, it is important to note that if an icon is missing from a label, the fire extinguisher will not be effective or safe to use on the missing icon representing that particular class of fire. Another way to indicate that the fire extinguisher would not be appropriate for

	certain fires is to display all the pictograms for all fire classes but with a red diagonal slash across the pictograms for which the extinguisher will be ineffective or dangerous for use.
Slide 20	Fire Extinguishers: • Are required in every building except a private dwelling but private dwellings are well advised to install an extinguisher even though it is not a code requirement • Portable extinguishers must be selected and installed in conformance with NFPA 10 and ULC standards for portable fire extinguishers • There should be at least one 2 A rated portable fire extinguisher per floor • The maximum travel distance to a Class A fire extinguisher in unsprinklered buildings is 75 feet • The travel distance can be doubled to 150 feet in sprinklered buildings What this means is that at least one Class “A” rated portable extinguisher is required on each floor regardless of travel distance. That can be a simple “A” class extinguisher like a pressurized water extinguisher, or it can be an ABC Multi-purpose dry chemical extinguisher as long the label indicates a minimum of a 2 “A” rating for Light and Ordinary hazard occupancies and 4-A for Extra Hazard occupancies.
Slide 21	Fire extinguisher signage may be required in occupancies with a large floor area such as retail “big box” type stores. These buildings tend to have a lot of rack storage and products on the rack shelving. This may make it difficult to see or find a fire extinguisher in the event of an emergency. NFPA 10 requires that the installation of signs or other means to indication the location of fire extinguishers. It says that the signs must be located in close proximity to the extinguisher and be visible from the normal path of travel. To prevent fire extinguishers from being moved or damaged, they should be mounted on brackets, in wall cabinets, or wall recesses with their carrying handles placed 1.07m (3-1/2’) to 1.5m or (5 feet) above the floor, depending on the weight of the extinguisher. If the extinguisher weighs more than 18.1 kg (40 pounds) the top of the extinguisher should be not more than 1.07 m or (42”) above the floor. If the extinguisher weighs 18.1 kgs or 40 pounds or less, the top of the extinguisher should be not more than 1.5m or 5 feet above floor level.

	The bottom of any extinguisher should be not less than 10.2cm or 4 inches above floor level.
Slide 22	Cabinets housing fire extinguishers should not be locked except where extinguishers are subject to malicious use or damage. In this case the cabinets can be locked but must include a means of emergency access like breaking a glass panel as shown in this photo. Fire Extinguisher Monitoring systems are an emerging technology that provides an electronic signal that notifies facility managers the moment a fire extinguisher is pulled from its mount, when the fire extinguishers accessibility is blocked or when its pressure falls below safe operating levels. NFPA 10 (2013) Allows For Electronic Monitoring of Fire Extinguishers and requires that: • Records must be kept for any fire extinguisher that requires corrective action • Electronic records must show that at least 12 monthly inspections have been performed An electronic event log must be kept at the fire alarm control panel.
Slide 23	There are two main methods to charge portable fire extinguishers: stored pressure and cartridge operated. Stored pressure is the most common type and, in these units, the expellant is stored in the same chamber as the firefighting agent itself. Depending on the agent used, different propellants are used. Water and foam extinguishers typically use compressed air to expel the extinguishing agent while in dry chemical extinguishers, nitrogen is typically used. All stored pressure extinguishers have a gauge showing the level of pressure in the chamber. Cartridge-operated extinguishers contain the expellant gas in a separate cartridge either inside or attached to the outside of the fire extinguisher. The cartridge is punctured prior to discharge, exposing the propellant to the extinguishing agent. Cartridge type extinguishers are not as common as the stored pressure type but have the advantage of being quickly recharged, allowing an operator to discharge the extinguisher, recharge it, and return it to service in a reasonable amount of time.
Slide 24	Water is an excellent extinguishing agent on Class A ordinary combustible fires. Water quickly converts into steam, absorbing a great amount of heat when it comes into contact with the burning fuel. As the fuel cools, the heat is reduced, and the fire goes out. Water is easily absorbed into Class A fuels and can prevent a fire from rekindling when an appropriate amount is applied. Water has some great advantages. Its inexpensive, very effective, widely available and relatively easy to clean up after

	suppression. Wetting chemicals may be added to the water which helps to reduce the surface tension of the water, allowing it to deeply penetrate very dense fuels such as bales of hay or straw. When wet water is applied too hard to penetrate fuel sources, the mixture is more readily absorbed, helping to reach the seat of the fire. Because the water is penetrating the fuel rather than just sitting on top, there is a better chance for extinguishment. Stored pressure water extinguishers like the one in this photo are very easy to recharge. The operator simply removes the top, fills the tank with water, and restores the pressure using compressed air.
Slide 25	There are some disadvantages of selecting water as an extinguishing agent. When the temperature remains below 0 degrees Celsius (32 degrees Fahrenheit) for an amount of time, the water in the extinguisher can freeze. Where subject to freezing loaded stream fire extinguishers contain an alkali metal salt additive. This helps reduce the freezing point of the water so the fire extinguisher can be used in colder environments. NFPA 10 requires that the antifreeze stipulated on the fire extinguisher name plate be used. Using water on Class B or Class C fires is ineffective and can be hazardous. Flammable liquids give off flammable vapours that are what is burning. Most flammable liquids will float on the water, so they are able to continue to give off those vapours and remain burning. Water streams may cause the fire to spread further away from the spill site. Water conducts electricity on energized electrical equipment and can draw current directly to the person holding the fire extinguisher. Should any of that metal also be combustible, the water will cause a violent reaction. Water applied to a cooking grease fire can create an explosive effect as can be seen in the following video. As the water turns to steam and propels the oil out of the pan.
Slide 26	Video.
Slide 27	The most common fire extinguisher you will encounter while on inspections is the multi-purpose dry-chemical extinguisher. These can be used on Class A, Class B and Class C fires, hence why they are considered multipurpose. The extinguishing agents are a blend of finely ground particles to apply onto a fire. The dry chemicals act to interrupt the chemical chain reactions that occur in the process of combustion. These chemicals have specific attributes that allow smooth, even flow when the extinguisher is deployed. There are additives as well that prevent the absorption of moisture to prevent caking or packing while stored inside the cylinder.

Slide 28	Multi-purpose dry-chemical fire extinguishers have a number of advantages compared to water extinguishers. These include a greater effectiveness on flammable liquids and gas vapour fires as the chemicals will not cause the fuel to spread or expand. Dry chemicals do not conduct electricity, so they are a safer option for electrical energized fires. Another positive attribute is that the chemicals will not freeze so they are always ready for use. The commonly seen multipurpose 2-A:10B-C dry-chemical extinguisher is light, at approximately five pounds, so it's much easier to handle and deploy. They are generally economical and provide a first line of defence against most fires in one cylinder.
Slide 29	There are some disadvantages to consider when selecting multipurpose dry- chemical extinguishers. While the chemical compounds are effective, they will leave a corrosive residue on metal surfaces they contact and, due to the fine particle size, will contaminate everything in the space where the extinguisher is used. Over time, this may cause irreparable damage, especially to more vulnerable equipment such as computer and telecommunications equipment. It is recommended to clean contaminated surfaces within 48 hours. Another disadvantage is that dry chemicals are not as effective on Class A fires. They do not have the same ability to permeate the burning fuel as water. This can be problematic because there is a greater risk of smoldering fuel causing the fire to rekindle. There are five compounds used in dry-chemical extinguishing agents. Small household extinguishers contain sodium bicarbonate while non-residential extinguishers contain other chemicals that have greater firefighting capabilities on Class B and C fires. These include potassium bicarbonate, urea- based potassium bicarbonate and potassium chloride. Ammonia phosphate is the only chemical suitable for use on Class A fires, but water will always be the better option.
Slide 30	Carbon dioxide, also known as CO2, is a fire extinguishing agent that is effective on Class B and C fires only. Carbon dioxide is 1.5 times heavier than air, and is colourless and odourless .It creates a cloud around a fire thereby, preventing oxygen from reaching the fire. In this way, a smothering blanketed effect is created. This is especially helpful on Class B fires because ignitable vapour formation is inhibited. The CO2 is stored under pressure in the extinguisher cylinder. It is discharged by pressing the lever, releasing through the hose, and discharging out of a cone or horned shaped nozzle. When the CO2 is released, it is very cold and forms a visible cloud of "dry ice" when moisture in the air blends with the expellant. The release of the compressed gas does not conduct electricity, produces no residue and is

	non-corrosive. Sensitive equipment, therefore, is not susceptible to corrosion but may be damaged by the extreme cold of the CO2. It is most effective in confined areas.
Slide 31	There are, however, a number of disadvantages and limiting factors to consider. CO2 portable fire extinguishers are considerably heavier than their dry-chemical counterparts. They have a shorter range which means the user may have to get closer to the fire. When used in smaller, confined spaces, such as a server room, there is a risk the user may have difficulty breathing when the CO displaces the oxygen in the space. Weather can have a negative impact on effectiveness as well. CO does not perform well in temperatures below 0 degrees Fahrenheit or minus 18 degrees Celsius. Winds or drafts can also disperse the CO before it even reaches the fire. At times, this cooling effect can cause the lever and or nozzle to freeze. This can create a “frost bite” like burning sensation on the skin. CO2 extinguishers should not be used on solid fuel burning fires, such as wood, paper and textiles or on cooking grease fires.
Slide 32	Firefighting foam has been around for over a hundred years and is used to suppress fire by coating the fuel to prevent contact with oxygen and cooling the fire. There are two common foam types of Class A and Class B. Class A foams were developed in mid-1980s for fighting wildfires. Class A foams lower the surface tension of the water which assists in the wetting and saturation of Class A fuels with water. This aids fire suppression and can prevent reignition. Favorable experiences led to its acceptance for fighting other types of Class A fires, including structure fires. Class B foams are designed for class B fires—flammable liquids. The use of Class A foam on a class B fire will likely produce negative results, as Class A foams are not designed to contain the vapours produced by flammable liquids.
Slide 33	Class B foams have two major subtypes, Synthetic Foam and Protein Foam Synthetic foam is based on synthetic surfactants. Surfactants are compounds that lower the surface tension between two liquids, between a gas and a liquid, or between a liquid and a solid. They provide better flow and spreading over the surface of hydrocarbon-based liquids, for faster knockdown of flames. They have limited post-fire security and are toxic groundwater contaminants. Aqueous film forming foams, better known as A Triple F (AFFF) are water- based and frequently contain hydrocarbon-based surfactants. Alcohol-resistant aqueous film-forming foams (AR-AFFF) are foams resistant to the action of alcohols and can form a protective film.

Slide 34	Protein foams contain natural proteins as the foaming agents. Unlike synthetic foams, protein foams are biodegradable. They flow and spread slower but provide a foam blanket that is more heat-resistant and more durable. There are a number of different foams mostly based on their expansion ratio as follows: • Low-expansion foams such as AFFF, have an expansion rate less than 20 to 1, can quickly cover large areas because they have a low viscosity. Low viscosity means the friction between the fluids is less, which allows for faster flow rates. • Medium expansion foams have an expansion ratio of 20 to 200 to 1 • High-expansion foams have an expansion ratio over 200 to 1 and are suitable for enclosed spaces such as aircraft hangars, where quick filling is needed. Alcohol-resistant foams contain a polymer that forms a protective layer between the burning surface and the foam, preventing foam breakdown by alcohols in the burning fuel. Alcohol-resistant foams are used in fighting fires of fuels containing oxygenates. Oxygenates are chemical compounds that contain oxygen as one of their components.
Slide 35	Foam fire extinguishers work in the following ways: • The foam blankets the fuel surface smothering the fire. • It separates the flames and ignition source from the fuel surface. • It cools the fuel and adjacent surfaces. • The foam blanket suppresses the release of flammable vapours that can mix with air. Foam fire extinguishers contain a mixture of a water and foam additives in measured amounts determined by the manufacturer. The nozzle is designed to induct air into the solution's stream which creates the foam. The foam blankets the surface area of the fire. In Class A fires, the foam acts to reduce the surface tension of the water solution allowing it to sit longer on the fuel's surface, giving it time to really penetrate the burning materials.
Slide 36	Class B fires are extinguished by discharging the blanketing foam over the surface of an ignited fluid. This blanket acts to put out the fire by controlling vapour production, removing oxygen from the fire and cooling the temperature, reducing the chance of reignition.

	Foam selection is based on its compatibility with a specific flammable liquid but also on possible contact with other extinguishing agents present. Some Class B foam agents are approved for use on polar solvents such as alcohols, ketones, acetones and esters but the fire extinguisher must be explicitly labelled for use on polar solvent-based fires. Polar solvent or Alcohol type fuels are fuels that mix readily with water or are miscible in water. Though not their intended use, some Class B foams can be applied to fires involving Class A ordinary combustibles. However, Class A foams will have a negative or no effect on Class B fires. Fire extinguishers should only be used on the fire type(s) that they have been listed for. Water based foam extinguishers should not be stored or used at freezing or below temperatures and should never be used on a Class C fires.
Slide 37	Kitchen fires are one of the leading reported causes of fire. Wet-chemical portable fire extinguishers are the only type of extinguisher that meets the fire code requirements for Class “K” fire extinguishing products. Class “K” fires involve combustible animal or vegetable cooking oils. They are required in every kitchen that has a fixed pipe kitchen fire suppression system. This includes both public and private cooking operations that produce smoke or grease-laden vapours such as institutions, public restaurants, community halls and mobile food vending trucks. These extinguishers are particularly relevant in fighting deep-fat coo king fires. They work on the principle of saponification. Saponification takes place when alkaline mixtures, such as potassium acetate, potassium citrate, or potassium carbonate, are applied to burning cooking oil or fat. The alkaline mixture combines with the fatty acid of the cooking medium to create a soapy foam on the surface that holds in the vapours and steam and extinguishes the fire. These extinguishers are identified by the letter K.
Slide 38	Some of the advantages of the “K” extinguisher are: • that they are more effective than dry chemical extinguishers • they dispense the solution in a fine spray to reduce the chance of splattering the hot oils • they cover the surface of the container completely creating a foam blanket which cools and smothers the fire • they are Is easy to clean-up after the fire which allows the kitchen to be placed back in service quickly in support of business continuity

	• they protect other expensive kitchen cooking equipment. If dry chemicals were used, cooking surfaces and nearby appliances would become contaminated requiring extensive cleanup before restarting operations. The biggest draw back to Class K solutions being applied to hot oils and fats is that reignition can occur if the surface of the soapy foam is disturbed, allowing oxygen to once again reach the heat and fuel. This is why many jurisdictions prohibit the installation of dry chemical or stored pressure water extinguishers in kitchens. To learn more about Wet chemical extinguishers please visit the Additional Learning Opportunities resource section and view the Amerex Class K Extinguisher Video. Reference: NFPA 10
Slide 39	Video.
Slide 40	Clean agents or Halogenated agents are another special type of extinguishing agent produced by a family of liquified gases called halogens. These are referred to as clean agents because there is no residue left after they discharge. Typically, they are used in areas containing sensitive or irreplaceable materials which could be damaged or destroyed by water, foam, dry chemical, or carbon dioxide. Typical applications include computer centers, data/document storage areas, communications facilities, control rooms, electronics manufacturing, museums, art galleries, and laboratories etcetera. The major advantage of halon is that it vaporizes rapidly in a fire situation, leaves no corrosive or abrasive residue, and Halon is a non-conductor of electricity.
Slide 41	Unfortunately, there is one major drawback to the use of halon. The release of halon into the atmosphere severely damages the earth's ozone layer. In 1987, the problem with Halon was globally recognized, and production was greatly reduced. By the mid 1990's, the US banned production and importation of these materials. However, halon products may be re-captured and recycled in certain approved circumstances. A new generation of clean agents have been developed which offers a much safer extinguishing product. The following video demonstrates a new Kidde Clean Agent total flooding system. The effectiveness of clean agents is diminished in the presence of wind or drafts, so most systems are contained in specialized rooms like the one shown in this video.

Slide 42	Video.
Slide 43	Carbon Tetrachloride was widely used in the early 20th century as a dry-cleaning solvent and in glass bulb or grenade type fire extinguishers. These extinguishers were originally designed to be thrown at the fire but evolved to include a bracket assembly that suspended them directly over areas of fire risk, as shown in this photograph. If high temperatures reach some styles of brackets, they will release the grenade which would then fall to the floor and shatter, releasing the fire suppression liquid. Other types had heat-activated, spring-loaded triggers that would break the bottom seal, spilling the liquid onto a deflector that would distribute it over a larger area. Once it became apparent that Carbon Tetrachloride exposure had severe adverse health effects, safer alternatives were found for these applications, and its use declined from about 1940 onward. Should you encounter this type of portable fire extinguisher during your inspection it should be treated as a hazardous material and the owner should remove it from service immediately and dispose of it. Carbon Tetrachloride should be disposed of as a hazardous waste material and be taken to any household hazardous waste collection facility. To learn more about Clean Agents and Halon extinguishing agents please see the Additional Resources section of this Chapter.
Slide 44	Class D fires involve combustible metals, such as magnesium, titanium, potassium and sodium. These materials burn at high temperatures and will react violently with water, air, carbon dioxide and/or other chemicals. The specific agents used on each type of fire are chosen for their inertness with respect to the burning material. • Class D extinguishers typically require a large amount of dry powder agent (several inches) to completely encapsulate and smother the fire which is why they are only available in 30 lb capacity for handheld units. These extinguishers are designed to gently apply the agent, so it piles up in a layer rather than the typical vigorous discharge of a conventional ABC-type extinguisher.
Slide 45	There are two types of dry-powder compounds found in either a fine granular or powdered form. One of these compounds is sodium chloride also known as table salt. Thermoplastic additives blended with the powder help to coat the particles and allow the powder to flow freely when deployed. When applied onto a fire, the dry-powder agent forms a solid mass over its surface area. This compound is found inside Class D fire extinguishers.

	The other dry-powder variant is made from a combination of graphite powder and phosphorous-containing compounds. The phosphorous materials react with the fire to release oxygen inhibiting gases. The graphite cools the temperature of the fire by absorbing heat. This powder is produced in bulk and must be applied manually with a scoop or shovel. This can pose a problem to the user who would have to get very close to the fire to put it out.
Slide 46	Class D agents must be applied gently and with care. f the powder is dumped onto the molten metal too forcefully, it can splatter, allowing the fire to spread or seriously injure the user. Water should never come in contact the Class D fires as it reacts very violently with the burning metal. The following video shows and Ansul Met-L-X Class D portable extinguisher at work.
Slide 47	Video.
Slide 48	To work properly portable fire extinguishers, require monthly inspection and annual testing and maintenance in accordance with NFPA 10, the Standard for Portable Fire Extinguishers. The monthly inspection is usually performed in-house but the annual testing and maintenance must be done by a certified service technician acceptable to the AHJ. The monthly inspection involves: • Ensuring the extinguisher is in its designated location • It is not obstructed from access or visibility • The pressure gauge is in the operating range • The Tamper Seal is intact • Fullness is determined by weighing or hefting the extinguisher • The visual inspection also insures there is not physical damage to the unit. Records of the monthly inspections should be kept. This could be through a tag on the extinguisher like the one shown in this photo or in a fire protection system logbook.
Slide 49	Video.
Slide 50	The annual inspection must be completed by a qualified person and includes an external examination to detect obvious physical damage, corrosion, nozzle blockage, and to verify that the operating instructions are present, legible, and facing outward. The tamper proof seal must be

	removed by operating the pull pin or locking device and replaced with a new seal. It is important that the pin comes out easily and is not bent in a way that can hinder its removal. Once the annual inspection is completed a new tag or label should be attached indicating the month and year the inspection was done, the initials of the person and the name of the company performing the work. The annual inspection must also verify when the next hydro-static test is due.
Slide 51	Video.
Slide 52	Fire extinguishers are the first line of defence against small fires. The graphic on this slide provides an example of a generic checklist to assist you when assessing fire extinguisher availability and readiness while conducting your inspections. It will help you remember what to look for. For example, the placement of fire extinguishers is based on a number of factors including travel distance which you may need to evaluate. NFPA 10, Chapter 6, provides clear instruction for the installation of extinguishers relevant to the hazard risk including travel distance. Generally, fire extinguishers must always be in plain view, unobstructed by any items, be mounted properly based on extinguisher size, and be easily accessible. Extinguishers should be installed in or close to the means of egress so that an escape route is always available to the operator. Reference: Bartlett & Jones, p. 215
Slide 53	Deficiencies identified during inspections frequently involve fire extinguishers. Commonly observed deficiencies can include missing or outdated inspection tag, mechanical damage, low pressure indicated on the gauge, or the fire extinguisher is missing altogether. Deficiencies found by the service technician during their inspection will be noted on the tag and in the report provided to the property owner or manager. In some cases, a large X will be marked across the tag as seen in this photo. This indicates that the extinguisher does not function, and additional work is urgently required. In other cases, the inspection tag may indicate that all is well, but deficiencies may have developed since the last annual inspection. These items must be documented in your fire inspection report. A copy of your report must give to the building owner outlining a reasonable amount of time to correct the deficiencies.
Slide 54	In this chapter, we discussed:

	• The importance and purpose of portable fire extinguishers and that they are the most common fire safety equipment you will see during your inspections • That extinguishers sold or installed in Canada must be ULC approved • The basic concepts of the fire triangle and tetrahedron • The five classes of fires A,B,C,D & K • We talked about the pictogram system for marking extinguishers • The selection of the appropriate type of fire extinguisher based on the hazard being protected • Hazard classification being Light Hazard, Ordinary Hazard and Extra Hazard How fire extinguishers are classified and rated and the advantages and disadvantages of each type
Slide 55	• That A and B class extinguishers have a number in front of the letter and the larger the number the bigger the fire the unit should be able to handle – A 2A rated extinguisher should be able to extinguish a fire twice as big as a 1A rated extinguisher • Class K extinguishers are required in kitchens that produce smoke and grease laden vapours • fire extinguisher travel distance, location, signs, and that they should be properly mounted on the wall or in cabinets • we talked about NFPA 10 which is the “Standard for Portable Fire Extinguishers” • the types of extinguishing agents contained in fire extinguishers and that obsolete extinguishers should be removed from service • Fire extinguisher monitoring systems including electronic signals and record keeping • Two methods of charging extinguishers, stored pressure and cartridge operated • Types of extinguishers including Loaded Stream, Dry Chemical, CO2, Foam, Wet Chemical, Clean Agent and Dry Powder and their advantages and disadvantages We talked about Inspection, Testing and Maintenance of portable fire extinguishers including the monthly, annual, and external and internal inspections