MAINTENANCE PRACTICES-I

MODULE - 7

REFERENCE BOOKS: SHOP THEORY (REFERENCE BOOKS: SHOP THEORY (J. A Enderson & Tatro),EASA Module-07A Maintenance Practices (AIRCRAFT TECH BOOK CO) ,

7.1 Safety Precautions-Aircraft and Workshop

1. Aspects of safe working practices including precautions to take when working with electricity, gases especially oxygen, oils and chemicals. ·
2. Also, instruction in the remedial action to be taken in the event of a fire or another accident with one or more of these hazards including knowledge on extinguishing agents

❖ Shop Safety

- Keeping hangars, shop, and the flight line orderly and clean is essential to safety and efficient maintenance.
- The highest standards of orderly work arrangements and cleanliness should be observed during the maintenance of aircraft.
- Where continuous work shifts are established, the outgoing shift should remove and properly store personal tools, rollaway boxes, all work stands, maintenance stands, hoses, electrical cords, hoists, crates, and box that were needed for the work to be accomplished.
- Signs should be posted to indicate dangerous equipment or hazardous conditions. There should also be signs that provide the location of first aid and fire equipment.
- Safety lanes, pedestrian walkways, and fire lanes should be painted around the perimeter inside the hangars. This is a safety measure to prevent accidents and to keep pedestrian traffic out of work areas. Safety is everyone's business, and communication is key to ensuring everyone's safety. Technicians and supervisors should watch for their own safety and for the safety others working around them. If other personnel are conducting their actions in an unsafe manner, communicate with them, reminding them of their safety and that of others around them.

❖ **Electrical Safety**

❖ ***Physiological Safety***

- Working with electrical equipment poses certain physiological safety hazards. It is known that when electricity is applied to the human body, it can create severe burns

in the area of entrance to and at the point of exit from the body. In addition, the nervous system is affected and can be damaged or destroyed. To safely deal with

electricity, the technician must have a working knowledge of the principles of electricity, and a healthy respect for its capability to do both work and damage

- Wearing or use of proper safety equipment can provide a psychological assurance at the same time it physically protects the user. The use of rubber gloves, safety glasses, rubber or grounded safety mats, and other safety equipment contributes to the physiological safety of the technician working on or with electrical equipment.
- Two factors that affect safety when dealing with electricity are fear and overconfidence. These two factors are major causes of accidents involving electricity.
- While both a certain amount of respect for electrical equipment is healthy and a certain level of confidence is necessary, extremes of either can be deadly. Lack of respect is often due to lack of knowledge. Personnel who attempt to work with electrical equipment and have no knowledge of the principles of electricity lack the skills to deal with electrical equipment safely.

❖ **Fire Safety**

- Anytime current flows, whether during generation or transmission, a byproduct of that flow is heat. The greater the current flow, the greater the amount of heat created. When this heat becomes too great, protective coatings on wiring and other electrical devices can melt, causing shorting, which leads to more current flow and greater heat. This heat can become so great that metals can melt, liquids vaporize, and flammable substances ignite. An important factor in preventing electrical fires is to keep the area around electrical work or electrical equipment clean, uncluttered, and free of all unnecessary flammable substances.
- Ensure that all power cords, wires, and lines are free of kinks and bends which can damage the wire. Never place wires or cords where they will be walked on or run over by other equipment. When several wires inside a power cord are broken, the current passing through the remaining wires increases. This generates more heat than the insulation coatings on the wire are designed to withstand and can lead to a fire. Closely monitor the condition of electrical equipment.

- Repair or replace damaged equipment before further use.

Safety Around Compressed Gases

Compressed air, like electricity, is an excellent tool as long as it is under control. The following "do's and don'ts" apply when working with or around compressed gases:

• Inspect air hoses frequently for breaks and worn spots. Unsafe hoses should be replaced immediately.

Keep all connections in a "no-leak condition."

• Maintain in-line oilers, if installed, in operating condition.

• The system should have water sumps installed and should be drained at regular intervals.

• Air used for paint spraying should be filtered to remove oil and water.

• Never use compressed air to clean hands or clothing. Pressure can force debris into the flesh leading to infection.

• Never spray compressed air in the area of other personnel.

• Air hoses should be straightened, coiled, and properly stored when not in use.

Safety around Hazardous Materials

Material safety diamonds are very important with regard to shop safety. These forms and labels are a simple and quick way to determine the risk and, if used properly with the tags, will indicate what personal safety equipment to use with the hazardous material.

The most observable portion of the Material Safety Data Sheet (MSDS) label is the risk diamond. It is a four color segmented diamond that represents Flammability (Red), Reactivity (Yellow), Health (Blue), and special Hazard (White). In the Flammability, Reactivity, and Health blocks, there should be a number from 0 to 4. Zero represents little or no hazard to the user; 4 means that the material is very hazardous. The special hazard segment contains a word or abbreviation to represent the special hazard. Some examples are: RAD for radiation, ALK for alkali materials, Acid for acidic materials, and CARC for carcinogenic materials. The letter W with a line through it stands for high reactivity to water.

Safety Around Machine Tools

Hazards in a shop's operation increase when the operation of lathes, drill presses, grinders, and other types of machines are used. Each machine has its own set of safety practices. The following discussions regarding precautions should be followed to avoid injury.

The drill press can be used to bore and ream holes, to do facing, milling, and other similar types of operations. The following precautions can reduce the chance of injury:

- Wear eye protection.
- Securely clamp all work.
- Set the proper RPM for the material used.
- Do not allow the spindle to feed beyond its limit of travel while drilling.
- Stop the machine before adjusting work or attempting to remove jammed work.
- Clean the area when finished.

Lathes are used in turning work of a cylindrical nature.

This work may be performed on the inside or outside of the cylinder. The work is secured in the chuck to provide the rotary motion, and the forming is done by contact with a securely mounted tool. The following precautions can reduce the chance of injury:

- Wear eye protection.
- Use sharp cutting tools.
- Allow the chuck to stop on its own. Do not attempt to stop the chuck by hand pressure.
- Examine tools and work for cracks or defects before starting the work.
- Do not set tools on the lathe. Tools may be caught by the work and thrown.
- Before measuring the work, allow it to stop in the lathe.

Milling machines are used to shape or dress; cut gear teeth, slots, or key ways; and similar work. The following precautions can reduce the chance of injury:

- Wear eye protection.
- Clean the work bed prior to work.
- Secure the work to the bed to prevent movement during milling.
- Select the proper tools for the job.
- Do not change the feed speed while working. Lower the table before moving under or away from the work.
- Ensure all clamps and bolts will pass under the arbor.

Grinders are used to sharpen tools, dress metal, and perform other operations involving the removal of small amounts of metal. The following precautions can reduce the chance of injury:

• Wear eye protection even if the grinder has a shield.

• Inspect the grinding wheel for defects prior to use.
• Do not force grinding wheels onto the spindle.
They fit snugly, but do not require force to install them. *Placing side pressure on a wheel could cause it to explode.*
• Check the wheel flanges and compression washer. They should be one-third the diameter of the wheel.
• Do not stand in the arc of the grinding wheel while operating, in case the wheel explodes.
Welding should be performed only in designated areas.
Any part to be welded should be removed from the aircraft, if possible. Repair would then be accomplished in the welding shop under a controlled environment. A welding shop should be equipped with proper tables, ventilation, tool storage, and fire prevention and extinguishing equipment.
Welding on an aircraft should be performed outside, if possible. If welding in the hangar is necessary, observe these precautions:
• During welding operations, there should be no open fuel tanks, and no work on fuel systems should be in progress.
• No painting should be in progress.
• No aircraft are to be within 35 feet of the welding operation.
• No flammable material should be in the area around the welding operation.
• Only qualified welders should be permitted to do the work.
• The welding area should be roped off and placarded.
• Fire extinguishing equipment of a minimum rating of 20B should be in the immediate area with 80B rated equipment as a backup. These ratings will be explained later in this chapter.
There should be trained fire watches in the area around the welding operation.
• Aircraft being welded should be in towable condition, with a tug attached, and the aircraft parking brakes released. A qualified operator should be on the tug, and mechanics available to assist in the towing operation should it become necessary to tow the aircraft. If the aircraft is in the hangar, the hangar doors should be opened.

Flight Line Safety

Hearing Protection

The flight line is a place of dangerous activity. Technicians who perform maintenance on the flight line must constantly be aware of what is going on around them. The noise on a flight line comes from many places. Aircraft are only one source of noise. There are auxiliary- power units (APUs), fuel trucks, baggage handling equipment, and so forth. Each has its own frequency of sound. Combined all together, the ramp or flight line can cause hearing loss. There are many types of hearing protection available. Hearing protection can be external or internal. The external protection is the earmuff**/**headphone type. The internal type fit into the auditory canal. Both types will reduce the sound level reaching the eardrum and reduce the chances of hearing loss. Hearing protection should also be used when working with pneumatic drills, rivet guns, or other loud or noisy tools or machinery. Because of their high frequency, even short duration exposure to these sounds can cause a hearing loss. Continued exposure *will* cause hearing loss.

Foreign Object Damage (FOD)

FOD is any damage caused by any loose object to aircraft, personnel, or equipment. These loose objects can be anything from broken runway concrete to shop towels to safety wire.

To control FOD, keep ramp and operation areas clean, have a tool control program, and provide convenient receptacles for used hardware, shop towels, and other consumables.

The modern gas turbine engine will create a low pressure area in front of the engine that will cause any loose object to be drawn into the engine. The exhaust of these engines can propel loose objects great distances with enough force to damage anything that is hit.

Fire Safety

Performing maintenance on aircraft and their components requires the use of electrical tools which can produce sparks, along with heat-producing tools and equipment, flammable and explosive liquids, and gases.

As a result, a high potential exists for fire to occur.

Measures must be taken to prevent a fire from occurring and to also have a plan for extinguishing it.

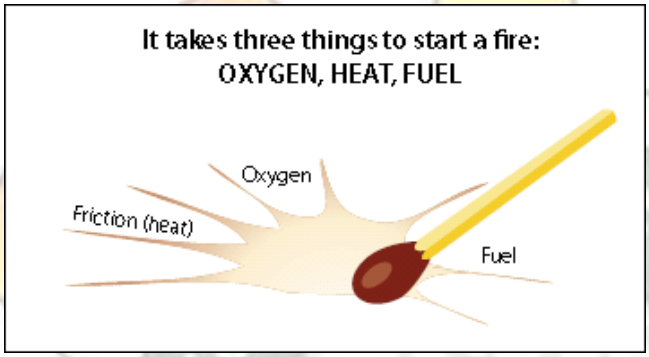
The key to fire safety is knowledge of what causes fire, how to prevent it, and how to put it out. This knowledge must be instilled in each technician emphasized by their supervisors through sound safety programs, and occasionally practiced. Airport or other local fire departments can normally be called upon to assist in training personnel and helping to establish fire safety programs for the hangar, shops, and flight line.

Requirements for Fire to Occur

Three things are required for a fire: (1) fuel — something that will, in the presence of heat, combine with oxygen, thereby releasing more heat and as a result reduces itself to other chemical compounds;

(2) Heat — accelerates the combining of oxygen with fuel, in turn releasing more heat; and (3) oxygen — the Element which combines chemically with another substance through the process of oxidation. Rapid oxidation, accompanied by a noticeable release of heat and light, is called combustion or burning. Remove any one of these things and the fire extinguishers.

Classification of Fires



For commercial purposes, the National Fire Protection Association (NFPA) has classified fires into three basic **Types: Class A, Class B, and Class C.**

1. Class A fires occur in ordinary combustible materials, such as wood, cloth, paper, upholstery materials, and so forth.
2. Class B fires occur in flammable petroleum products of other flammable or combustible liquids, greases, solvents, paints, and so forth.
3. Class C fires occur involve energized electrical wiring and equipment

A fourth class of fire, with which the technician should be familiar, the Class D fire, is defined as fire in flammable metal. Class D fires are not commercially considered by the National Fire Protection Association to be a basic type or category of fire since they are caused by a Class A, B, or C fire. Usually Class D fires involve magnesium in the shop or in aircraft wheels and brakes, or are the result of improper or poorly conducted welding operations. Any one of these types of fires can occur during maintenance on or around, or operations involving, aircraft.

There is a particular type extinguisher which is most effective for each type of fire. Types and Operation of Shop and Flight Line

Fire Extinguishers

- Water extinguishers are the best type to use on Class A fires. Water has two effects on fire: it deprives fire of oxygen and cools the material being burned. Since most petroleum products float on water, water-type fire extinguishers are not recommended for Class B fires.
- Extreme caution must be used when fighting electrical fires with water-type extinguishers. Not only must all electrical power be removed or shut off to the burning area, but residual electricity in capacitors, coils, and so forth must be considered to prevent severe injury, and possibly death from electrical shock. Never use water-type fire extinguishers on Class D fires. Because metals burn at extremely high temperatures, the cooling effect of water causes an explosive expansion of the metal. Water fire extinguishers are operated in a variety of ways. Some are hand pumped, while some are pressurized. The pressurized types of extinguishers may have a gas charge stored in the container with the water, or it may contain a “soda-acid” container where acid is spilled into a container of soda inside the extinguisher. The chemical reaction of the soda and the acid causes pressure to build inside the fire extinguisher, forcing the water out.
- Carbon dioxide (CO2) extinguishers are used for Class A, B, and C fires, extinguishing the fire by depriving it of oxygen. Additionally, like water-type extinguishers, CO2 cools the burning material. Never use CO2 on Class D fires. As with water extinguishers, the cooling effect of CO2 on the hot metal can cause explosive expansion of the metal. When using CO2 fire extinguishers, all parts of the extinguisher can become extremely cold, and remain so for a short time after operation. Wear protective equipment or take other precautions to prevent cold injury (such as frostbite) from occurring. Extreme caution must be used when operating CO2 fire extinguishers in closed or confined areas. Not only can the fire be deprived of oxygen, but so too can the operator. CO2 fire extinguishers generally use the self-expelling method of operation. This means that the CO2 has

sufficient pressure at normal operating pressure to expel itself. This pressure is held inside the container by some type of seal or frangible disk, which is broken or punctured by a firing mechanism, usually a pin. This means that once the seal or disk is broken, pressure in the container is released, and the fire extinguisher is spent, requiring replacement

- Halogenated hydrocarbon extinguishers are most effective on Class B and C fires. They can be used on Class A and D fires but they are less effective. Halogenated hydrocarbon, (commonly called Freon™ by the industry), are numbered according to chemical formulas with Halon™ numbers. Carbon tetrachloride (Halon 104), chemical formula CCl4, has an Underwriters Laboratory (UL) toxicity rating of 3. As such, it is extremely toxic. [Figure 11-6] Hydrochloric acid vapor, chlorine and phosgene gas are produced whenever carbon tetrachloride is used on ordinary fires. The amount of phosgene gas is increased whenever carbon tetrachloride is brought in direct contact with hot metal, certain chemicals, or continuing electrical arcs. It is not approved for any fire extinguishing use. Old containers of Halon 104 found in or around shops or hangars should be disposed of in accordance with Environmental Protection Agency (EPA) regulations and local laws and ordinances.
- Methyl bromide (Halon 1001), chemical formula CH3Br, is a liquefied gas with a UL toxicity rating of 2. Very toxic, it is corrosive to aluminum alloys, magnesium, and zinc. Halon 1001 is not recommended for aircraft use.
- Chlorobromomethane (Halon 1011), chemical formula CH2ClBr, is a liquefied gas with a UL toxicity rating of 3. Like methyl bromide, Halon 1011 is not recommended for aircraft use.
- Dibromodifluoromethane (Halon 1202), chemical formula CBr2F2, has a UL toxicity rating of 4. Halon 1202 is not recommended for aircraft use.
- Bromochlorodifluoromethane (Halon 1211), chemical formula CBrClF2, is a liquefied gas with a UL toxicity rating of 5. It is colorless, noncorrosive and evaporates rapidly leaving no residue. It does not freeze or cause cold burns, and will not harm fabrics, metals, or other materials it contacts. Halon 1211 acts rapidly on fires by producing a heavy blanketing mist that eliminates oxygen from the fire source. But more importantly, it interferes

chemically with the combustion process, of the fire. It has outstanding properties in preventing reflash after the fire has been extinguished.

- Bromotrifluoromethane (Halon 1301), chemical formula CF3Br, is also a liquefied gas with a UL toxicity rating of 6. It has all the characteristics of Halon 1211. The significant difference between the two is: Halon 1211 forms a spray similar to CO2, while Halon 1301 has a vapor spray that is more difficult to direct.

Inspection of Fire Extinguishers

Fire extinguishers should be checked periodically utilizing a checklist. If a checklist is unavailable, check the following as a minimum:

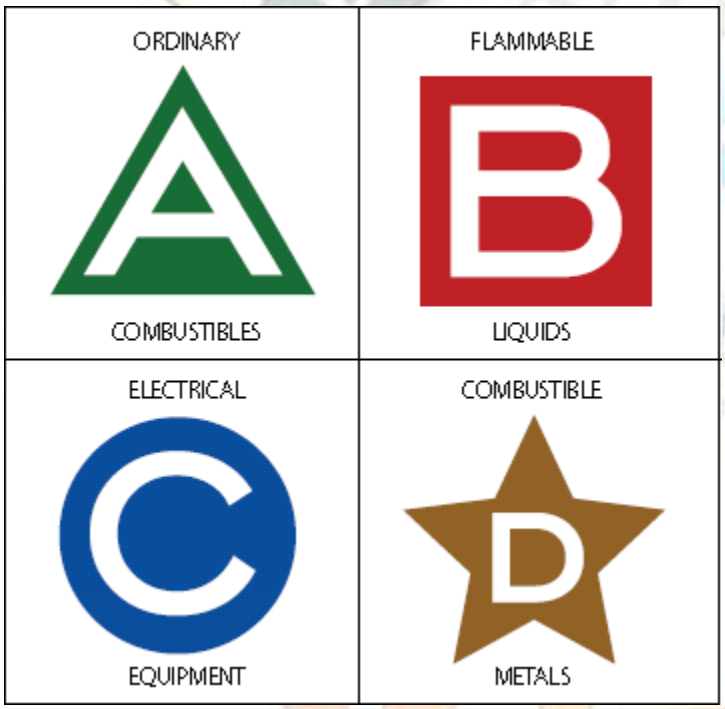
- Proper location of appropriate extinguisher
- Safety seals unbroken
- All external dirt and rust removed
- Gauge or indicator in operable range
- Proper weight
- No nozzle obstruction
- No obvious damage

Airport or other local fire departments can usually help in preparing and often can provide extinguisher checklists. In addition, these fire departments can be helpful in answering questions and assisting in obtaining repairs to or replacement of fire extinguishers.

Identifying Fire Extinguishers

Fire extinguishers should be marked to indicate suitability for a particular class of fire. The markings on should be placed on the fire extinguisher and in a conspicuous place in the vicinity of the fire extinguisher. When the location is marked, however, extreme care must be taken to ensure that the fire extinguisher kept at that location is in fact the type depicted by the marking. In other words, if a location is marked for a Class B fire extinguisher, ensure that the fire extinguisher in that location is in fact suitable for Class B fires. Markings should be applied by decalcomanias (decals), painting, or similar methods. They should be legible and as durable as necessary for the location. For example,

markings used outside need to be more durable than those in the hangar or office spaces. Where markings are applied to the extinguisher, they should be located on the front of the shell (if one is installed) above or below the extinguisher nameplate. Markings should be large enough and in a form that is easily seen and identifiable by the average person with average eyesight at a distance of at least 3 feet. Where markings are applied to wall panels, and soforth, in the vicinity of extinguishers, they should be large enough and in a form that is easily seen and identifiable by the average person with average eyesight, at a distance of at least 25 feet.



Signature of the Instructor **Signature of Training manager**