

SYLLABUS

1st Year (Volume I of II)

Duration: Six Month

Week No.	Ref. Learning Outcome	Professional Skills(Trade Practical) with Indicative hours	Professional Knowledge (Trade Theory)
1.	<ul style="list-style-type: none"> • Apply safe working practices • Install and setup operating system and related software in a computer. 	<p>Safe working practices</p> <ol style="list-style-type: none"> 1. Visit various sections of the institutes and location of electrical installations. (05 hrs) 2. Identify safety symbols and hazards. (05 Hrs) 3. Preventive measures for electrical accidents and practice steps to be taken in such accidents. (05 hrs) 4. Practice safe methods of fire fighting in case of electrical fire. (05 hrs) 5. Use of fire extinguishers. (05 Hrs) 	<p>Scope of the electrician trade. Safety rules and safety signs. Types and working of fire extinguishers</p>
2.	<ul style="list-style-type: none"> • Install and setup operating system and related software in a computer. 	<ol style="list-style-type: none"> 6. Practice elementary first aid. (05 hrs) 7. Rescue a person and practice artificial respiration. (05 Hrs) 8. Disposal procedure of waste materials. (05 Hrs) 9. Use of personal protective equipments. (05 hrs) 10. Practice on cleanliness and procedure to maintain it. (05 hrs) 	<p>First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc</p>
3	<ul style="list-style-type: none"> • Prepare profile with an appropriate accuracy as per drawing 	<ol style="list-style-type: none"> 11. Identify trade tools and machineries. (10 Hrs) 12. Practice safe methods of lifting and handling of tools & equipment. (05 Hrs) 13. Select proper tools for operation and precautions in operation. (05 Hrs) 14. Care & maintenance of trade tools 	<p>Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011</p>

4 - 5	<ul style="list-style-type: none"> Prepare profile with an appropriate accuracy as per drawing 	<ol style="list-style-type: none"> Operations of allied trade tools. (05 Hrs) Workshop practice on filing and hacksawing. (10 Hrs) Prepare hand coil winding assembly. (5 Hrs) Practice on preparing T-joint, straight joint and dovetail joint on wooden blocks. (15 Hrs) Practice sawing, planing, drilling and assembling for making a wooden switchboard. (15 Hrs) 	<p>Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use. Types of drills, description & drilling machines. Various wooden joints</p>
6 - 7	<ul style="list-style-type: none"> Prepare profile with an appropriate accuracy as per drawing 	<ol style="list-style-type: none"> Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting. (10 Hrs) Workshop practice on drilling, chipping, internal and external threading of different sizes. (20 Hrs) Practice of making square holes in crank handle. (5 Hrs) Prepare an open box from metal sheet. (15 Hrs) 	<p>Marking tools; calipers Dividers, Surface plates, Angle plates, Scribers, punches, surface gauges Types, Uses, Care and maintenance. Sheet metal tools: Description of marking & cutting tools. Types of rivets and riveted joints. Use of thread gauge. Description of carpenter's tools Care and maintenance of tools</p>
8	<ul style="list-style-type: none"> Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable 	<ol style="list-style-type: none"> Prepare terminations of cable ends (02 hrs) Practice on skinning, twisting and crimping. (15 Hrs) Identify various types of cables and measure conductor size using SWG and micrometer. (8 Hrs) 	<p>Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison</p>
9 - 10	<ul style="list-style-type: none"> Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of under ground cable 	<ol style="list-style-type: none"> Make simple twist, married, Tee and western union joints. (18 Hrs) Make britannia straight, britannia Tee and rat tailjoints. (18 Hrs) Practice in Soldering of joints / lugs. (14 Hrs) 	<p>Joints in electrical conductors. Techniques of soldering. Types of solders and flux</p>

11 - 12	<ul style="list-style-type: none"> Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable 	<ol style="list-style-type: none"> Identify various parts, skinning and dressing of underground cable. (15 Hrs) Make straight joint of different types of underground cable. (15 Hrs) Test insulation resistance of underground cable using megger. (05 hrs) Test underground cables for faults and remove the fault. (15 Hrs) 	<p>Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables</p>
13 - 14	<ul style="list-style-type: none"> Verify characteristics of electrical and magnetic circuits 	<ol style="list-style-type: none"> Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources and analyse by drawing graphs. (15 Hrs) Measure current and voltage in electrical circuits to verify Kirchhoff's Law (10 Hrs) Verify laws of series and parallel circuits with voltage source in different combinations. (05Hrs) Measure voltage and current against individual resistance in electrical circuit (10 hrs) Measure current and voltage and analyse the effects of shorts and opens in series circuit. (05 Hrs) Measure current and voltage and analyse the effects of shorts and opens in parallel circuit. (05 Hrs) 	<p>Ohm's Law; Simple electrical circuits and problems. Kirchoff's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks</p>
15	<ul style="list-style-type: none"> Verify characteristics of electrical and magnetic circuits 	<ol style="list-style-type: none"> Measure resistance using voltage drop method. (5 Hrs) Measure resistance using wheatstone bridge. (5 Hrs) Determine the thermal effect of electric current. (5Hrs) Determine the change in resistance due to temperature. (5 Hrs) Verify the characteristics of series parallel combination of resistors. (5 Hrs) 	<p>Laws of Resistance and various types of resistors Wheatstone bridge; principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance. Series and parallel combinations of resistors</p>

16 - 17	<ul style="list-style-type: none"> Verify characteristics of electrical and magnetic circuits 	<ol style="list-style-type: none"> Determine the poles and plot the field of a magnet bar. (08 Hrs) Wind a solenoid and determine the magnetic effect of electric current. (06 Hrs) Measure induced emf due to change in magnetic field. (06 hrs) Determine direction of induced emf and current. (06 hrs) Practice on generation of mutually induced emf. (08 hrs) Measure the resistance, impedance and determine inductance of choke coils in different combinations. (06 Hrs) Identify various types of capacitors, charging / discharging and testing. (05 Hrs) Group the given capacitors to get the required capacity and voltage rating. (05 Hrs) 	<p>Magnetic terms, magnetic materials and properties of magnet.</p> <p>Principles and laws of electromagnetism.</p> <p>Self and mutually induced EMFs.</p> <p>Electrostatics: Capacitor- Different types, functions, grouping and uses.</p> <p>Inductive and capacitive reactance, their effect on AC circuit and related vector concepts</p>
18 - 19	<ul style="list-style-type: none"> Verify characteristics of electrical and magnetic circuits 	<ol style="list-style-type: none"> Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits. (08 Hrs) Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (07 hrs) Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. (08 Hrs) Measure the resonance frequency in AC parallel circuit and determine its effects on the circuit. (07 hrs) Measure power, energy for lagging and leading power factors in single phase circuits and compare characteristic graphically. (08 Hrs) Measure Current, voltage, power, energy and power factor in three phase circuits. (07 hrs) Practice improvement of PF by use of capacitor in three phase circuit.(05 Hrs) 	<p>Comparison and Advantages of DC and AC systems.</p> <p>Related terms frequency, Instantaneous value, R.M.S. value</p> <p>Average value, Peak factor, form factor, power factor and Impedance etc.</p> <p>Sine wave, phase and phase difference.</p> <p>Active and Reactive power.</p> <p>Single Phase and three-phase system.</p> <p>Problems on A.C. circuits</p>

20 - 21	<ul style="list-style-type: none"> Verify characteristics of electrical and magnetic circuits 	<p>60. Ascertain use of neutral by identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter. (10 Hrs)</p> <p>61. Determine effect of broken neutral wire in three phase four wire system.(05 hrs)</p> <p>62. Determine the relationship between Line and Phase values for star and delta connections. (10Hrs)</p> <p>63. Measure the Power of three phase circuit for balanced and unbalanced loads. (15 Hrs)</p> <p>64. Measure current and voltage of two phases in case of one phase is short-circuited in three phase four wire system and compare with healthy system.(10 hrs)</p>	<p>Advantages of AC poly-phase system.</p> <p>Concept of three-phase Star and Delta connection.</p> <p>Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.</p> <p>Phase sequence meter</p>
22 - 23	<p>Project work / Industrial visit</p> <p>Broad Areas:</p> <p>a) Prepare and assemble a test board with switches, plug socket, lamp holder etc.</p> <p>b) Temperature controlled system for switching 'ON' and 'OFF' of any circuit using bimetallic strip.</p> <p>c) Series/ parallel combinational circuits</p>		
24 - 25	Revision		
26	Examination		

Organization of ITI's and scope of the electrician 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 interms 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 programs are delivered under the aegis of **National Council of Vocational Training (NCVT)**. Craftsman Training scheme (CTS) and Apprenticeship Training Scheme (ATS) and two pioneer programs of NCVT for Propagatory Vocational Training.

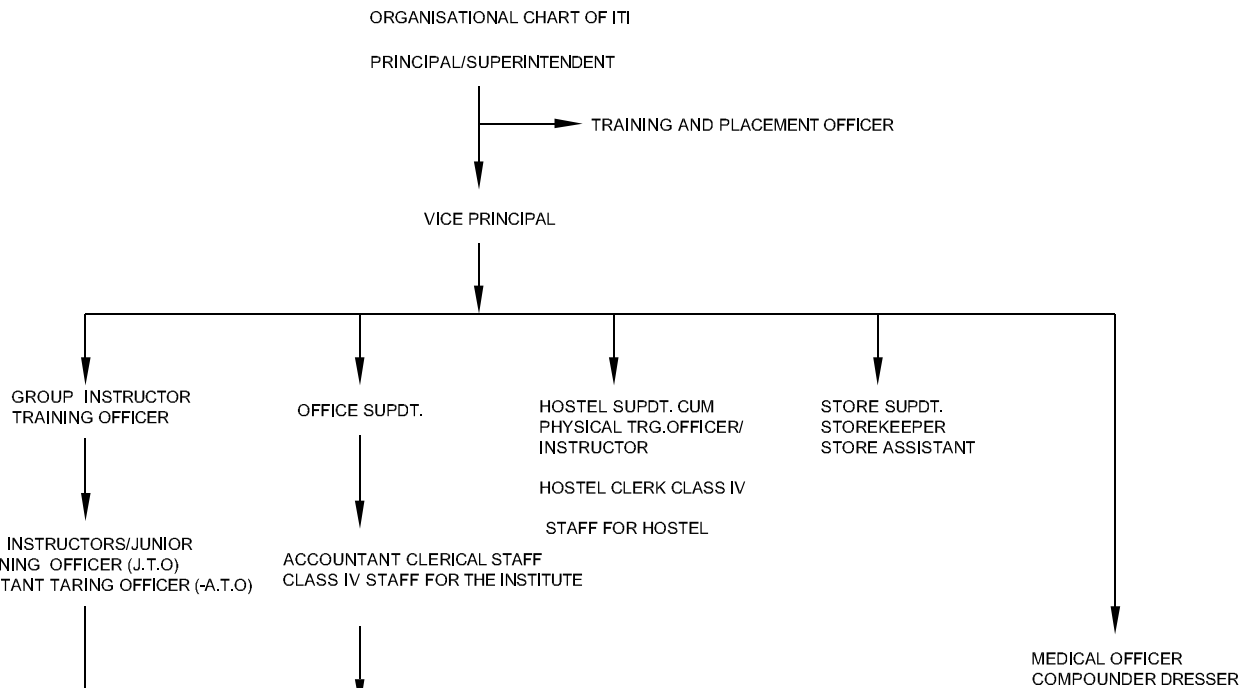
Total number of ITIs in India as on April 2016 is about 13105 (Govt. 2293 + 10812 Private ITIs). They are giving training about 132 trades including Engineering and Non-

engineering 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 80 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. 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 Frame work (NSQF)** with Level 4 and Level 5.

Fig 1



After finishing instructional training with 'NTC' certificate, they have to undergo Apprenticeship training (ATS) for one or two year in respective trades under the Apprentice ACT 1961, in various government and private establishments with stipend. At the end of the Apprenticeship training, All India Apprentice 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

In most of the ITIs, the head of the institute is the principal under him one vice-principal (VP). then Training Officers (TO)/Group Instructors (GI) who are the management and supervisory staff. Then Assistant Training Officers(ATO), Junior Training Officer (JTO), and Vocational Instructors (VI) are under Training officers for each trade and for Workshop calculations, Engineering Drawing, Employability skills etc. Administrative staff, Hostel Superintendent (H.S.) physical Education Trainer (PET), Library incharge, Pharmacist, etc. will be under the head of the Institution.

The typical organizational of ITI chart is shown in Fig 1

Scope of the electrician trade

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

- explain the duties of electrician general and electrical fitter and their NCO
 - state the key skills and carrier pathway for electrician
 - list out the job opportunities and self employment opportunities.
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Welcome to the electrician trade

Electrician trade under craftsman training scheme (CTS) is one of the most popular trade delivered nationwide through the network of ITIs. This trade is of two year (4 semester) duration.

It mainly consists of domain area and core areas. In domain area trade practical and trade theory and core area workshop calculation and science, Engineering drawing and employability skills which imparts soft and life skills. There are two professional classification in electrician trade based on National Code of Occupation (NCO) as

- (i) Electrician general (NCO - 2015 reference is 7411.0100)
- (ii) Electrical fitter (NCO - 2015 reference is 7412.0200)

Duties of Electrician - General and Electrical - Fitter

Electrician - General installs, maintains and repairs electrical machinery, equipment and fittings in factories, workshops, power houses, business and residential premises, etc. Studies drawings and other specifications to determine electrical circuit, installation etc. Positions and installs electrical motors, transformers, switchboards, microphones, loud-speakers and other electrical equipment, fittings and lighting fixtures. Makes connections and solder terminals. Tests electrical installations and equipment and locates faults using megger, test lamp etc.

Repairs or replaces defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. may do armature winding, draw wires and cables and do simple cable joining. May operate, attend and maintain electrical motors, pumps etc. NCO - 2015 reference is 7411.0100

Record class of work in which experienced such as factory, power-house, ship etc., whether experienced in electrical repairs or detecting faults, details of experience in electrical

equipment such as sound recording apparatus, air purification plant, heating apparatus etc. whether used to working do drawing, whether accustomed to high tension or low tension supply system and if in possession of competency certificate issued under electricity act.

Electrical fitter fits and assembles electrical machinery and equipment such as motors, transformers, generators, switch gears, fans, etc., Studies drawings and wiring diagrams of fittings, wiring and assemblies to be made. Collects prefabricated electrical and mechanical components according to drawing and wiring diagram and checks them with gauges, megger etc. to ensure proper function and accuracy.

Fits mechanical components, resistance, insulators, etc. as per specification doing supplementary tooling where necessary. Follows wiring diagrams, makes electrical connections and solder points as specified. Checks for continuity, resistance, circuit shorting, leakage, earthing etc., at each stage of assembly using megger, ammeter, voltmeter and other appliances and ensures stipulated performance of both mechanical and electrical components filled in assembly.

Erects various equipment such as bus bars, panel board, electrical post, fuse boxes switch gears, meters, relays etc., using non-conductors, insulating and hoisting equipment as necessary for receipt and distribution of electrical current to feeder lines.

Installs motors, generators, transformers, etc. as per drawing using lifting and hoisting equipment as necessary, does prescribed electrical wirings and connects to supply line. Locates faults in case of breakdown and replaces blown out fuses, burnt coils, switches, conductors, etc. as required. Checks dismantles, repairs and overhauls electrical units periodically or as required according to scheduled procedure.

Test electrical equipment and rewind blown out coils. May specialize in repairs of particular type of electrical appliances and machinery, equipment manufacturing, installation or power house work and be designated accordingly NCO - 2015 reference is 7412.0200

Record nature of work done; if specialized in repairing or assembling any particular item such as generator, motor, transformer, relays switchgear, domestic appliance etc. , experience of working in power-house and distribution centre and if in possession of electrician's competency certificate

Key Skills of Electrician

After passing the electrician trade, they are able to

- Read and interpret technical parameter documents, plan and organic work process, identify necessary materials and tools
- Perform tasks with due consideration to safety rules, accident prevention regulation and environment protection.
- Apply professional skill knowledge and employability skills while performing jobs.
- Checking job/assembly as per drawing for functioning, identifying and rectifying errors in job/assembly.
- Document the technical parameters related to the tasks undertaken
- In 2013, semester systems was introduced and the syllabus also revised for semester pattern
- Then in 2014 Sector Mentor Council (SMC) was formed and the syllabus was also re-revised and implemented.

Presently electrician syllabus again revised and sequentially structured by National Skill Qualification Framework NSQF - level 5 and implemented from August 2017

Carrier Progress Pathways

After passing the electrician trade the trainee can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for general Technical education.

- Take admission in diploma course in notified branches of engineering by lateral entry
- Can join the apprenticeship training in different types

of industries and obtain National Apprenticeship Certificate (NAC)

- Can join Craftsman Instructor Training Scheme (CITS) in the trade to become instructor in ITIs
- Eligible to obtain directly wireman 'B' license, which is issued by the Electrical Licensing Board Authorities

Job Opportunities: There are good numbers of job opportunities for an electrician

- Electrician in local electricity boards, railways, Telephone department, airport and other government and semi-government establishments
- Electrician in factories (Public/Private) Install, test and maintain electrical equipment in auditorium and cinema halls
- Assembler of electrical control gears and switches on panel boards at switch gear factories.
- Winder of electrical motors in winding shops
- Electrical appliances repairer in electrical shops.
- Electrician to Install, service and maintain electrical equipment and circuits in hotels, resorts hospitals and flats
- Assembler in the domestic appliances manufacturing factories
- Service technician for domestic appliances in reputed companies.

Self-employment opportunities

- Service centre for repairing electrical switch gear and motors in rural and urban areas.
- Maintenance contractor of wiring installation in hotels/resorts/hospitals/banks etc.
- Manufacturer of sub-assembly for electrical panels
- Contractor for domestic wiring and industrial wiring
- Armature winder of electrical motors
- Repairer of simple electronic of gadgets.
- Service, maintain and repair of domestic appliances
- Dealership/agency for electrical hardware
- With an added training in the specified field can become Audio/Radio/ TV Mechanic

Safety rules - Safety signs - Hazards

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

- explain the necessity of adopting the safety rules
 - list the safety rules to be followed by the electrician.
 - explain how to treat a person for electric shock/injury
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Necessity of safety rules: Safety consciousness is one of the essential attitudes required for any job. A skilled electrician always should strive to form safe working habits. Safe working habits always save men, money and material. Unsafe working habits always end up in loss of production and profits, personal injury and even death. The safety hints given below should be followed by Electrician to avoid accidents and electrical shocks as his job involves a lot of occupational hazards.

The listed safety rules should be learnt, remembered and practised by every electrician. Here a electrician should remember the famous proverb, **“Electricity is a good servant but a bad master”**.

Safety rules

- Only qualified persons should do electrical work.
- Keep the workshop floor clean, and tools in good condition, and keep proper places.
- Do not work on live circuits; if unavoidable, use rubber gloves rubber mats, etc.
- Use wooden or PVC insulated handle screwdrivers when working on electrical circuits.
- Do not touch bare conductors
- When soldering, place the hot soldering irons in their stand. Never lay switched ‘ON’ or heated soldering iron on a bench or table as it may cause a fire to break out.
- Use only correct capacity fuses in the circuit. If the capacity is less it will blow out when the load is connected. If the capacity is large, it gives no protection and allows excess current to flow and endangers men and machines, resulting in loss of money.
- Replace or remove fuses only after switching off the circuit switches.
- Use extension cords with lamp guards to protect lamps against breakage and to avoid combustible material coming in contact with hot bulbs.
- Use accessories like sockets, plugs, switches and appliances only when they are in good condition and be sure they have the mark of BIS (ISI). Necessity of using BIS(ISI) marked accessories is explained under standardisation.
- Never extend electrical circuits by using temporary wiring.
- Stand on a wooden stool, or an insulated ladder while repairing live electrical circuits/ appliances or replacing

fused bulbs. In all the cases, it is always good to open the main switch and make the circuit dead.

- Stand on rubber mats while working/operating switch panels, control gears etc.
- Position the ladder, on firm ground.
- While using a ladder, ask the helper to hold the ladder against any possible slipping.
- Always use safety belts while working on poles or high rise points.
- Never place your hands on any moving part of rotating machine and never work around moving shafts or pulleys of motor or generator with loose shirt sleeves or dangling neck ties.
- Only after identifying the procedure of operation, operate any machine or apparatus.
- Run cables or cords through wooden partitions or floor after inserting insulating porcelain tubes.
- Connections in the electrical apparatus should be tight. Loosely connected cables will heat up and end in fire hazards.
- Use always earth connection for all electrical appliances along with 3-pin sockets and plugs.
- While working on dead circuits remove the fuse grips; keep them under safe custody and also display ‘Men on line’ board on the switchboard.
- Do not meddle with interlocks of machines/switch gears.
- Do not connect earthing to the water pipe lines.
- Do not use water on electrical equipment.
- Discharge static voltage in HV lines/equipment and capacitors before working on them.

Safety practice - first aid

Electric shock

We are aware that the prime reasons for severity of shock are the magnitude of current and duration of contact. In addition, the other factors contribute to the severity of shock are:

- age of person
- body resistance
- not wearing insulating footwear or wearing wet footwear

- Weather condition
- Wet or dry floor
- Mains voltage etc.

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

If you are alone, proceed with the treatment immediately.

Make sure the victim is not in contact with the supply.

Effects of electric shock

The effect of current at very low levels may only be an unpleasant tingling sensation, but this itself may be sufficient to cause some persons to lose their balance and fall.

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

At an excessive shock can also cause burning of the skin at the point of contact.

Treatment of electric shock

Prompt treatment is essential.

Check for the victim's natural breathing and consciousness. Take steps to apply respiratory resuscitation if the victim is unconscious and not breathing.

Check the victim for injury and burns. Decide on the suitable method of artificial resuscitation.

In the case of injury/burns to chest and or belly, follow the mouth-to-mouth method.

In the case of burns/injury in the back, follow Nelson's method

In case the mouth is closed tightly, use Schafer's or Holgen-Nelson method.

These methods should be practiced. (Refer Exercise 1.1.06)

Treatment for electrical burns

A person receiving an electric shock may also sustain burns when the current passes through the body.

Do not waste time by rendering first aid to the victim until breathing has been restored and the patient can breathe normally unaided.

Burns are very painful. If a large area of the body is burnt, do not give treatment, except to exclude the air, eg. by covering with clean paper or a clean cloth, soaked in clean water. this relieves the pain.

Severe bleeding

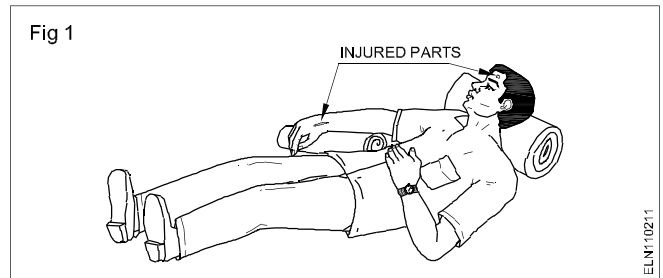
Any wound which is bleeding profusely, especially in the wrist, hand or fingers must be considered serious and must receive professional attention. As an immediate first

aid measure, pressure on the wound itself is the best means of stopping the bleeding and avoiding infection.

Immediate action

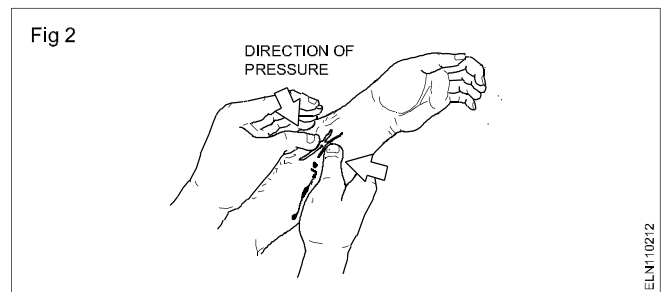
Always in cases of severe bleeding

- make the patient to lie down and rest
- if possible, raise the injured part above the level of the body (Fig 1)



- apply pressure to the wound
- call for medical assistance

To control severe bleeding

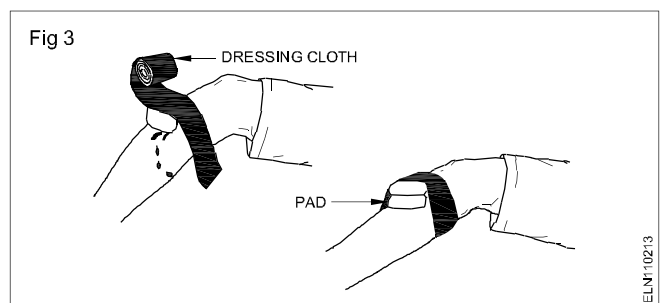


Squeeze together the sides of the wound. Apply pressure as long as it is necessary to stop the bleeding. When the bleeding has stopped, put a dressing over the wound and cover it with a pad of soft material. (Fig 2)

For an abdominal wound which 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 and bandage firmly in place. If bleeding is very severe apply more than one dressing. (Fig 3)



Safety signs (Road signals)

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

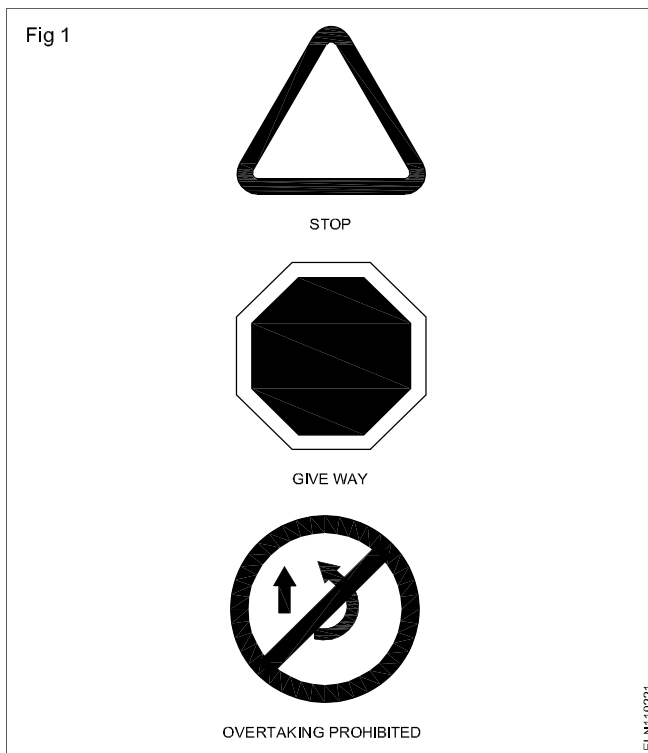
- list three kinds of road sign
- describe the “marking” on the road
- describe the various police traffic hand signal and light signal
- list the causes for collision.

In olden days road locomotive carrying a red flag by day and red lantern by night. Safety is the prime motive of every traffic.

Kinds of road signs

- Mandatory
- Cautionary and
- Informatory

Mandatory signs (Fig 1)



Violation of mandatory sign can lead to penalties. Eg. Stop, give way, limits, prohibited, no parking and compulsory sign.

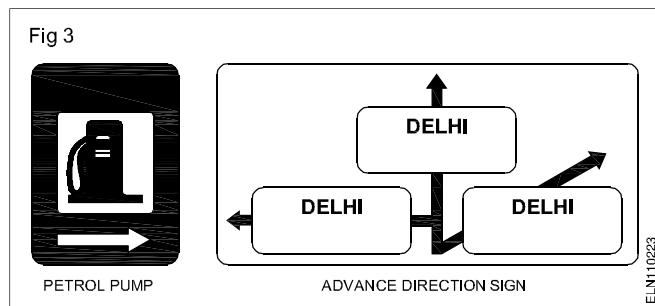
Cautionary signs (Fig 2)



Cautionary/ warning signs are especially safe. Do's and don'ts for pedestrians, cyclists, bus passengers and motorists.

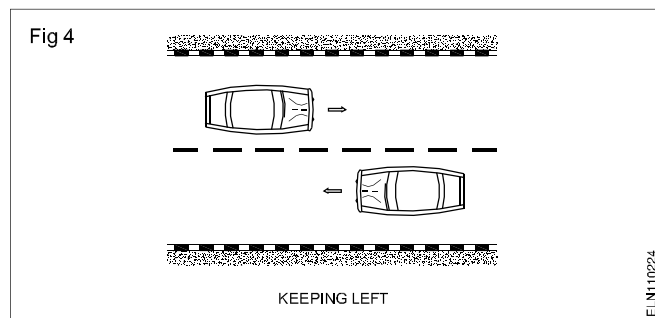
Information signs (Fig 3)

Information signs as especially benefit to the passengers and two wheelers.



Marking lines on road (Fig 4)

- Marking lines are directing or warning to the moving vehicles, cyclist and pedestrians to follow the law.



- Single and short broken lines in the middle of the road allow the vehicle to cross the dotted lines safely overtake whenever required.
- When moving vehicle approaching pedestrian crossing, be ready to slow down or stop to let people cross.
- Do not overtake in the vicinity of pedestrian crossing.

Police signals (Fig 5)

To stop a vehicle approaching from behind. (Fig 5/1)

To stop a vehicle coming from front. (Fig 5/2)

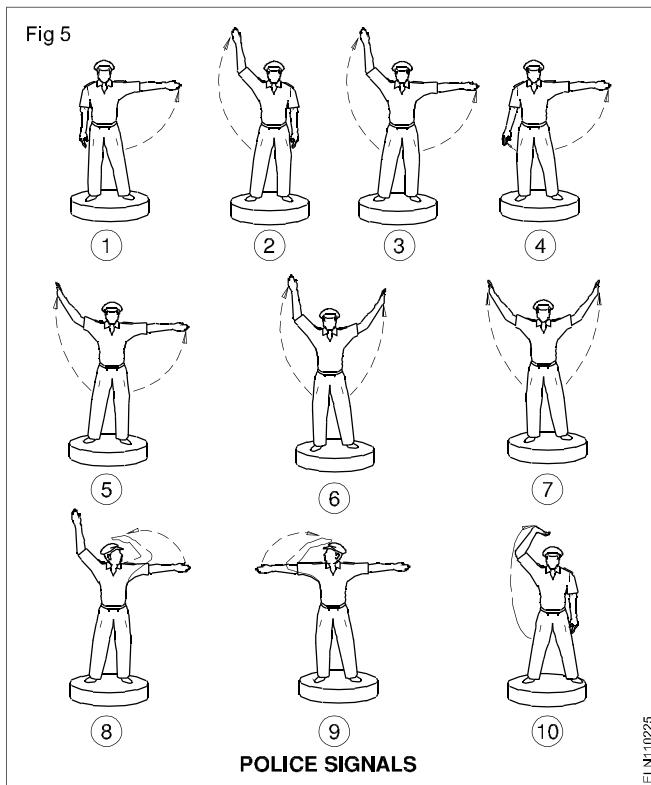
To stop vehicles approaching simultaneously from front and behind. (Fig 5/3)

To stop traffic approaching from left and wanting to turn right. (Fig 5/4)

To stop traffic approaching from the right to allow traffic from left to turn right. (Fig 5/5)

To allow traffic coming from the right and turning right by stopping traffic approaching from the left. (Fig 5/6)

Warning signal closing all traffic. (Fig 5/7)

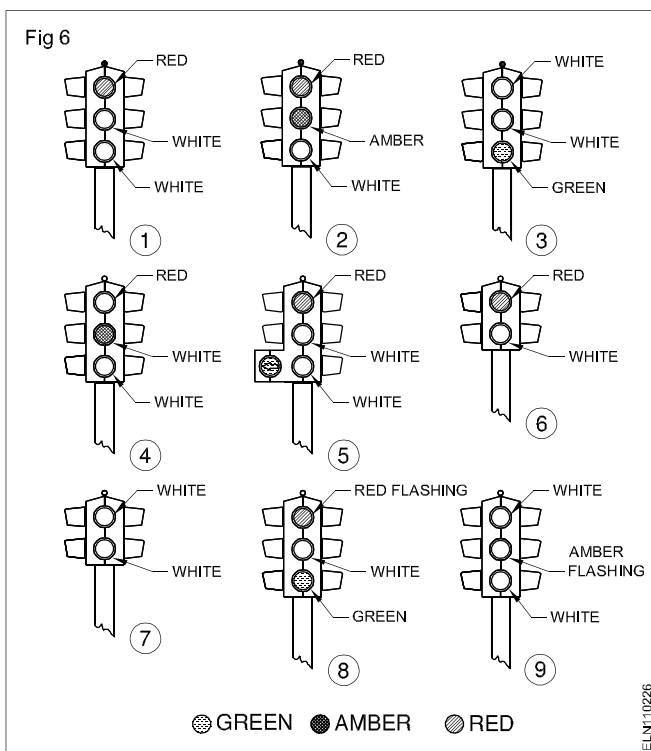


Beckoning on vehicles approaching from left. (Fig 5/8)

Beckoning on vehicles approaching from right. (Fig 5/9)

Beckoning on vehicles from front. (Fig 5/10)

Traffic light signals (Fig 6)



Red means stop. Wait behind the stop line on the carriage way. (Fig 6/1)

Red and amber also means stop. Do not pass through or start until green shows. (Fig 6/2)

Green means you may go on if the way is clear. Take special care if you mean to turn left or right and give way to pedestrians who are crossing. (Fig 6/3)

Amber means stop at the stop line. you may only go on if the amber appears after you have crossed the stop line or so close to it that to pull up may not be possible. (Fig 6/4)

Green arrow means that you may go in the direction shown by the arrow. You may do this whatever other lights may be showing. (Fig 6/5)

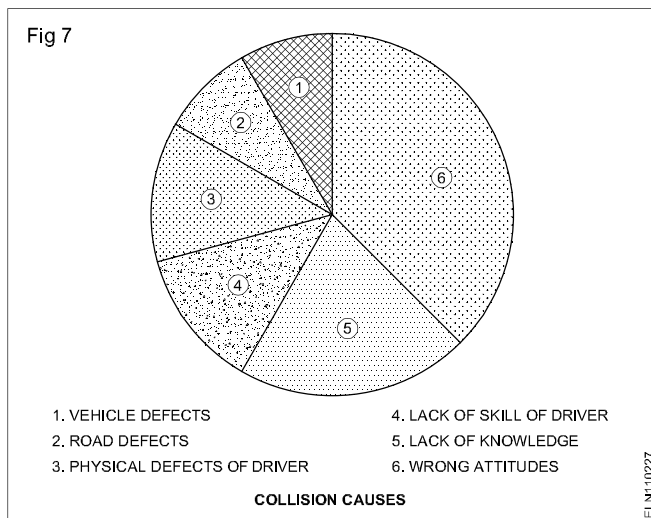
Pedestrians - do not cross. (Fig 6/6)

Pedestrians - cross now. (Fig 6/7)

Flashing red means stop at the stop line and if the way is clear proceed with caution. (Fig 6/8)

Flashing amber means proceed with caution. (Fig 6/9)

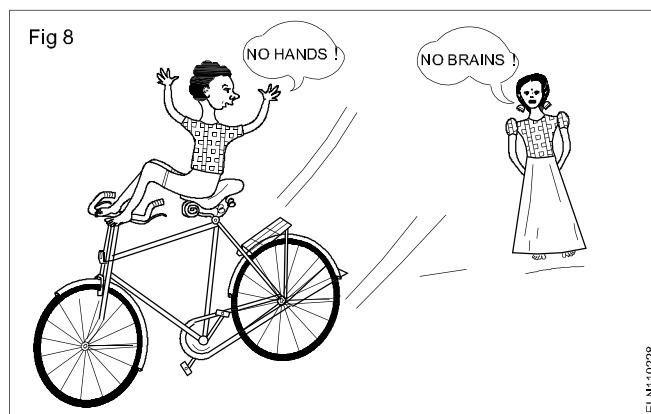
Collision causes (Fig 7)



Three factors are responsible for collision

- Roads
- Vehicles and
- Drivers

The Fig 8 shows approximately proportionate causes of collision. In wrong attitudes such that avoid foolish acts at the wheel (Fig 8). Driving time is not play time.



Safety practice - Safety signs

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

- state the responsibilities of employer and employees
- state the safety attitude and list the four basic categories of safety signs.

Responsibilities

Safety doesn't just happen - it has to be organised and achieved like the work-process of which it forms a part. The law states that both an employer and his employees have a responsibility in this behalf.

Employer's responsibilities

The effort a firm puts into planning and organising work, training people, engaging skilled and competent workers, maintaining plant and equipment, and checking, inspecting and keeping records - all of this contributes to the safety in the workplace.

The employer will be responsible for the equipment provided, the working conditions, what the employees are asked to do, and the training given.

Employee's responsibilities

You will be responsible for the way you use the equipment, how you do your job, the use you make of your training, and your general attitude to safety.

A great deal is done by employers and other people to make your working life safer; but always remember you are responsible for your own actions and the effect they have on others. You must not take that responsibility lightly.

Rules and procedure at work

What you must do, by law, is often included in the various rules and procedures laid down by your employer. They may be written down, but more often than not, are just the way a firm does things - you will learn these from other workers as you do your job.

They may govern the issue and use of tools, protective clothing and equipment, reporting procedures, emergency drills, access to restricted areas, and many other matters. Such rules are essential; they contribute to the efficiency and safety of the job.

Safety signs

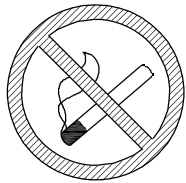
As you go about your work on a construction site you will see a variety of signs and notices. Some of these will be familiar to you - a 'no smoking' sign for example; others you may not have seen before. It is up to you to learn what they mean - and to take notice of them. They warn of the possible danger, and must not be ignored.

Safety signs fall into four separate categories. These can be recognised by their shape and colour. Sometimes they may be just a symbol; other signs may include letters or figures and provide extra information such as the clearance height of an obstacle or the safe working load of a crane.


The four basic categories of signs are as follows:

- prohibition signs (Fig 1 & Fig 5)
- mandatory signs (Fig 2 & Fig 6)
- warning signs (Fig 3 & Fig 7)
- information signs (Fig 4)

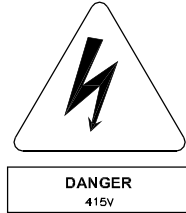
Prohibition signs

Fig 1 	SHAPE	Circular.
	COLOUR	Red border and cross bar. Black symbol on white background.
	MEANING	Shows it must not be done.
	Example	No smoking.

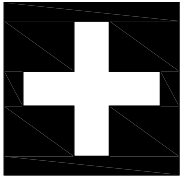
Mandatory signs

Fig 2 	SHAPE	Circular.
	COLOUR	White symbol on blue background
	MEANING	Shows what must be done.
	Example	Wear hand protection.

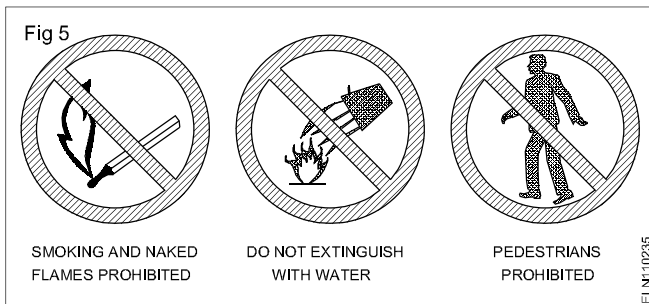
Warning signs

Fig 3 	SHAPE	Triangular.
	COLOUR	Yellow background with black border and symbol.
	MEANING	Warns of hazard or danger.
	Example	Caution, risk of electric shock.

Information signs

<p>Fig 4</p> 	SHAPE	Square or oblong.
	COLOUR	White symbols on green background.
	MEANING	Indicates or gives information of safety provision.
	Example	First aid point.

Prohibition signs



Mandatory signs



Warning signs



Fire - Types - Extinguishers

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

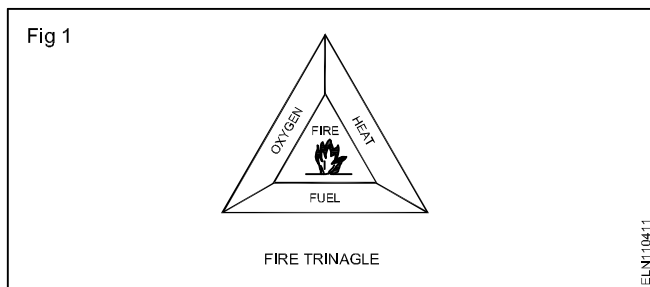
- state the effects of a fire break out and causes of fire in a workshop
- distinguish the different types of fire extinguishers
- state the classification of fires and basic ways for extinguishing the fire
- determine the correct type of fire extinguisher to be used based on the class of fire
- describe the general procedure to be adopted in the event of fire
- state the method of operation of fire extinguisher and extinguishing of fire.

Fire

Fire is the burning of combustible material. A fire in an unwanted place and on an unwanted occasion and in an 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.

Classification of fires: Fires are classified into four types in terms of the nature of fuel.

Different types of fires (Fig 2, Fig 3 Fig 4 & Fig 5) have to be dealt with in different ways and with different extinguishing agents.

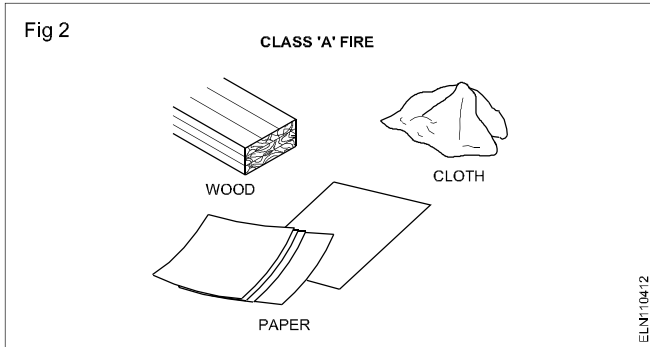
An extinguishing agent is the material or substance used to put out the fire, and is usually (but not always) contained in a fire extinguisher with a release mechanism for spraying into the fire.

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.

Fire Classification and Fuel

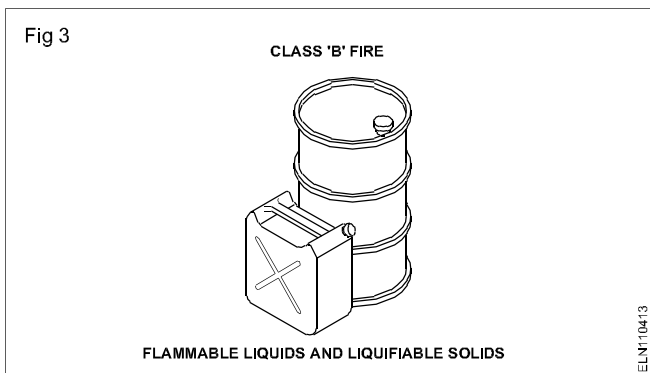
Extinguishing Method

Fig 2



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

Fig 3

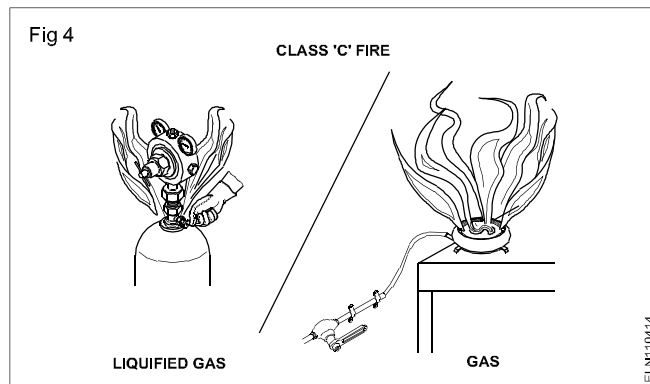


Should be smothered :- The aim is to cover the entire surface of the burning liquid. This has the effect of cutting off the supply of oxygen to the fire.

Water should never be used on burning liquids.

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

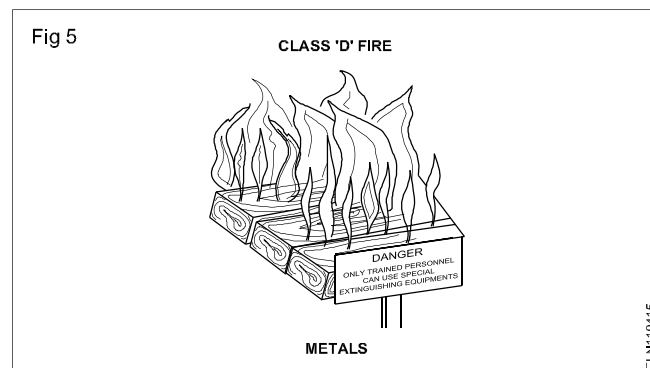
Fig 4



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.

Fig 5



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

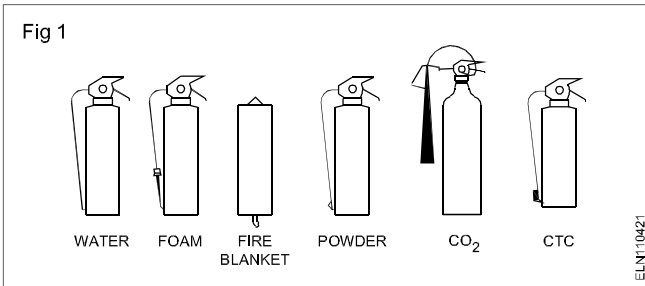
The standard range of fire extinguishing agents is inadequate or dangerous when dealing with metal fires.

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.

Types of Fire Extinguisher

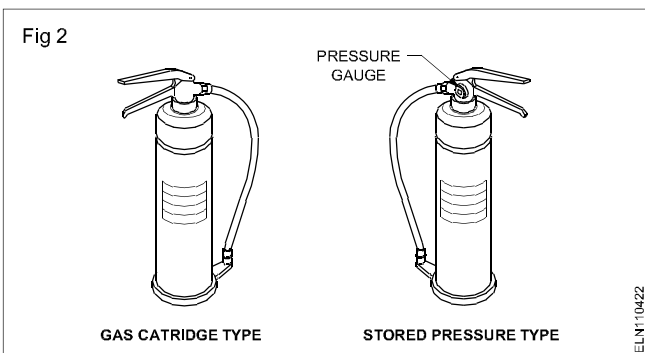
Many types of fire extinguishers are available with different extinguishing 'agents' to deal with different classes of fires. (Fig 1)



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.

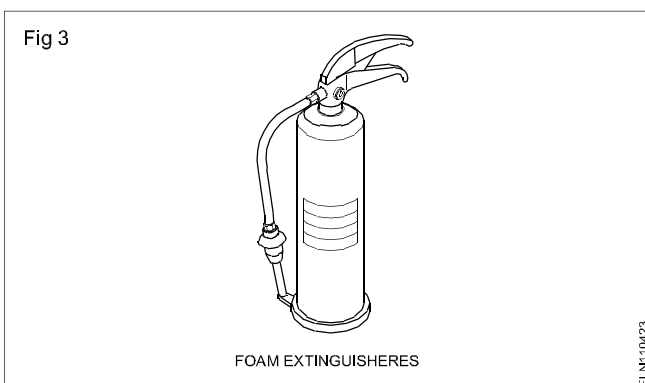


Foam extinguishers (Fig 3): These may be of stored pressure or gas cartridge types. Always check the operating instructions on the extinguisher before use.

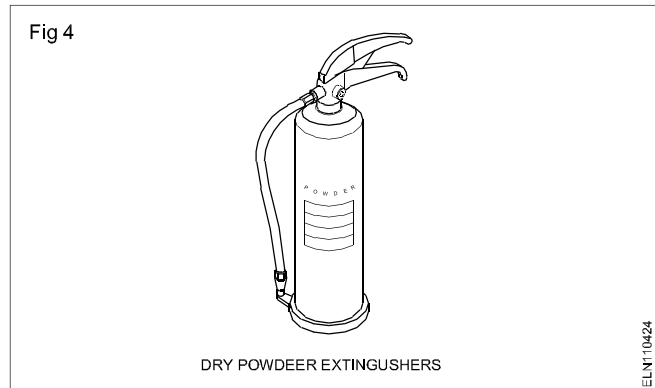
Most suitable for

- flammable liquid fires
- running liquid fires

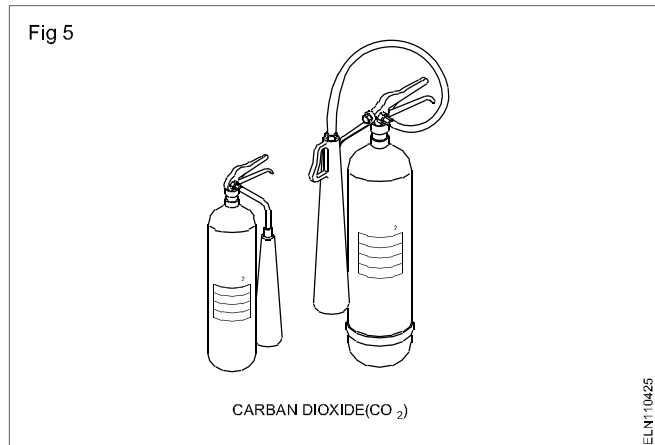
Must not be used on fires where electrical equipment is involved.



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.



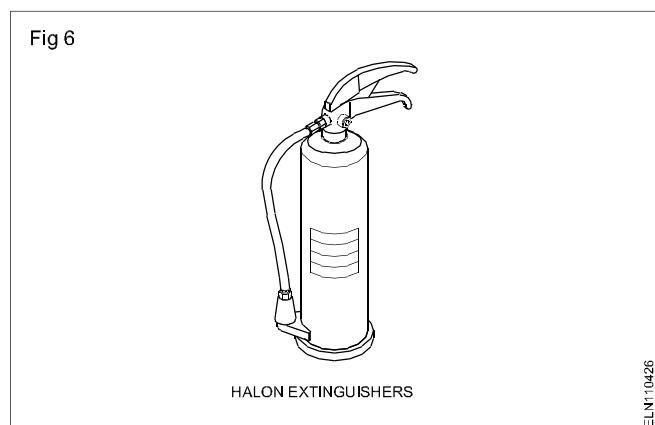
Carbon dioxide (CO₂): This type is easily distinguished by the distinctively shaped discharge horn. (Fig 5).



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 methene (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 fed 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.

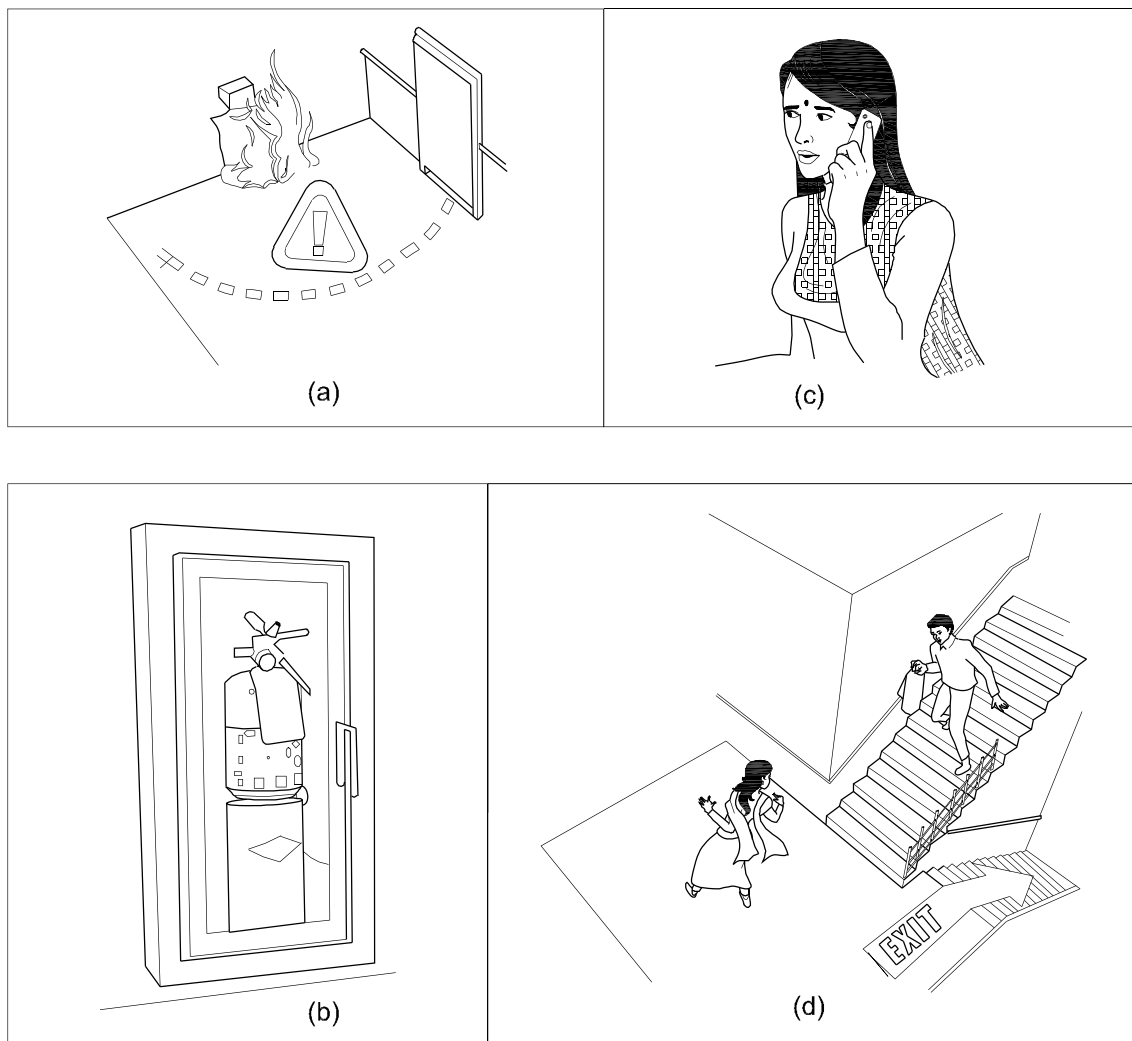
Failure to do this may mean that some person being unaccounted for and others may have to put themselves to the trouble of searching for him or her at risk to themselves.

Working on fire extinguishers:-

- Alert people surrounding by shouting fire, fire, fire when observe the fire. (Fig 1a & b)
- Inform fire service or arrange to inform immediately. (Fig 1c)
- Open emergency exist and ask them to go away. (Fig 1d)
- Put "OFF" electrical power supply.

Don't allow people to go nearer to the fire

Fig 1



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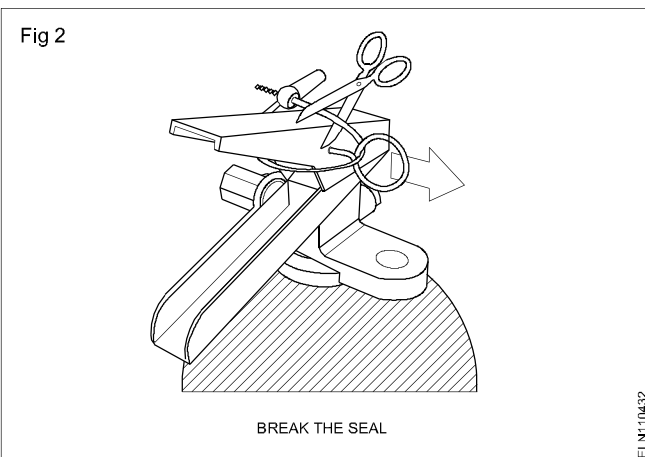
- Analyze and identify the type of fire. Refer Table 1.

Table 1

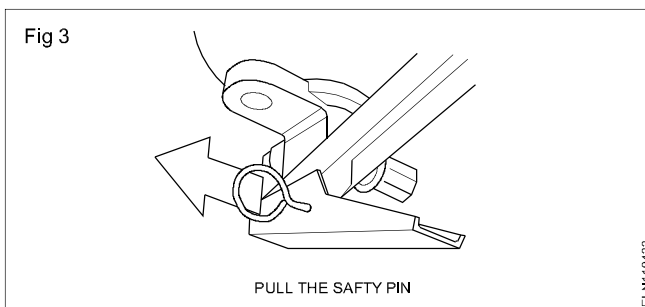
Class 'A'	Wood, paper, cloth, solid material
Class 'B'	Oil based fire (grease, gasoline, oil) liquifiable gases
Class 'C'	Gas and liquifiable gases
Class 'D'	Metals and electrical equipment

Assume the fire is 'B' type (flammable liquifiable solids)

- Select CO₂ (Carbon di oxide) fire extinguisher.
- Locate and pickup, CO₂ fire extinguisher. Click for its expiry date.
- Break the seal (Fig 2)



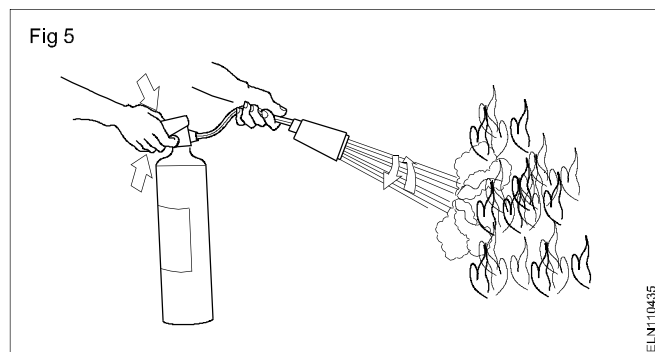
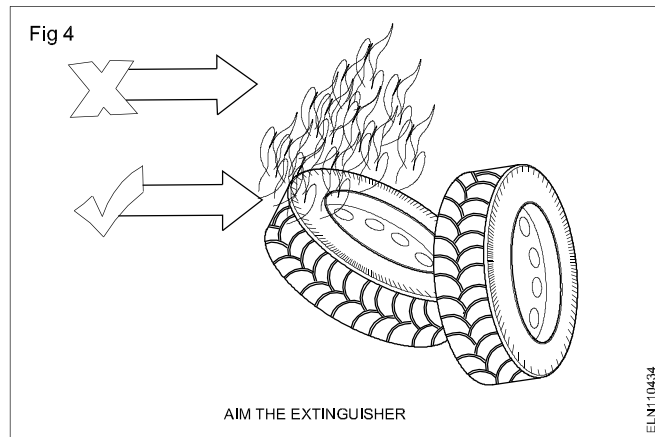
- Pull the safety pin from the handle (Pin located at the top of the fire extinguisher) (Fig 3)



- Aim the extinguisher nozzle or hose at the base of the fire (this will remove the source of fuel fire) (Fig 4)

Keep your self low and safe distance

- Squeeze the handle lever slowly to discharge the agent (Fig 5)
- Sweep side to side approximately 15 cm over the fuel fire until the fire is put off (Fig 5)



Fire extinguishers are manufactured for use from the distance.

Caution

- While putting off fire, the fire may flare up
- Do not be panick belong as it put off promptly.
- If the fire doesn't respond well after you have used up the fire extinguisher move away yourself away from the fire point.
- Do not attempt to put out a fire where it is emitting toxic smoke leave it for the professionals.
- Remember that your life is more important than property. So don't place yourself or others at risk.

In order to remember the simple operation of the extinguisher. Remember P.A.S.S. This will help you to use the fire extinguisher.

P for Pull

A for Aim

S for Squeeze

S for Sweep