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LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Check & perform measuring & marking by using various measuring & marking tools. (Vernier callipers, micrometre, telescope gauges, dial bore gauges, dial indicators, straightedge, feeler gauge, thread pitch gauge, vaccum gauge, tire pressure gauge.)**
- **Plan & perform basic fastening & fitting operation by using correct hand tools, machine tools & equipment.**
- **Trace and test all electrical & electronic components & circuits and assemble circuit to ensure functionality of system.**
- **Join components by using Arc & Gas welding.**
- **Trace & test hydraulic and pneumatic components**
- **Check & interpret vehicle specification data and VIN, select & operate various service station equipment.**

Organization of ITI's and scope of the mechanic diesel trade

Objectives: At the end of this lesson you shall be able to

- **state brief introduction about Industrial Training Institutes (ITI)**
 - **state about the organized structure of the Institute.**
-

Brief Introduction of Industrial Training Institute (ITIs)

Industrial Training Institute plays a vital role in economy of the country, especially in terms of providing skilled manpower.

The Directorate General of Training (DGT) comes under **Ministry of Skill Development and Entrepreneurship (MSDE)** offers a range of vocational training trades in different sectors based on economy/labour market. The vocational training programmes are delivered under the aegis of **National Council of Vocational Training (NCVT)**. Craftsmen Training scheme (CTS) and Apprenticeship Training Scheme (ATS) and two pioneer programmes of NCVT for Propagatory Vocational Training.

Total number of ITIs in India as on April 2016 is about 13105 (Govt. it is 2293 + 10812 Private affiliated ITIs). They are giving training about 132 trades including Engineering and Non-engineering trades with the duration of 1 or 2 years. The minimum eligibility for admission in ITIs 8th, 10th and 12th pass with respect to the trades and admission process will be held in every year in July.

From 2013, semester pattern was introduced with 6 months/Semester and revised the syllabus for each semester. Then in 2014, they introduced and implemented "Sector Mentor council (SMC)" re-revised syllabus under 11 sectors of about 87 trades.

At the end of each semester, All India Trade Test (AITT) will be conducted in every July and January, with OMR answer sheet pattern and multiple choice type questions.

Scope of the mechanic diesel trade

Objectives: At the end of this lesson you shall be able to

- **importance and scope of the diesel mechanic trade training**
 - **general discipline in the institute.**
-

Scope of the diesel mechanic trade training : Mechanic diesel trade under craftsmen training scheme (CTS) is one of the most popular trade delivered nation wide through the network of ITI. This trade one year (2 semester) duration.

- Identify the various types of tools equipment, raw materials, spares used in mechanic diesel trade,
- Practice to measuring, fitting, welding, sheet metal works, mechanical and electrical and hydraulic system fault diagnosis and rectification

After passing, National trade certificates (NTC), will be issued by DGT which is authorized and recognized internationally. In 2017, for some trades they have introduced and implemented National Skill Qualification Framework (NSQF) with Level 4.

After finishing instructional training with 'NTC' certificate, they have to undergo Apprenticeship training (ATS) for one or two year with respect to trades under the Apprenticeship ACT 1961, in various government and private establishments with stipend. At the end of the Apprenticeship training, All India Apprenticeship Test will be conducted and apprentice certificate will be issued. They can get job opportunities in private or government establishment in India/Abroad or they can start small scale industries in manufacturing or in service sector with subsidiary government loan.

Organizational Structure of ITIs

The head of the institute is the Principal /DDT/HDT under him one vice-principal (VP). then Training Officers (TO), Group Instructors (GI) who are the management and supervisory staff. Then deputy training officer (DTO) Assistant Training Officers (ATO)/junior training officer (JTO) technical assistants are under Training officers for each trade and for Workshop calculations, Engineering Drawing, Employability skills etc. Administrative office staff superintendent, UDC, LDC, office assistant, employees. Hostel Superintendent (H.S.) physical Education Trainer (PET), Library incharge, Pharmacist, store keeper etc. will be under the one umbrella of the institute.

- Practice to indent and repairing various type of diesel engines,

Carrier Progress Pathways: Can join the apprenticeship training in different types of industries and often National Apprenticeship Certificate (NAC)

Can join Craftsman Instructor Training Scheme (CITS) to become an instructor in ITIs

Job Opportunities

- Mechanic diesel can join in central and state government establishments, like railway, airport, marine, military, joins as a service technician in dealer of agricultural machinery minining, trucks, bus, car, stationary engines, compressors, diesel generators, construction equipments, etc.
- employment. opportunities in overseas.

Self-employment opportunities

- Service centre in rural and urban areas.
- Maintenance contractor
- Manufacturer of sub-assembly
- Dealership/agency for automobile spare parts
- Own repair shop or garrage.

General discipline in the institute : Always be polite, courteous while in institue

Do not arguments with others, on matters of related to your training or with the office while seeking clarifications

Do not bring bad name to your institute by your improper habitude.

Do not waste your precious time in gossips with your friends and on activities other than training.

Do not be late to the theory practical and other classes.

Do not unnecessarily interfere in other's activities.

Do very attentive and listen to the lecture carefully during the theory classes and practical demonstration given by the training staff.

Give respect to your trainer and all other training staff, office staff and co-trainees.

Be interested in all the training activities.

Do not make noise or be playful while undergoing training.

Keep the institute premises neat and clean avoid poluting the environment.

Do not take away any material from the institute which does not belong to you.

Always attend the institute well dressed and good physical appearance.

Be regular to attend the training without fail and avoid absent from the theory or practical classes for simple reasons.

Prepare well before writing a test/examination.

Avoid any malpractice during the test/examination.

Write your theory and practical records regularly and submit them on time for correction

Take care of your safety as well as other's safety while doing the practicals.

Knowledge of personal safety and safety precautions in handling diesel machines.

Objectives: At the end of this lesson you shall be able to

- state the is personal protective equipment and its purpose
- name the two categories of personal protective equipment
- list the most common type of personal protective equipment
- list the conditions for selection of personal protective equipment
- state the safety precaution in handling diesel machines.

Personal Protective Equipment (PPE)

Devices, equipment, clothing are used by the employees, as a last resort, to protect against hazards in the workplace. The primary approach in any safety effort is that the hazard to the workmen should be eliminated or controlled by engineering methods rather than protecting the workmen through the use of personal protective equipment (PPE). Engineering methods could include design change, substitution, ventilation, mechanical handling, automation, etc. In situations where it is not possible to introduce any effective engineering methods for controlling hazards, the workmen shall use appropriate types of PPE.

As changing times have modernized the workplace, government and advocacy groups have brought more safety standards to all sorts of work environments. The Factories Act, 1948 and several other labour legislations 1996 have provisions for effective use of appropriate types of PPE.

Ways to ensure workplace safety and use personal protective equipment (PPE) effectively.

- Workers to get up-to-date safety information from the regulatory agencies that workplace safety in their specific area.
- To use all available text resources that may be in work area and for applicable safety information on how to use PPE best.
- When it comes to the most common types of personal protective equipment, like goggles, gloves or bodysuits, these items are much less effective if they are not worn at all times, or whenever a specific danger exists in a work process. Using PPE consistent will help to avoid some common kinds of industrial accidents.
- Personal protective gear is not always enough to protect workers against workplace dangers. Knowing more about the overall context of your work activity can help to fully protect from anything that might threaten health and safety on the job.
- Inspection of gear thoroughly to make sure that it has the standard of quality and adequately protect the user should be continuously carried out.

Categories of PPEs

Depending upon the nature of hazard, the PPE is broadly divided into the following two categories:

- 1 **Non-respiratory:** Those used for protection against injury from outside the body, i.e. for protecting the head, eye, face, hand, arm, foot, leg and other body parts
- 2 **Respiratory:** Those used for protection from harm due to inhalation of contaminated air.

They are to meet the applicable BIS (Bureau of Indian Standards) standards for different types of PPE.

The guidelines on 'Personal Protective Equipment' is issued to facilitate the plant management in maintaining an effective programme with respect to protection of persons against hazards, which cannot be eliminated or controlled by engineering methods listed in table1.

Table1

No.	Title
PPE1	Helmet
PPE2	Safety footwear
PPE3	Respiratory protective equipment
PPE4	Arms and hands protection
PPE5	Eyes and face protection
PPE6	Protective clothing and coverall
PPE7	Ears protection
PPE8	Safety belt and harnesses

Common type of personal protective equipments and their uses and hazards are as follows:

Types of protection	Hazards	PPE to be used
Head protection (Fig 1)	<ol style="list-style-type: none"> 1. Falling objects 2. Striking against objects 3. Spatter 	Helmets
Foot protection (Fig 2)	<ol style="list-style-type: none"> 1. Hot spatter 2. Falling objects 3. Working wet area 	Leather leg guards Safety shoes Gum boots
Nose (Fig 3)	<ol style="list-style-type: none"> 1. Dust particles 2. Fumes/ gases/ vapours 	Nose mask
Hand protection (Fig 4)	<ol style="list-style-type: none"> 1. Heat burn due to direct contact 2. Blows sparks moderate heat 3. Electric shock 	Hand gloves
Eye protection (Fig 5, Fig 6)	<ol style="list-style-type: none"> 1. Flying dust particles 2. UV rays, IR rays heat and High amount of visible radiation 	Goggles Face shield Hand shield Head shield
Face Protection (Fig 6, Fig 7)	<ol style="list-style-type: none"> 1. Spark generated during Welding, grinding 2. Welding spatter striking 3. Face protection from UV rays 	Face shield Head shield with or without ear muff Helmets with welders screen for welders
Ear protection (Fig 7)	<ol style="list-style-type: none"> 1. High noise level 	Ear plug Ear muff
Body protection (Fig 8, Fig 9)	<ol style="list-style-type: none"> 1. Hot particles 	Leather aprons

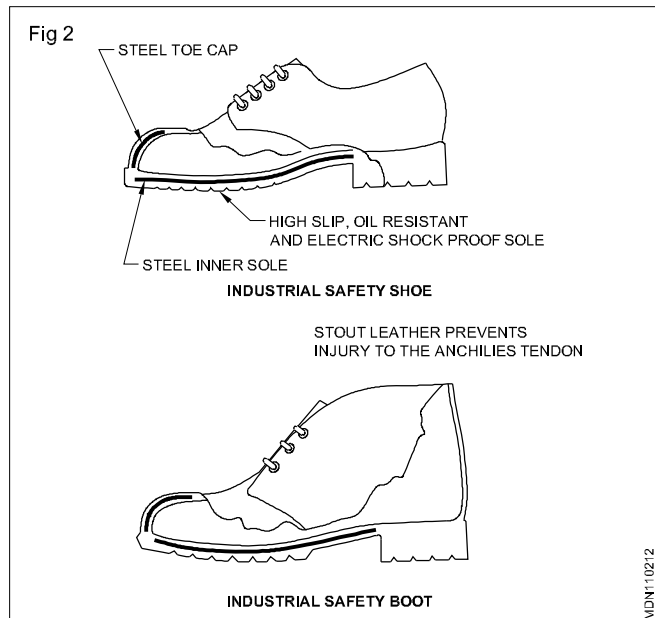
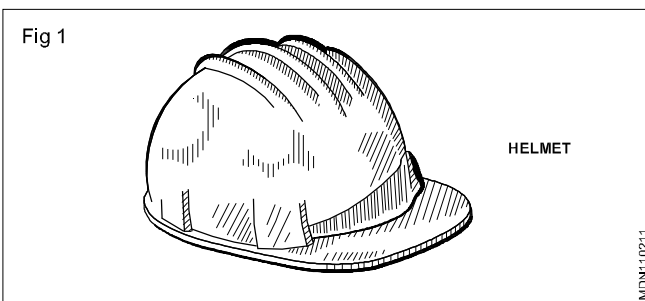
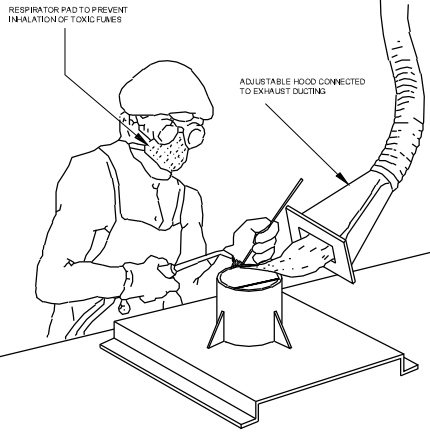
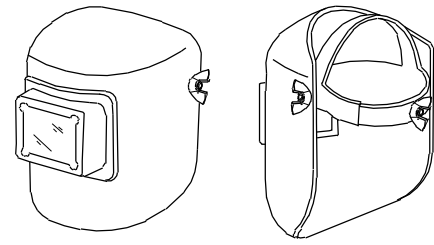


Fig 3



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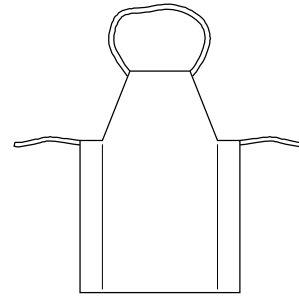
Fig 7



WELDING HELMET

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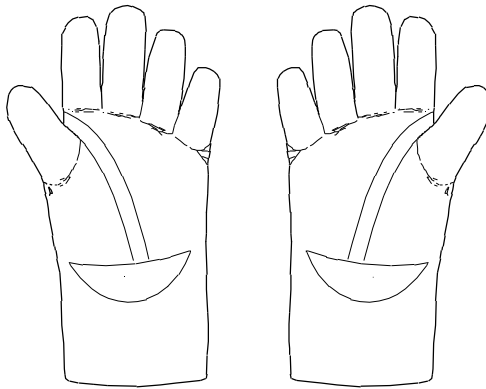
Fig 8



APRON

MDN110218

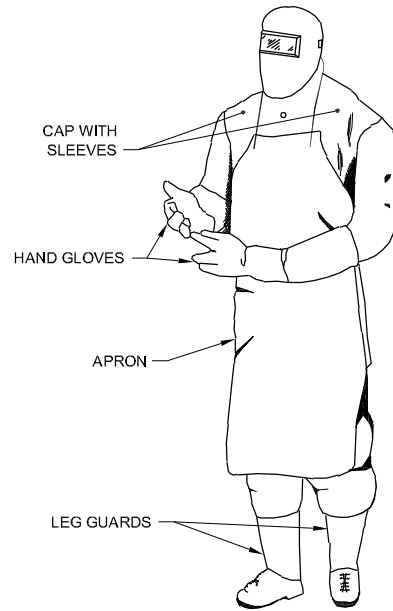
Fig 4



GLOVES

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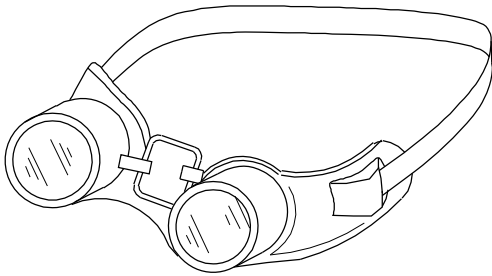
Fig 9



LEG GUARDS

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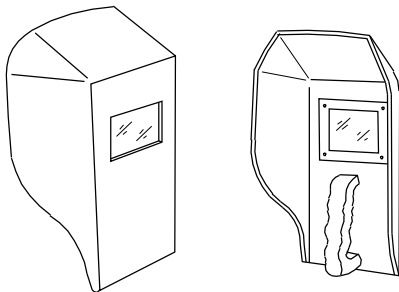
Fig 5



GOGGLES

MDN110215

Fig 6



HAND SCREEN

MDN110216

Quality of PPE's

PPE must meet the following criteria with regard to its quality-provide absolute and full protection against possible hazard and PPE's be so designed and manufactured out of materials that it can withstand the hazards against which it is intended to be used.

Selection of PPE's requires certain conditions

- Nature and severity of the hazard
- Type of contaminant, its concentration and location of contaminated area with respect to the source of respirable air
- Expected activity of workmen and duration of work, comfort of workmen when using PPE
- Operating characteristics and limitations of PPE
- Easy of maintenance and cleaning and
- Conformity to Indian/ International standards and availability of test certificate.

Proper use of PPEs

Having selected the proper type of PPE, it is essential that the workmen wears it. Often the workmen avoids using PPE. The following factors influence the solution to this problem.

- The extent to which the workmen understands the necessity of using PPE
- The ease and comfort with which PPE can be worn with least interference in normal work procedures
- The available economic, social and disciplinary sanctions which can be used to influence the attitude of the workmen
- The best solution to this problem is to make 'wearing of PPE' mandatory for every employee.
- In other places, education and supervision need to be intensified. When a group of workmen are issued PPE for the first time.

Safety precaution in handling diesel machine:

- Diesel mechanic must know the safety rules first and then practice to handling diesel machine as well as we known, when accident starts means safety rules are not followed during the handling of diesel machine. So safety precautions are always based on good sense.
- The following precautions are to be observed to keep a diesel mechanic/personal accident free.

General safety:

- Do not spill the fuel and lubricant on work place, the spills may cause for the risk of slipping.

- Keep all flammable material away from the diesel machine.
- Always keep clean hand and tools while work on machine
- Keep the diesel machines operating area free from any form of fire.
- Safety operation of diesel machine:
 - Don't operate the machine with loose engine mounting
 - Don't operate the machine without lubricant
 - Don't spill diesel during fill in to the fuel tank
 - Keep the empty diesel /lubricant can away from the machine.
 - Ensure stationary engine exhaust gas outlet should be far away from work place otherwise it will be harm full to human health
 - Use preheat before start the diesel engine
 - Use safe guard around rotating part of the engine
 - Maintains the coolant and lubricant level in the engine.
 - Always keep engine in an upright places for easy handling and safety.
 - use specified grade lubricant and coolant in an engine

safety of rubber hose and pipes:

- Inspect the rubber hose periodically and replace the damaged parts
- Inspect the fuel leaks in fuel system and rectify the leakages
- Inspect the exhaust gas leaks and rectify the leakages
- Check the engine performance if any air lock in fuel system, bleed the fuel system.

Safety of engine operation:

- Check the coolant circulation and pressure cap function
- Check the oil pressure
- Check the tappet noise and rectify the noise/adjust the defective tappet
- Check the abnormal noise in the engine
- Check leakages of lubricant and coolant in the engine and rectify the leakages.
- Ensure free air circulation in engine operating place

Concept of house keeping & 5S method

Objectives: At the end of this lesson you shall be able to

- **elements of house keeping and cleanliness at work place**
 - **state the concept of 5'S' techniques.**
-

Concept of house keeping

House keeping is the systematic process of making home/work place neat and clean. House keeper is responsible for administering housekeeping maintenance and for assuring that every thing is in order and he is responsible for systematic administration of activities that provide segregation, storage, transfer, processing treatment and disposal of solid waste (which is collected during cleaning)

Scope of house keeping maintenance

The scope of work highly depend on where the house keeping activity is performed in general, maintains cleanliness and orderliness, Furnishes the room, office, workplace, house keeping supervisor assisted by an assistant house keeper.

- eye appeal
- safety
- maintenance

Elements of housekeeping and cleanliness at workplace

The major elements which are normally included in the housekeeping and cleanliness practices at the workplace are described below.

- **Dust and dirt removal:** Working in dusty and dirty area is unhygienic as well as unhealthy for the employees since there can be respiratory type irritations. Also, If dust and dirt are allowed to accumulate on surfaces, there is a potential for a slip hazard. Hence, regular sweeping the workplace for the removal of dust and dirt is an essential housekeeping and cleanliness practice. Further, compressed air is not to be used for removing dust or dirt off employees or equipment. Compressed air can caused dirt and dust particles to be embedded under the skin or in the eye.
- **Employees facilities:** Adequate employees facilities such as drinking water, wash rooms, toilet blocks, and rest rooms etc. are to be provided for the employees at the workplace so that employees can use them when there is a need. Cleanliness at the place of these facilities is an important aspect of the facilities.
- **Flooring:** Floors are to be cleaned regularly and immediately if liquids or other materials are spilled. Poor floor conditions are a leading cause of accidents

in the workplace. Area such as entranceways which cannot be cleaned continuously are to have mats or some type of anti-slip flooring. It is also important to replace worn, ripped or damaged flooring that poses a trip hazard.

- **Lighting:** Adequate lighting reduces the potential for accidents. It is to be ensured that inoperative light fixtures are repaired and dirty light fixtures are cleaned regularly so that the light intensity levels are maintained at the workplace.
- **Aisles and stairways:** Aisles and stairways are to be kept clear and not to be used for storage. Warning signs and mirrors can improve sight lines in blind corners and help prevent accidents. It is also important to maintain adequate lighting in stairways. Further stairways need to have railings preferably round railings for adequate grip.
- **Spill control:** The best method to control spills is to prevent them from happening. Regular cleaning and maintenance on machines and equipment is an essential practice. Also, the use of drip pans where spills might occur is a good preventative measure. When spills do occur, it is important to clean them up immediately. When cleaning a spill, it is required to use the proper cleaning agents or absorbent materials. It is also to be ensured that the waste products are disposed of properly.
- **Waste disposal:** The regular collection of the waste materials contribute to good housekeeping and cleanliness practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities. Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing containers for wastes near the place where the waste is produced encourages orderly waste disposal and makes collection easier. All recyclable wastes after their collection are to be transferred to their designated places so that the waste materials can be dispatched to the point of use or sold.
- **Tools and equipment:** Tools and equipment are required to be inspected prior to their use. Damaged or worn tools are to be taken out of service immediately. Tools are to be cleaned and returned to their storage place after use.

- **Maintenance:** One of the most important elements of good housekeeping and cleanliness practices is the maintenance of the equipment and the buildings housing them. This means keeping buildings, equipment and machinery in safe and efficient working condition. When a workplace looks neglected means there are broken windows, defective plumbing, broken floor surfaces and dirty walls etc. These conditions can cause accidents and affect work practices. It is important to have a replacement program for replacing or fixing broken and damaged items as quickly as possible.
- **Storage:** Proper storage of materials is essential in a good housekeeping and cleanliness practice. All storage areas need to be clearly marked. Flammable, combustible, toxic and other hazardous materials are to be stored in approved containers in designated areas which are appropriate for the different hazards that they pose. The stored materials are not to be obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations. Also it is important that all containers be labeled properly. If materials are being stored correctly, then the incidents of strain injuries, chemical exposures and fires get reduced drastically.
- **Clutter control:** Cluttered workplaces typically happen because of poor housekeeping practices. This type of workplace can lead to a number of issues which include ergonomic as well as injuries. It is important to develop practices where items like tools, chemicals, cords, and containers are returned to their appropriate storage location when not in use. Clutter is not only unattractive but, in a work area, it is also a serious threat to safety. Danger to the employees increases if the established exit routes and doors are blocked. For this reason, as well as to prevent slips and trips, assorted waste materials need to be disposed of promptly in the appropriate waste containers. Aisles are to be kept clear of obstructions for obvious reasons.
- **Individual workspace:** Individual workspace need to be kept neat, cleared of everything not needed for work. Many workplace injuries occur right in the employee's workspace. This space is often overlooked when conducting general housekeeping and cleanliness inspections. It is necessary to make a checklist which is to be used by the employees to evaluate their workspace.

It can be said that a clean work area demonstrate the pride employees have with the job and the culture of safety at the workplace.

5 Steps (5s) - Concept (Fig 1)

5s is a people-oriented and practice-oriented approach. 5s expects every one to participate in it. It becomes a basic for continuous improvement in the organisation.

The terms (5s) 5 steps are

Step 1: SEIRI (Sorting out)

Step 2: SEITON (Systematic arrangement)

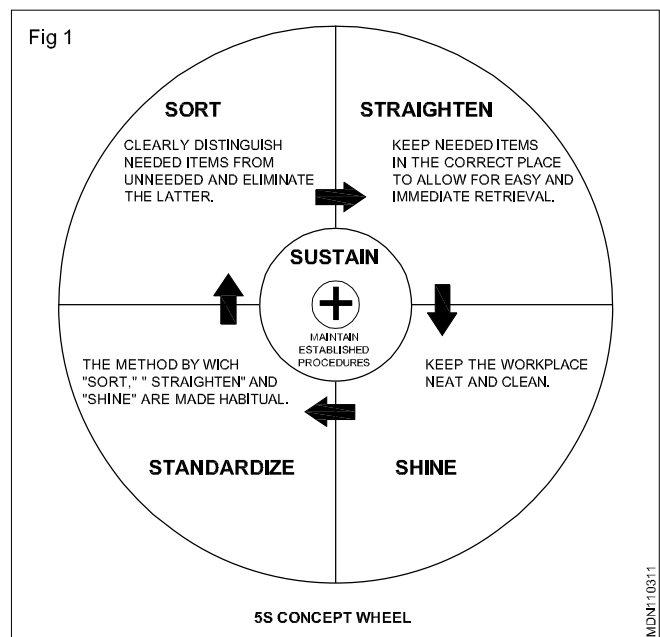
Step 3: SEISO (Shine cleanliness)

Step 4: SEIKTSU (Standardization)

Step 5: SHITSURE (Self discipline)

Fig 1 shows the 5s concept wheel.

The list describes how to organize a work space for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items and sustaining the new order.



Benefits of 5s

- Work place becomes clear and better organised.
- Working in working place becomes easier.
- Reduction in cost.
- People tend to be more disciplined.
- Delay is avoided.
- Less absenteeism.
- Better use of floor space.
- Less accidents.
- High productivity with quality etc.

Safe handling and periodic testing of lifting equipments

Objectives: At the end of this lesson you shall be able to

- **state the periodic testing of lifting equipments**
- **state the handling of lifting equipments**

Safe and successful lifting operations depends on periodical testing of lifting equipment, maintenance and handling of operation, failure of this equipment may result in significant loss and fatal accident.

Lifts and cranes

Safety precautions for handling of lifts and cranes.

- Never exceed the safe working load (SWL) of the equipment you are using.
- Always support vehicles with axle stands before working underneath them.
- There is always a danger when loads are lifted or suspended. Never work under an unsupported, Suspended or raised load such as a suspended engine.
- Always ensure that lifting equipment such as jacks, hoists, axle stands, slings, etc, are adequate and suitable for the job, In good condition and regularly maintained.

- Never improvise lifting tackle.

Periodic testing of lifting equipment

- Visually inspect the component of the lifting equipment such as lifting chain, slings chain hoist before operating the equipment.
- In Hydraulic function of lift (or) cranes check the oil level and top up the oil level periodically.
- The Hydraulic oil used in the lifts or cranes should be replaced periodically.
- The lifting equipment should be over hauled once (or) twice a year.
- Check the electrical connections of the lifting equipment periodically.
- The calibration of the lifting equipment should be done once in a year and calibration certificate must to be obtained from the authorized testing center.

Safety disposal of used engine oil

Objectives: At the end of this lesson you shall be able to

- **state the purpose of disposal used oil**
- **state the method of safety disposal of used oil**

Waste oil

The waste oils, derived from fuels or lubricants, originally come from petroleum oil, sometimes known as mineral oils. Many lubricants may also contain synthetic components.

Waste oil is harmful to the environment and some, for example used engine oils, may cause cancer. so it needs to be managed carefully. You may need to account for Health and Safety guidance as well as the environment.

Purpose

Oils are defined as greasy, viscous substances from plant, animal, mineral sources (petroleum), and synthetics that are not soluble in water, and are usually flammable. These oils which have been used could be contaminated by physical or chemical impurities such as dirt, metal scrapings, and water. Oils that enter storm drains or waterways are a serious environmental hazard. used oil can pollute fresh water. The purpose of this procedure is to describe the proper means for handling and disposing of used oil from equipment maintenance operations, process procedures, and any other activities where used oils are generated.

This procedure applies to the disposal of any used oil that is collected during normal work functions at work place. Used oil may include:

1 Gasoline. Volatile, flammable, it can be ignited by sparks and flames even at cold temperatures. Vapors can migrate to distant ignition sources and in poorly ventilated spaces, can accumulate to explosive levels. Typical gasoline contains about 150 different chemicals including benzene, toluene and xylene.

Used Oil Disposal

2 Fuel oils. Fuel oils such as diesel fuel are petroleum based fluids which are somewhat volatile and flammable and can be ignited only when heated above 100°F. Vapors can travel and flash from ignition sources and can accumulate to explosive levels in poorly ventilated areas. All fuel oils consist of complex mixtures of aliphatic and aromatic hydrocarbons such as kerosene, benzene, and styrene.

3 Lubricating oils. Lubricating oils such as motor oil and hydraulic fluids are not volatile but are combustible. For lubricating oil to catch fire some other intense heat source (i.e., other materials on fire, hot engine manifold, etc.) must be present. Mineral-based lube oils are refined from

petroleum or crude oil and contain additives such as lead or metal sulphide and other polymers.

4 Transformer oil. Transformer oil conducts heat away from and insulates equipment used to convert electricity from high amperage to low amperage lines. Transformer oil is a liquid by product of the distillation of petroleum to produce gasoline.

Cooking oils and grease: Cooking oils and grease are not volatile but they are combustible. With a 400°F flash point, another heat source must be present for cooking oils or grease to catch fire. Vegetable oils contain chemical solvents that are strong enough to dissolve engine seals and gaskets.

Note: for all other waste chemicals, please refer SOP regarding Used Chemical Disposal.

Procedures

Products saturated with petroleum products require special handling and disposal by licensed transporters. During the collection of used oils for disposal, some basic principles should be followed:

- 1 Wear gloves because oil contains chemicals and contaminants that are not good for skin contact.
- 2 Put used oil in a clean plastic or metal container in good condition and with a tight lid.
- 3 If the oil is hot, avoid sudden contact with other substances because mixing may cause ignition or the receiving container to fracture due to thermal shock.
- 4 Do not allow used fuel and used oils to mix with any other substances because unknown and dangerous chemical reactions may occur.
- 5 Keep used oils away from gas cylinders and gasoline.
- 6 Do not fill container to the top but allow a couple inches below the rim.
- 7 Label the container with contents, and department.

Safe handling of fuel spillage

Objectives: At the end of this lesson you shall be able to

- state the safe handling of fuel spillage
- state the effect of fuel spillage in workplace.

Diesel fuel is a flammable liquid and fuel spillage or leaks in work place maybe cause for slippage or fire hazard.

Safe handling of fuel:

- 1 Improper handling of fuel may cause for fuel spillage and explosion, so fuel handling should be use appropriate method.
- 2 Fuel should not be stored near the working hot engine
- 3 Don't refueling, when it is hot, fuel tank vapor may cause for fire.
- 4 No smoking is allowed when refueling to the engine.
- 5 Don't spill the fuel during refilling the fuel in fuel tank or fuel container.
- 6 Use funnel during filling the fuel in fuel tank to avoid fuel spillage
- 7 Use tray during air bleeding from the fuel system to avoid fuel spillage
- 8 Fuel leaks and spills near the engine may cause for accident so it should be clean and mopped up quickly as soon as the spillage.
- 9 Stationary engine fuel tank should be position away from any source of direct heat to the fuel tank

Safe disposal of toxic dust

Objectives: At the end of this lesson you shall be able to

- list the waste material in a work shop
- explain the methods of disposal of waste material.

Introduction

The Automobiles produces fumes containing unburnt gases such as carbon-monoxide, nitrogen oxide and other gases which are harmful to human health. Hence a systematic and scientifically designed methods are adopted for safe disposal of such toxic waste.

Dust from vehicle components to be blown into the air, since such dust floating in air for many hours, may cause harm to people who breath unknowingly.

Brake and clutch components produces dust, when used compressed air jet to clean them. While cleaning conforming the PPE to safety regulation & policies. This includes overall coat, Face mask, safety goggles for eyes earmuffs & earplug for ear protection, rubber gloves & barrier cream for hand and valved respirator for breathing.

Some auto parts having asbestos, is a toxic material, which cause lung cancer. Airborne dust in workshop leads to asthma and throat infections. Do not use compressed air to clean dust from various components & parts of the Vehicle. Solvent used for cleaning can also form a toxic waste. Wash work cloths separately from other cloths so that toxic dust does not get transfer to other clothes. After cleaning a vehicle, there are certain chemicals present in this vehicle diet which turns toxic. To eliminate the toxic waste, create small diet piles and dispose them spontaneous rather than waiting for big diet pile till the end of the day. Workshop diet is best cleaned using a water hose, which does not allow diet to fully. But the

waste water must be caught in a sledge pit and not into the storm water drain. Vacuum cleaner is a best device control toxic waste. Providing high speed exhaust ventillation can solve toxic diet.

Use grease which can not re-used is stored in a separate container and stored with unique identification. In a similar manner waste oil is stored in separate container, labeled 'Waste oil' and stored in different location, meant for disposal used diesel oil and kerosene are also stored in separate containers and kept at disposal area.

Elementary first-aid

Objectives: At the end of this lesson you shall be able to

- **define first aid**
 - **list out the first aid key points**
 - **describe the responsiveness**
-

First aid is defined as the immediate care and support given to an acutely injured or ill person, primarily to save life, prevent further deterioration or injury, plan to shift the victims to safer places, provide best possible comfort and finally help them to reach the medical centre/ hospital through all available means. It is an immediate life-saving procedure using all resources available within reach.

Imparting knowledge and skill through institutional teaching at younger age group in schools, colleges, entry point at industry level is now given much importance. Inculcating such habits at early age, helps to build good healthcare habits among people.

First aid procedure often consists of simple and basic life saving techniques that an individual performs with proper training and knowledge.

The key aims of first aid can be summarized in three key points:

- **Preserve life:** If the patient was breathing, a first aider would normally place them in the recovery position, with the patient leant over on their side, which also has the effect of clearing the tongue from the pharynx. It also avoids a common cause of death in unconscious patients, which is choking on regurgitated stomach contents. The airway can also become blocked through a foreign object becoming lodged in the pharynx or larynx, commonly called choking. The first aider will be taught to deal with this through a combination of 'back slaps' and 'abdominal thrusts'. Once the airway has been opened, the first aider would assess to see if the patient is breathing.
- **Prevent further harm:** Also sometimes called prevent the condition from worsening, or danger of further injury, this covers both external factors, such as moving a patient away from any cause of harm, and applying first aid techniques to prevent worsening of the condition, such as applying pressure to stop a bleed becoming dangerous.
- **Promote recovery:** First aid also involves trying to start the recovery process from the illness or injury, and in some cases might involve completing a treatment, such as in the case of applying a plaster to a small wound.

ABC of first aid

ABC stands for airway, breathing and circulation.

- **Airway:** Attention must first be brought to the airway to ensure it is clear. Obstruction (choking) is a life-threatening emergency.
- **Breathing:** Breathing if stops, the victim may die soon. Hence means of providing support for breathing is an important next steps. There are several methods practiced in first aid.
- **Circulation:** Blood circulation is vital to keep person alive. The first aiders now trained to go straight to chest compressions through CPR methods.

When providing first aid one needs to follow some rule. There are certain basic norms in teaching and training students in the approach and administration of first aid to sick and injured.

Important guideline for first aiders

Evaluate the situation

Are there things that might put the first aider at risk. When faced with accidents like fire, toxic smoke, gasses, an unstable building, live electrical wires or other dangerous scenario, the first aider should be very careful not to rush into a situation, which may prove to be fatal.

Avoid moving the victim

Avoid moving the victim unless they are immediate danger. Moving a victim will often make injuries worse, especially in the case of spinal cord injuries.

Call emergency services

Call for help or tell someone else to call for help as soon as possible. If alone at the accident scene, try to establish breathing before calling for help, and do not leave the victim alone unattended.

Determine responsiveness

If a person is unconscious, try to rouse them by gently shaking and speaking to them.

If the person remains unresponsive, carefully roll them on the side (recovery position) and open his airway.

- Keep head and neck aligned.
- Carefully roll them onto their back while holding hishead.

First aid

- Call EMERGENCY number.
 - Check the person's airway, breathing, and pulse frequently. If necessary, begin rescue breathing and CPR.
 - If the person is breathing and lying on the back and after ruling out spinal injury, carefully roll the person onto the side, preferably left side. Bend the top leg so both hip and knee are at right angles. Gently tilt the head back to keep the airway open. If breathing or pulse stops at any time, roll the person on to his back and begin CPR.
 - If there is a spinal injury, the victims position may have to be carefully assessed. If the person vomits, roll the entire body at one time to the side. Support the neck and back to keep the head and body in the same position while you roll.
 - Keep the person warm until medical help arrives.
- If you see a person fainting, try to prevent a fall. Lay the person flat on the floor and raise the level of feet above and support.
 - If fainting is likely due to low blood sugar, give the person something sweet to eat or drink when they become conscious.

DO NOT

- Do not give an unconscious person any food or drink.
- Do not leave the person alone.
- Do not place a pillow under the head of an unconscious person.
- Do not slap an unconscious person's face or splash water on the face to try to revive him.

Occupational health and safety

Objectives: At the end of this lesson you shall be able to

- define safety
 - state the goal of occupational health and safety
 - explain need of occupational health and safety
 - state what is occupational hygiene?
 - list types of occupational hazards.
-

Safety

Safety means freedom or protection from harm, danger, hazard, risk, accident, injury or damage.

Occupational health and safety

- Occupational health and safety is concerned with protecting the safety, health and welfare of people engaged in work or employment.
- The goal is to provide a safe work environment and to prevent hazards.
- It may also protect co-workers, family members, employers, customers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment.
- It involves interactions among many related areas, including occupational medicine, occupational (or industrial) hygiene, public health, and safety engineering, chemistry, and health physics.

Need of occupational health and safety

- Health and safety of the employees is an important aspect of a company's smooth and successful functioning.
- It is a decisive factor in organizational effectiveness. It ensures an accident-free industrial environment.
- Proper attention to the safety and welfare of the employees can yield valuable returns.

- Improving employees morale
- Reducing absenteeism
- Enhancing productivity
- Minimizing potential of work-related injuries and illnesses
- Increasing the quality of manufactured products and/or rendered services.

Occupational (Industrial) Hygiene

- Occupational hygiene is anticipation, recognition, evaluation and control of work place hazards (or) environmental factors (or) stresses
- This is arising in (or) from the workplace.
- Which may cause sickness, impaired health and well being (or) significant discomfort and inefficiency among workers.

Anticipation (Identification): Methods of identification of possible hazards and their effects on health

Recognition (Acceptance): Acceptance of ill-effects of the identified hazards

Evaluation (Measurement & Assessment): Measuring or calculating the hazard by Instruments, Air sampling and Analysis, comparison with standards and taking judgment whether measured or calculated hazard is more or less than the permissible standard

Control of Workplace Hazards: Measures like Engineering and Administrative controls, medical examination, use of Personal Protective Equipment (PPE), education, training and supervision

Occupational Hazards

"Source or situation with a potential for harm in terms of injury or ill health, damage to property, damage to the workplace environment, or a combination of these"

Types of occupational health hazards

- Physical Hazards
- Chemical Hazards
- Biological Hazards
- Physiological Hazards
- Psychological Hazards
- Mechanical Hazards
- Electrical Hazards
- Ergonomic Hazards.

1 Physical Hazards

- Noise
- Heat and cold stress
- Vibration
- Radiation (ionising & Nonionising)
- Illumination etc.,

2 Chemical Hazards

- Inflammable
- Explosive
- Toxic
- Corrosive
- Radioactive

3 Biological Hazards

- Bacteria
- Virus
- Fungi
- Plant pest
- Infection.

4 Physiological

- Old age
- Sex
- Ill health
- Sickness
- Fatigue.

5 Psychological

- Wrong attitude
- Smoking
- Alcoholism
- Unskilled
- Poor discipline
 - absentism
 - disobedience
 - aggressive behaviours
- Accident proneness etc,
- Emotional disturbances
 - violence
 - bullying
 - sexual harassment

6 Mechanical

- Unguarded machinery
- No fencing
- No safety device
- No control device etc.,

7 Electrical

- No earthing
- Short circuit
- Current leakage
- Open wire
- No fuse or cut off device etc,

8 Ergonomic

- Poor manual handling technique
- Wrong layout of machinery
- Wrong design
- Poor housekeeping
- Awkward position
- Wrong tools etc,

Safety Slogan

A Safety rule breaker , is an accident maker

Safety practice - fire extinguishers

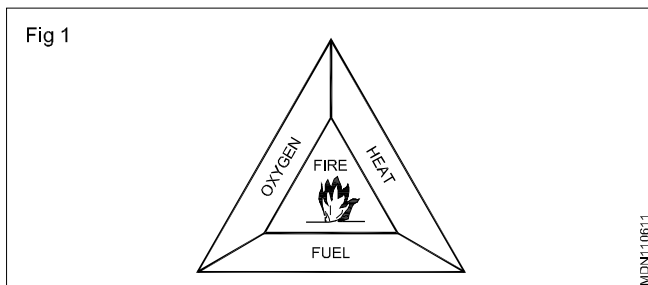
Objectives: At the end of this lesson you shall be able to

- state the effects of a fire break out.
- state the causes for fire in a workshop
- state the general precautionary measures to be taken for prevention of fire.
- state the types of fire and different extinguishing agent

Fire is the burning of combustible material. A fire in an unwanted place and on an unwanted occasion and in uncontrollable quantity can cause damage or destroy property and materials. It might injure people, and sometimes cause loss of life as well. Hence, every effort must be made to prevent fire. When a fire outbreak is discovered, it must be controlled and extinguished by immediate corrective action.

Is it possible to prevent fire? Yes, fire can be prevented by eliminating anyone of the three factors that causes fire.

The following are the three factors that must be present in combination for a fire to continue to burn. (Fig 1)



Fuel: Any substance, liquid, solid or gas will burn, if there is oxygen and high enough temperatures.

Heat: Every fuel will begin to burn at a certain temperature. It varies and depends on the fuel. Solids and liquids give off vapour when heated, and it is this vapour which ignites. Some liquids do not have to be heated as they give off vapour at normal room temperature say 15°C, eg. petrol.

Oxygen: Usually exists in sufficient quantity in air to keep a fire burning.

Extinguishing of fire: Isolating or removing any of these factors from the combination will extinguish the fire. There are three basic ways of achieving this.

- **Starving** the fire of fuel removes this element.
- **Smothering** - ie. isolate the fire from the supply of oxygen by blanketing it with foam, sand etc.
- **Cooling** - use water to lower the temperature.

Removing any one of these factors will extinguish the fire.

Preventing fires: The majority of fires begin with small outbreaks which burn unnoticed until they have a secure hold. Most fires could be prevented with more care and by following some simple common sense rules.

Accumulation of combustible refuse (cotton waste soaked with oil, scrap wood, paper, etc.) in odd corners are a fire risk. Refuse should be removed to collection points.

The cause of fire in electrical equipment is misuse or neglect. Loose connections, wrongly rated fuses, overloaded circuits cause overheating which may in turn lead to a fire. Damage to insulation between conductors in cables causes fire.

Clothing and anything else which might catch fire should be kept well away from heaters. Make sure that the heater is shut off at the end of the working day.

Highly flammable liquids and petroleum mixtures (thinner, adhesive solutions, solvents, kerosene, spirit, LPG gas etc.) should be stored in the flammable material storage area.

Blowlamps and torches must not be left burning when they are not in use.

Extinguishing fires: Fires are classified into four types in terms of the nature of fuel.(Fig 2,3,4 & 5)

Different types of fire have to be dealt with in different ways and with different extinguishing agents.

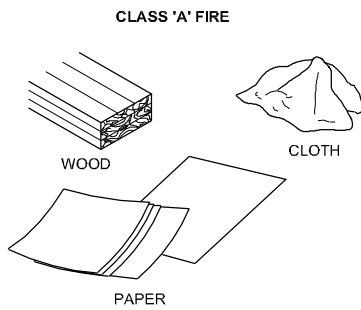
An extinguishing agent is the material or substance used to put out the fire, and is usually (but not always) contained in a fire extinguisher with a release mechanism for spraying into the fire.

It is important to know the right type of agent for extinguishing a particular type of fire; using a wrong agent can make things worse. There is no classification for 'electrical fires' as such, since these are only fires in materials where electricity is present.

Fuel

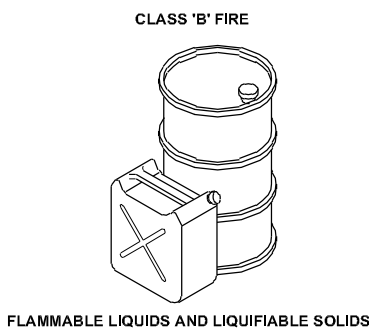
Extinguishing

Fig 2



Most effective ie. cooling with water. Jets of water should be sprayed on the base of the fire and then gradually upwards.

Fig 3

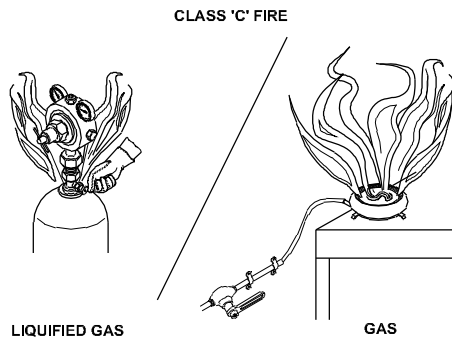


Should be smothered. The aim is to cover the entire surface of the burning liquid. This has the effect of cutting off the supply of oxygen to the fire.

Water should never be used on burning liquids.

Foam, dry powder or CO2 may be used on this type of fire.

Fig 4

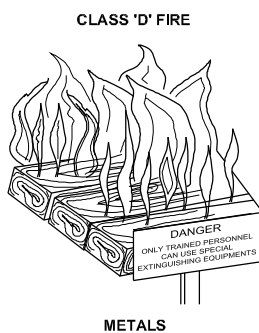


Extreme caution is necessary in dealing with liquefied gases. There is a risk of explosion and sudden outbreak of fire in the entire vicinity. If an appliance fed from a cylinder catches fire - shut off the supply of gas. The safest course is to raise an alarm and leave the fire to be dealt with by trained personnel.

Dry powder extinguishers are used on this type of fire.

Special powders have now been developed which are capable of controlling and/or extinguishing this type of fire.

Fig 5



The standard range of fire extinguishing agents is inadequate or dangerous when dealing with metal fires.

Fire on electrical equipment.

Halon, Carbon dioxide, dry powder and vapourising liquid (CTC) extinguishers can be used to deal with fires in electrical equipment. Foam or liquid (eg. water) extinguishers must not be used on electrical equipment under any circumstances.

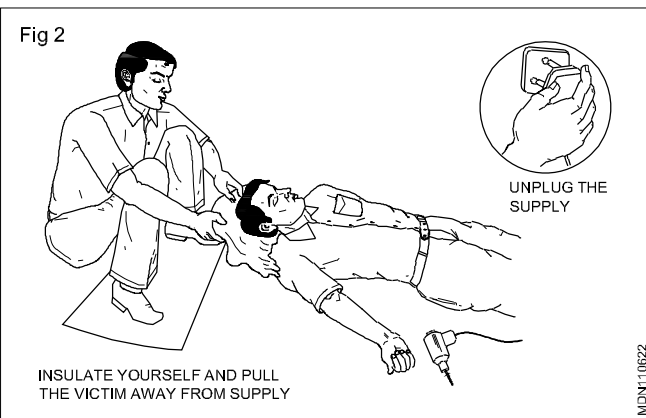
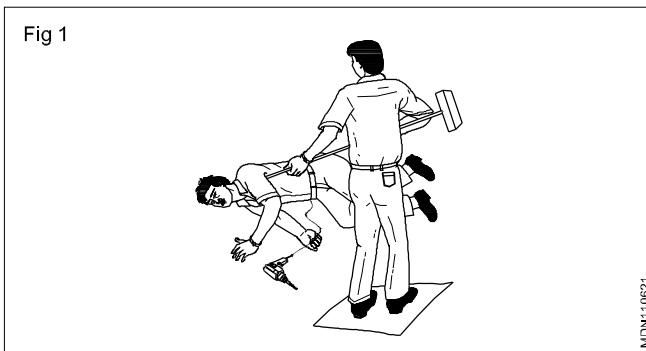
Electrical safety tips

Objectives: At the end of this lesson you shall be able to

- rescue a person who is in contact with a live wire
- treat a person for electric shock/injury.

The severity of an electric shock will depend on the level of current which passes through the body and the length of time of contact. Do not delay, act at once. Make sure that the electric current has been disconnected.

If the casualty is still in contact with the supply - break the contact either by switching off the power, removing the plug or wrenching the cable free. If not, stand on some insulating material such as dry wood, rubber or plastic, or using whatever is at hand to insulate yourself and break the contact by pushing or pulling the person free. (Figs 1 & 2)



In bare foot, do not touch the victim with your bare hands until the circuit is made dead or he is moved away from the equipment.

If the victim is aloft, measures must be taken to prevent him from falling or atleast make him fall safe.

Electric burns on the victim may not cover a big area but may be deep seated. All you can do is to cover the area with a clean, sterile dressing and treat for shock. Get expert help as quickly as possible.

If the victim is unconscious but is breathing, loosen the clothing about the neck, chest and waist and place the casualty in the recovery position.(Fig 3)

Keep a constant check on the breathing and pulse rate.



Keep the casualty warm and comfortable. (Fig 4)



Send for help.

Do not give an unconscious person anything by mouth.

Do not leave an unconscious person unattended

If the casualty is not breathing - Act at once - don't waste time!

Safety practice frist - aid

Electric shock: The severity of an electric shock will depend on the level of the current which passes through the body and the length of time of the contact.

Other factors that contribute to the severity of shock are:

- age of the person
- not wearing insulating footwear or wearing wet foot wear
- weather condition
- floor is wet or dry
- mains voltage etc.

Effects of electric shock: The effect of current at very low levels may only be an unpleasant tingling sensation, but this in itself may be sufficient to cause one to lose his balance and fall.

At higher levels of current, the person receiving the shock may be throen off his feet and will experience sever pain, and possibly minor burns at the point of contact.

At an excessive level of current flow, the muscles may contract and the person unable to release his grip on the conductor. He becomes conscious and the muscles of the heart may contract spasmodically (fibrillation). This may be fatal.

Electric shock can also cause burning of the skin at the point of contact.

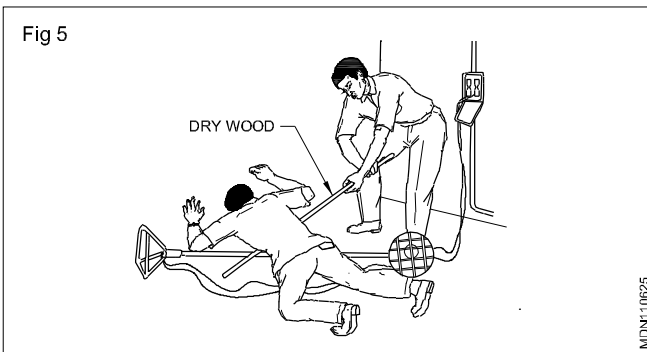
Treatment of electric shock

Prompt treatment is essential.

If assistance is close at hand, send for medical aid, then carry on with emergency treatment.

If you are alone, proceed with treatment at once.

Switch off the current, if this can be done without undue delay. Otherwise, remove the victim from contact with the live conductor, using dry non-conducting materials such as a wooden bar, rope, a scarf, the victim's coat-tails, any dry article of clothing, a belt, rolled-up newspaper, non-metallic hose, PVC tubing, bakelised paper, tube etc. (Fig 5)



Avoid direct contact with the victim. Wrap your hands in dry material if rubber gloves are not available.

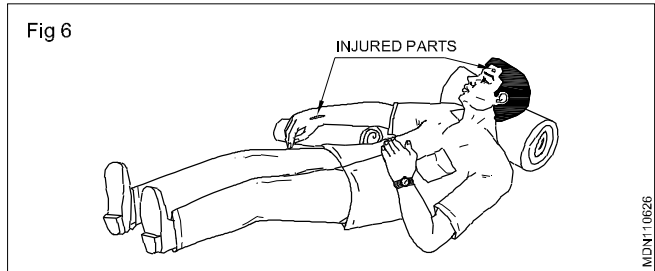
Electrical burns: A person receiving an electric shock may also sustain burns when the current passes through his body. Do not waste time by applying first aid to the burns until breathing has been restored and the patient can breathe normally - unaided.

Burns and scalds: Burns are very painful. If a large area of the body is burnt, give no treatment, except to exclude the air, eg. by covering with water, clean paper, or a clean shirt. This relieves the pain.

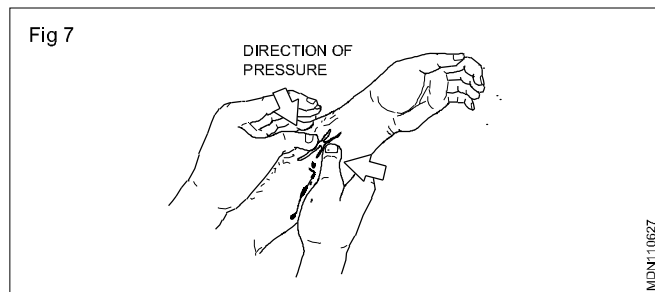
Severe bleeding: Any wound which is bleeding profusely, especially in the wrist, hand or fingers must be considered serious and must receive professional attention. As an immediate first aid measure, pressure on the wound itself is the best means of stopping the bleeding and avoiding infection.

Immediate action: Always in cases of severe bleeding

- make the patient lie down and rest
- if possible, raise the injured part above the level of the body (Fig 6)
- apply pressure to the wound
- summon assistance.

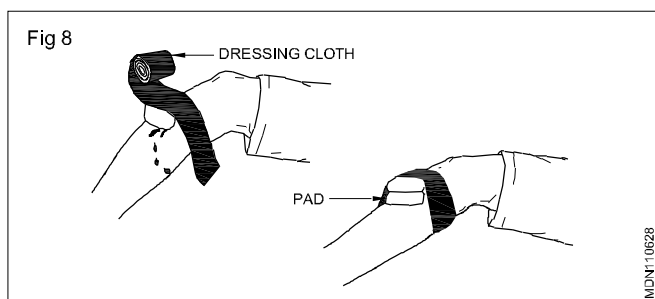


To control severe bleeding: Squeeze together the sides of the wound. Apply pressure as long as it is necessary to stop the bleeding. When the bleeding has stopped, put a dressing over the wound, and cover it with a pad of soft material. (Fig 7)



For an abdominal stab wound, such as may be caused by falling on a sharp tool, keep the patient bending over the wound to stop internal bleeding.

Large wound: Apply a clean pad (preferably an individual dressing) and bandage firmly in place. If bleeding is very severe apply more than one dressing. (Fig 8)



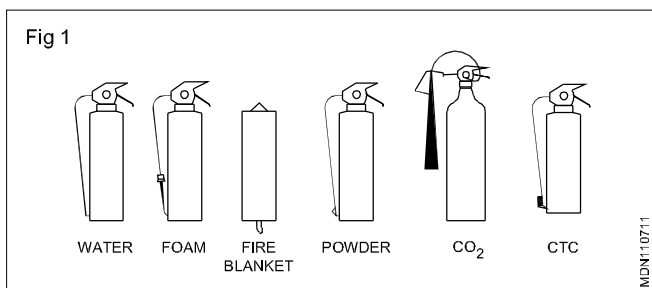
Follow the right methods of artificial respiration.

Used for different types of fire extinguishers

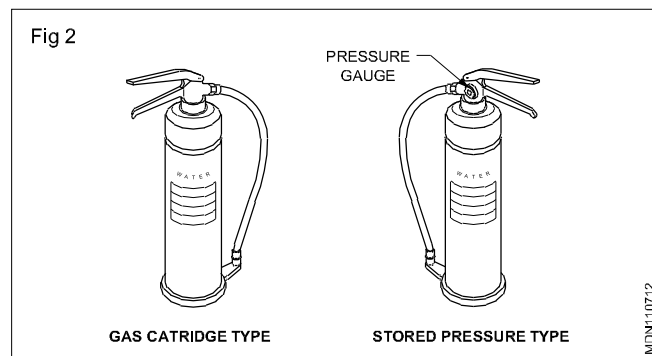
Objectives: At the end of this lesson you shall be able to

- **determine the correct type of fire extinguisher to be used based on the class of fire**

Many types of fire extinguishers are available with different extinguishing 'agents' to deal with different classes of fires. (Fig 1)



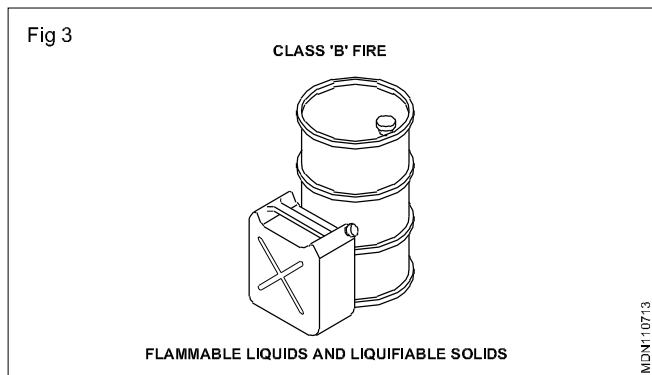
Water-filled extinguishers: There are two methods of operation. (Fig 2)



- Gas cartridge type
- Stored pressure type

With both methods of operation the discharge can be interrupted as required, conserving the contents and preventing unnecessary water damage.

Foam extinguishers (Fig 3): These may be of stored pressure or gas cartridge types. Always check the operating instructions on the extinguisher before use.

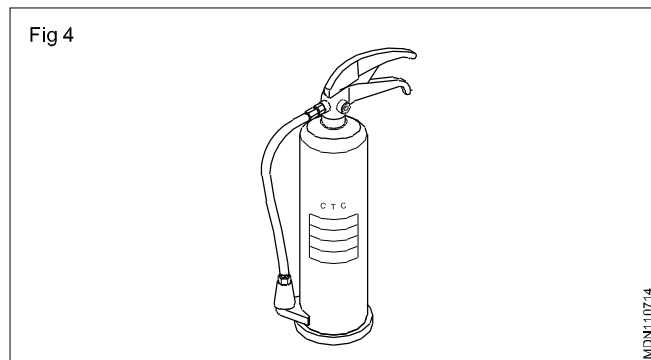


Most suitable for

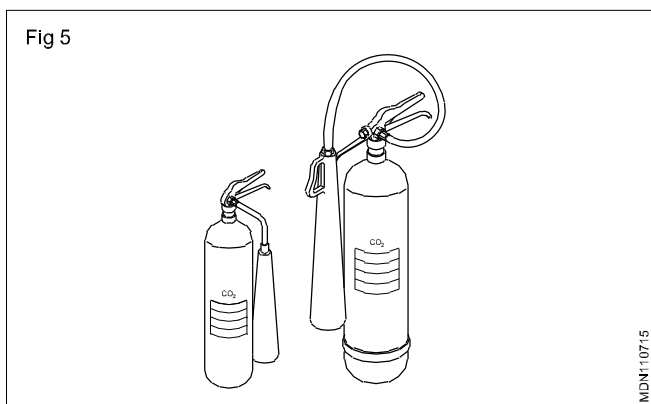
- flammable liquid fires
- running liquid fires.

Must not be used on fires where electrical equipment is involved.

Dry powder extinguishers (Fig 4): Extinguishers fitted with dry powder may be of the gas cartridge or stored pressure type. Appearance and method of operation is the same as that of the water-filled one. The main distinguishing feature is the fork shaped nozzle. Powders have been developed to deal with class D fires.



Carbon dioxide (CO₂): This type is easily distinguished by the distinctively shaped discharge horn. (Fig 5).

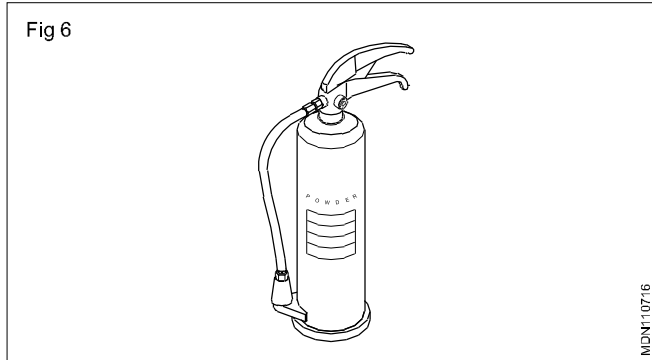


Suitable for Class B fires. Best suited where contamination by deposits must be avoided. Not generally effective in open air.

Always check the operating instructions on the container before use. Available with different gadgets of operation such as - plunger, lever, trigger etc.

Halon extinguishers (Fig 6): These extinguishers may be filled with carbon-tetrachloride and Bromochlorodifluoro methane (BCF). They may be either gas cartridge or stored pressure type.

They are more effective in extinguishing small fires involving pouring liquids. These extinguishers are particularly suitable and safe to use on electrical equipment as the chemicals are electrically non-conductive.



The fumes given off by these extinguishers are dangerous, especially in confined space.

The general procedure in the event of a fire:

- Raise an alarm.
- Turn off all machinery and power (gas and electricity).
- Close the doors and windows, but do not lock or bolt them. This will limit the oxygen feed to the fire and prevent its spreading.
- Try to deal with the fire if you can do so safely. Do not risk getting trapped.
- Anybody not involved in fighting the fire should leave calmly using the emergency exits and go to the designated assembly point. Failure to do this may mean that some person being unaccounted for and others may have to put themselves to the trouble of searching for him or her at risk to themselves.

Energy conservation process

Objectives: At the end of this lesson you shall be able to

- **define energy conservation**
 - **classify energy conservation opportunities**
-

Energy Conservation

To achieve and maintain optimum energy procurement and utilization, throughout the organization

To minimize energy costs / waste without affecting production, comfort and quality.

To reduce environmental pollution per unit of industrial output - as carbon dioxide, smoke, sulphur dioxide.

Defination of Energy Conservation

Energy conservation is achieved when growth of energy consumption is reduced, measured in physical terms.

Energy conservation can, therefore, be the result of several processes or developments, such as productivity increase or technological progress.

For example, replacing traditional light bulbs with Compact Fluorescent Lamps (CFL) (which use only 1/4th of the energy to same light output). Light Emitting Diode (LED) lamps are also used for the same purpose.

Energy Conservation Opportunities (ECOs)

Opportunities to conserve energy are broadly classified into three categories:

i) Minor ECOs

These are simple, easy to implement, and require less investment implementation time. These may correspond to stopping of leakage points, avoiding careless waste, lapses in housekeeping and maintenance etc.

ii) Medium ECOs

These are more complex, and required additional investment and moderate implementation time. For example, replacement of existing household appliances by new energy efficient ones.

iii) Major ECOs

These provide significant energy saving. They are complex and demand major investment and long implementation periods. For example, replacement or major renovation of old buildings, machineries etc.