Doc. No. ETD 20 (25696)/ Revision of IS 5216 Part 2:1982

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BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

Draft *Indian Standard*

RECOMMENDATIONS ON SAFETY PROCEDURES AND PRACTICES IN ELECTRICAL WORK

PART 2 LIFE SAVING TECHNIQUES

(ICS 91.140.50)

Electrical Installations Sectional Committee, ETD 20

Last Date for Comments
20th JUNE 2024

FOREWORD

(Formal clause shall be added later)

This standard was first published in 1969 and subsequently revised in 1982 to introduce new concepts in the safety practices in electrical work and also to make the guide comprehensive in all respects as far as safety-in electrical installations are concerned. The current revision has been brought out to bring the standard in the latest style and format of the Indian Standards. This part has to be read in conjunction with other parts of IS 5216.

Most accidents are generally due to carelessness and result in fall, fire or electric shock to personnel. Extreme care is therefore recommended while working on, or in close proximity to live mains or apparatus. However, in cases of untoward accidents, the safety instructions are to be strictly adhered to with speed and precision by personnel.

The object of this standard (Part 2) is therefore to cover , the DO's and DON'TS instructions to be adhered to in the case of an accident and details of the life saving techniques in the event of all accidents to persons, whether minor or major.

This standard covers in detail the various alternative methods of inducing artificial respiration to a victim of electric shock.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values *(revised)'* . The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Draft Indian Standard

RECOMMENDATIONS ON SAFETY PROCEDURES AND PRACTICES IN ELECTRICAL WORK

PART 2 LIFE SAVING TECHNIQUES

(Second Revision)

1 SCOPE

1.1 This part of the standard covers methods of dealing with electrical accidents and techniques for saving the life of a person who is affected.

2 ACCIDENTS

2.1 General

2.1.1 Most accidents are generally due to carelessness and result in fall, fire or electric shock. Extreme care should, therefore, be taken in connection with work on, or in close proximity to live mains or apparatus.

2.1.2 The DO'S and DON'TS instructions mentioned in Annex A of the standard should be strictly followed.

2.1.3 In case of fire, the instructions given in **8** of Part 1 of this standard shall be strictly followed.

2.2 First Aid, Fire Fighting and Resuscitation

2.2.1 All technical staff should be familiar with first aid and artificial respiration techniques.

2.2.2 All technical staff should be made familiar with firefighting techniques and the equipment used in it.

2.2.3 The person-in-charge should also conduct drills in artificial respiration, rendering first aid and firefighting.

2.2.4 *First Aid Box* – A box containing first aid equipment shall be kept handy for use when required. A periodical check shall be made of its contents. Any deficiencies shall be immediately made up.

2.2.5 *Stretchers* - Stretchers should be kept at all important electrical installations.

2.3 Reporting of Accidents

2.3.1 All accidents to persons; whether minor or major, fatal or nonfatal, including slight injuries (when the injured person is capable of performing his duties), shall be immediately reported in accordance with the rules in force. First aid shall be rendered, where necessary. The injured person shall be sent to the doctor for medical examination or the doctor shall be sent for to attend on the patient.

2.3.2 The provisions of Section 161 of the Electricity Act, 2003 shall be complied with for the purpose of intimation of accidents.

2.3.3 *Department Reports* – Every accident should be thoroughly investigated and recorded. The records should show the date and time of the accident, name of person or persons involved, nature of injury, name of investigating persons, their findings and preventive action taken, if any.

3 TREATMENT FOR ELECTRIC SHOCK

3.1 General

3.1.1 In most cases of electric shock and collapse, it is the lungs and the diaphragm (the thin sheet of muscles which lies below the lungs) that stop working and there is a very good chance of revival by quickly applying artificial respiration. Methods of artificial respiration generally used are described in **4** and all persons concerned should qualify themselves by practical study and drill in the treatment for electric shock according to these methods.

3.1.2 While rendering artificial resuscitation, violent operations should be avoided as it may result into injury of the internal organs may result from excessive and sudden pressures.

3.1.3 In cases of severe shock, respiration is seldom established under an hour while 3 to 4 hours or more might be found necessary to restore normal breathing. It is, therefore, essential that in all cases of electric shock where the condition of the patient is doubtful or the patient is unconscious or not breathing, artificial resuscitation should be continued until death is diagnosed by a physician or until *rigor mortis* sets in.

3.2 Removal from Contact

3.2.1 If the person is still in contact with the apparatus that has given him shock, switch off the electric circuit at once. If it is not possible to switch off the circuit quickly, no time should be lost in removing the body from contact with the live conductor.

3.2.2 The victim's body should not be touched with bare hands, instead rubber gloves should be worn. However, if the rubber gloves are not available the victim should be pulled off from the live conductor by his coat, shirt, etc, if they are not wet or with any other dry cloth or even dry newspaper folded into 3 or more thicknesses. Wooden rods or broom handle may also be used to raise the body or to detach it from live conductor. A good plan is to stand on dry board or stool or on few layers of thick newspaper bundles or even dry sacking and remove the victim from the live conductor.

3.3 Preliminary Steps - If the patient's clothes are smoldering, the sparks should first be extinguished. The doctor should be immediately sent for and, in case the breathing has stopped, immediate action as given in **3.4** should be taken.

3.4 Immediate Action to Recover Patient

3.4.1 When a man has received a severe electric shock, his breathing usually stops. In accidents of this kind, speed may save the injured man's life. Hence, no time should be wasted in sending for a doctor but the patient should not be neglected during this period.

3.4.2 The patient should not be placed in such a position which may bring pressure on the burns he may have sustained. He should also not be exposed to cold. Stimulants should not be administered unless recommended by a doctor. Cold water may be given in small quantities in cases of electric fire or asphyxia and smelling salts may also be administered in moderation.

3.4.3 Artificial respiration without interruption, until natural breathing is restored, should be continued. Cases are on record of success after about 3 to 4 hours effort and even more.

3.4.4 Resuscitation should be carried on at the nearest possible place of accident. The patient should not be removed from this place until he is found breathing normally, and then also moved only in a lying position. Should it be necessary due to extreme weather conditions or other reasons to remove the patient before he is breathing normally, he should be kept in a prone position, and placed on a hard surface or on the floor of a conveyance, resuscitation being carried on during the time that he is being moved.

3.4.5 A brief return of spontaneous respiration is not a certain indication for terminating the treatment. Not infrequently, the patient, after a temporary recovery of respiration, stops breathing again. The patient should be watched, and if normal breathing stops, artificial respiration should be resumed at once.

3.5 Upon Recovery - When, the patient revives, he should be kept lying down and not allowed to get up or be raised under any circumstances without the advice of a doctor. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as a teaspoonful of aromatic spirits of ammonia in a small glass of water, or a drink of hot ginger, tea, or coffee. The patient should then have any other injuries attended to and be kept warm, being placed in the most comfortable position.

3.6 First aid treatment should be given to all the burns.

4 ARTIFICIAL RESPIRATION

4.1 General

4.1.1 The various methods of artificial respiration usually adopted are described below for general information only, and are not meant to replace the method actually followed in the area concerned

in accordance with Regulation 30 of Central Electricity authority Regulation (Measures relating to safety and Electric supply) 2023.

4.1.2 Schafer's method is the most common method used for artificial respiration and has been described in **4.2**. There are some other methods of artificial respiration described in **4.3** to **4.8** also in use. In recent years, many countries have changed over to more efficient ones, though Schafer's method has the merit of being the least-exhausting to perform and not requiring the use of any apparatus or appliances.

4.1.3 The first action the rescuer should take as he reaches near the victim is to disengage him from the live circuit. The instructions given in different methods of artificial respiration should be followed, even if the patient appears dead. As soon as possible, feel with your fingers in the patient's mouth and throat and remove any foreign body (tobacco, artificial teeth, etc.). If the mouth is tight shut, pay no more attention to it until later. Do not stop to loosen the patient's clothing, but immediately begin actual resuscitation. Every moment of delay is serious.

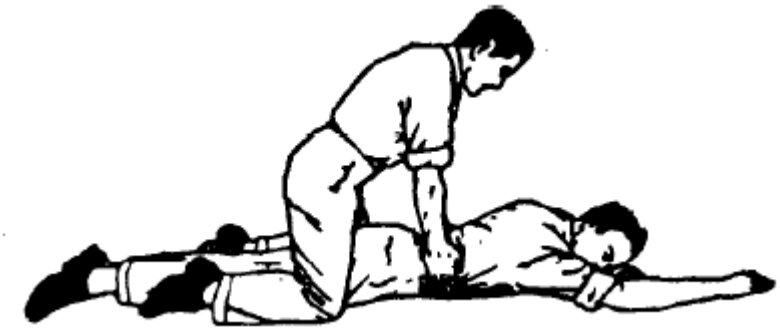
4.1.4 All concerned should be advised to study and practice under proper guidance as many methods of artificial respiration as possible.

4.2 Schafer's Prone Pressure Method

4.2.1 Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face turned outward and resting on the second hand or forearm, so that the nose and mouth are free for breathing. (*see* Position 1, Fig. **1**).

4.2.2 Kneel, straddling the patient's thighs, with your knees placed at such a distance from the hip bones as will allow you to assume Position 1 shown in Fig. I. Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position, and the tips of fingers just out of sight (*see* Position 1, Fig. **1**).

4.2.3 With arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing (see Position 2, Fig. **1**)- do not bend your elbows. This operation should take about two seconds.



POSITION 1

POSITION 2

POSITION 3

FIG.1 SCHAFER'S METHOD

Now immediately swing backward so as to completely remove the pressure. (*see* Position 3, Fig. **1**).

After 2 seconds, swing forward again, thus repeat deliberately 12 to 15 times a minute the double movement of compression and relaxation, a complete respiration in 4 or 5 seconds.

NOTE - Pressure should not be excessive and should be suited to the size and body structure of the patient. Pressure should be applied gradually and not suddenly.

4.2.4 As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest or waist. *Keep the patient warm.* Do not give any liquids whatever by mouth until the patient is fully conscious.

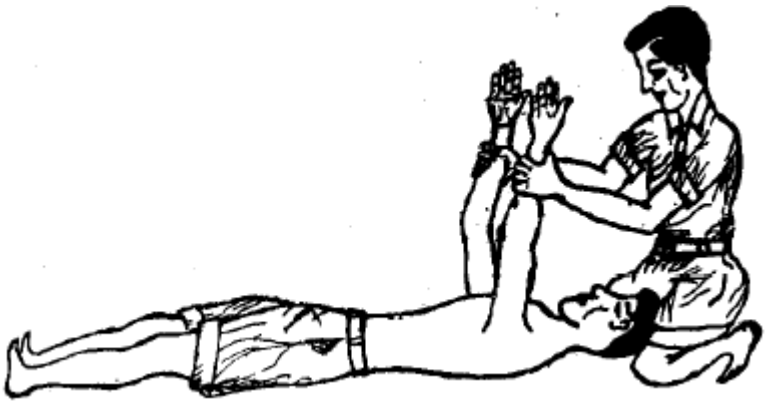
4.2.5 To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, he

should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water, or a hot drink of coffee or tea, etc. The patient should be kept warm.

4.2.6 A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently, the patient, after a temporary recovery of respiration, stops breathing again. The patient should be watched and, if natural breathing stops, artificial breathing should be resumed at once.

4.2.7 In carrying out resuscitation, it may be necessary to change the operator. This change should be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

4.3 Silvester's Method (Arm-Lift Chest-Pressure Method) - This, method is illustrated in Fig. **2**. The patient is laid on his back. His arms are grasped above the wrists and drawn first upward and then above the head until they touch the floor. Then they are brought back to the chest and pressure is exerted in a downward direction. The main defect of this method is that the tongue which is a boneless mass of muscle, having lost its tone due to lack of respiration, tends to fall back and block the wind pipe in about 50 percent of the cases, causing a choke. So, a second operator has to pull out the tongue and hold it so. But, sometimes no second man may be available. If, however, a large thick pad is placed behind the shoulders, so that the head lies dangling downward& the tongue does not seem to obstruct.

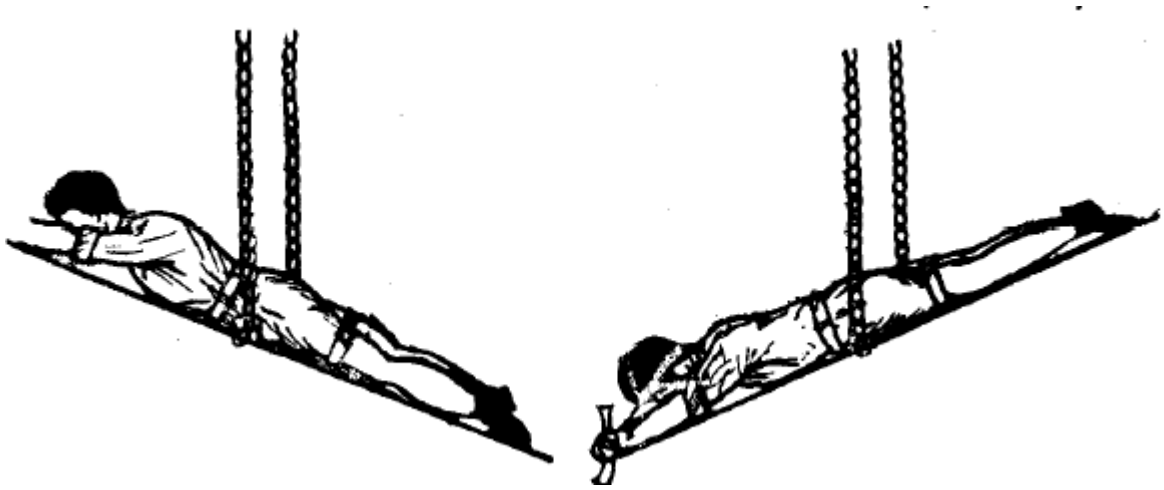


POSITION 1

POSITION 2

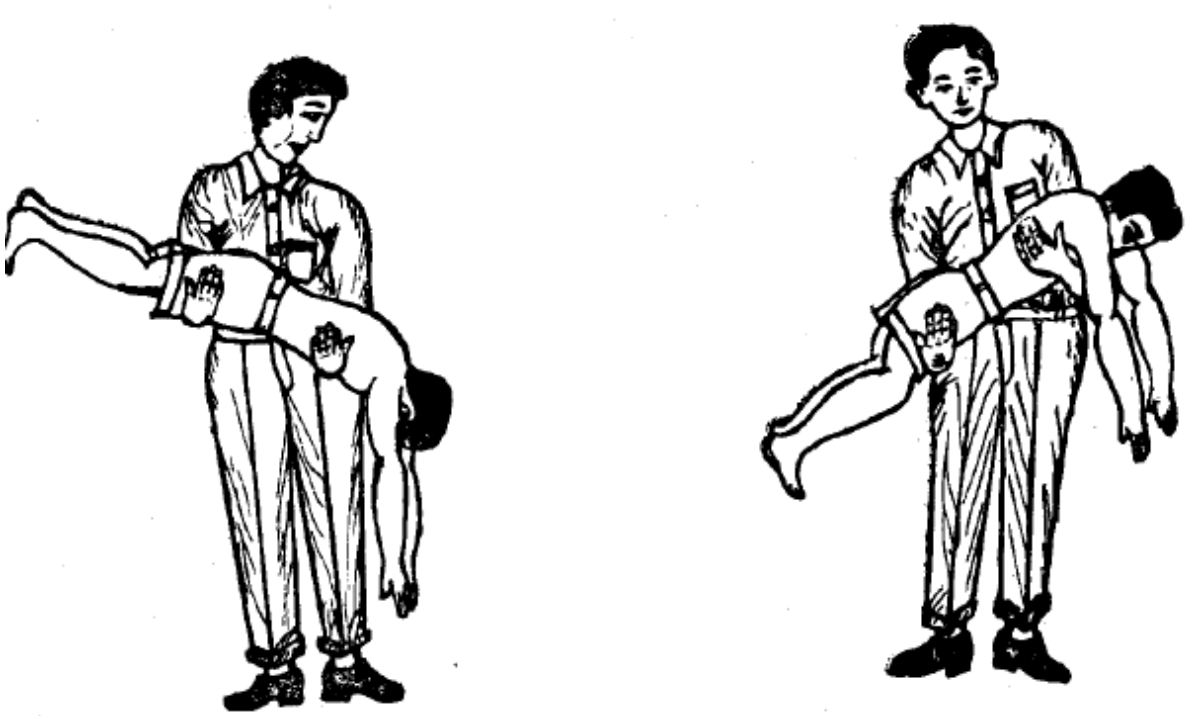
FIG. 2 SILVESTER'S METHOD (ARM-LIFT CHEST-PRESSURE METHOD)

4.4 Eve's Rocking Method - This method is illustrated in Fig. **3**. In this method, the patient is placed prone on a stretcher and his hands tied to its frame. He is then rocked by tilting the stretcher 45^{o} down and 45^{o} up repeatedly. Such special rocking stretchers are unlikely to be available readily. It may, however, be possible to use light two wheeled hand-carts for the purpose and the method is worth trying. In the case of children this method is very easy to apply. The operator stands holding the child in his hands and rocks in this manner. It has been claimed that the rocking which is peculiar to this method induces greater circulation of blood in the body and brain, helping earlier recovery.



POSITION 1 **POSITION 2**

FOR ADULTS



POSITION 1 **POSITION 2**

FOR CHILDREN

FIG. 3 EVE'S ROCKING METHOD

4.5 Hip-Lift Back-Pressure Method

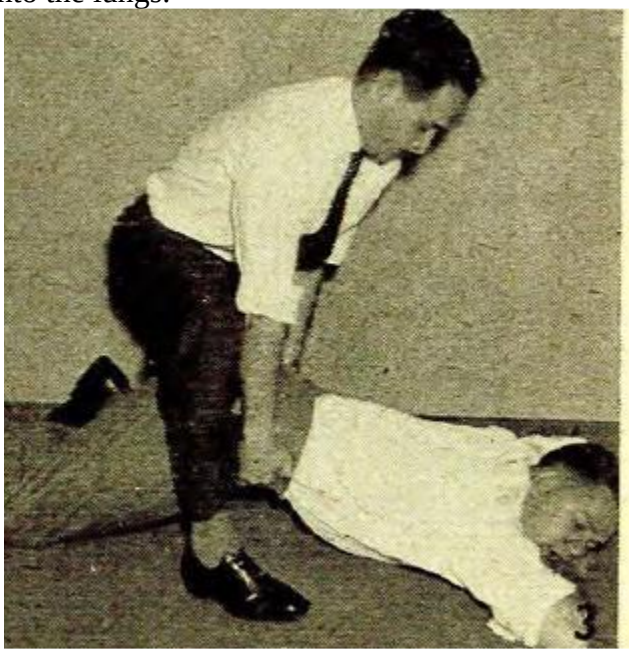
4.5.1 Though this method has the drawback that it is the most exhausting to the operator and difficult to apply if the victim is heavy, it is useful when the victim has been injured in the upper part of the body-chest, neck, shoulders or arms, or where due to lack of space, it is difficult to use the arm-lift back-pressure method.

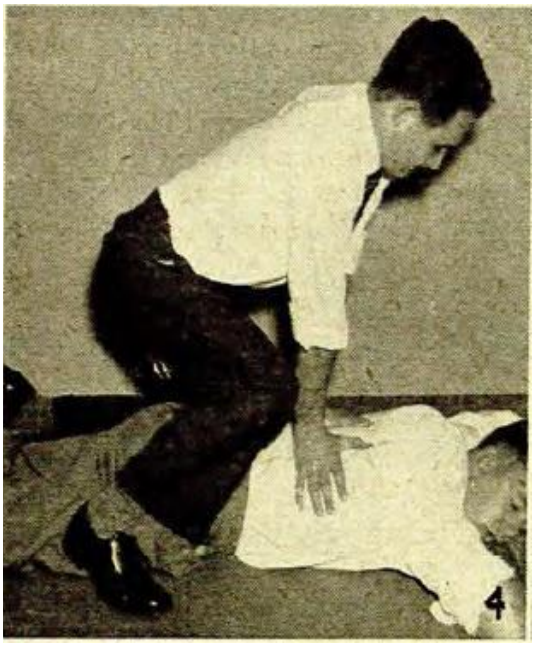
4.5.2 Place the victim prone with his face on one side and resting on the back of one hand which is bent at the elbow. The other arm is extended so that the hand is above the head. Straddle the victim at the level of his hips, kneel on one of your knees and put your other foot on the ground near his hip opposite the kneeling knee.

4.5.3 Place your hands on the middle of his back just between the shoulder blades with your fingers spread downwards and outwards and thumbs nearly touching. Now rock forward and allow the weight of your body to exert slow, even pressure downwards till resistance is met.

4.5.4 Release the pressure quickly, remove your hands from the victim’s back, rock backwards and slip your fingers underneath the hip bones (not waist). Lift his hips 10 to 15 cm, keeping your

arms straight and not bending your elbows to facilitate lifting. This lifting causes air to be sucked into the lungs.





4.5.5 Lower the victim's hips thus completing the full cycle. There should be about 12 cycles per minute. If a second man is available, he can relieve the first operator after one of the lift phases.

4.6 Arm-Lift Back Pressure Method

4.6.1 This is called Nielson's Method in Denmark and has been modified by Professor Drinker of USA. The modified method is illustrated in Fig. **4**. The subject lies prone with both arms folded and hands resting, one on the other, under his head. The arms are grasped above the elbow and lifted until firm resistance is met. This induces active inspiration. Then they are let down and pressure applied on the back to cause active expiration.

4.6.2 The movements in this method follow the sequence given below:

a) Position 1 - Place victim prone (that is, face down) with his arms folded with one palm on the other and head resting on his cheek over the palms. Kneel on one or both knee at victim's head. Place your hands on the victim's back beyond the line of armpits, with your fingers spread outwards and downwards, the thumbs just touching each other.

POSITION 1

POSITION 2

POSITION 3

POSITION 4

FIG. 4 NIELSON'S ARM-LIFT BACK-PRESSURE METHOD

b) *Position 2* - Then gently rock forward keeping arms straight until they are nearly vertical thus steadily pressing the victim's back. This completes expiration.

c) *Position 3* - Synchronizing the above movement, rock backwards, releasing pressure and slide your hands downward along the victim's arms and grasp his upper arm just above the elbows. Continue to rock backwards.

d) *Position 4* - As you rock back, gently raise and pull the victim's arms towards you, until you feel tension in his shoulders. This expands his chest and results in respiration. To complete the cycle, lower the victim's arms and move your hands up for initial position.

4.6.3 This method is considered to be the best, being most effective, easy to teach and fairly easy to perform.

4.7 Pole-Top Method -When a person receives electric shock it is most important that the artificial respiration is started without any loss of time whatsoever. Indeed, the non-neglect of the first few minutes is so necessary that in the USA where a good deal of live line work is done, a method of artificial respiration, called the Pole-Top Method, has been developed. The victim of the shock will be hanging by his safety belt and the rescuer ascends the pole, supports the victim astride his own safety belt and rhythmically compresses the victim's abdomen with both hands while he is being lowered to the ground. He is then changed on to one of the more effective methods. Several cases of successful operation of, this method have been reported. The need for not wasting any time whatsoever in starting artificial respiration cannot, therefore, be overemphasized.

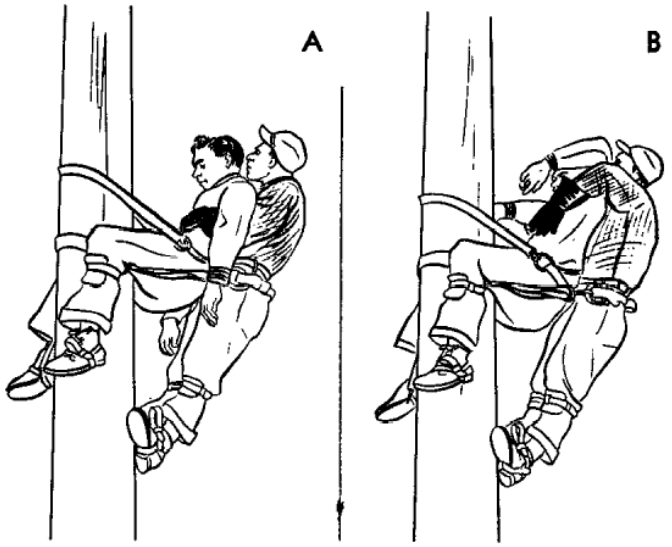


FIG. 1. Modified pole-top method of artificial respiration (the bear-hug arm lift). *Left*, compression of the chest for expiration; *right*, arm lift for inspiration.

4.8 Mouth-To-Mouth Method

4.8.1 Place victim on his back. Place his head slightly downhill, if possible. A folded coat or similar object under victim's shoulders will help maintain proper position. Tilt head back, so that the chin points straight upwards.

4.8.2 Grasp victim's jaw as illustrated in Fig. **5** (Position 1) and raise it upward until lower teeth are higher than upper teeth; or place fingers on both sides of jaw near ear lobes and pull upward. Maintain jaw position throughout resuscitation period to prevent tongue from blocking air passage.

4.8.3 Take a deep breath and place your mouth over victim's mouth (*see* Position 2, Fig. **5**) making air-tight contact. Pinch the victim's nose, shut with thumb and forefinger or close nostrils by pressing your cheek against them. If you hesitate at direct contact, place a porous cloth between you and victim. If an infant, place your mouth over its mouth and nose.

4.8.4 Blow into victim's mouth (gently, if an infant) until his chest rises. Remove your mouth to let him exhale, turning your head to hear outrush of air. The first 8 to 10 breaths should be as rapid as victim will respond, thereafter rate should be slowed to about 12 times a minute (20 times if an infant).

POSITION 1 POSITION 2

FIG .5 MOUTH-TO-MOUTH METHOD

4.8.5 *Things to Remember*

a) If air cannot be blown in, check position of victim's head and jaw and recheck mouth for obstructions, then try again more forcefully. If chest still does not rise, turn victim's face down and strike his back sharply to dislodge obstructions.

b) Sometimes air enters victim's stomach, evidenced by swelling of stomach. Expel air by gently pressing down on stomach during exhalation period.

4.9 Duration of Movements - In all the methods, the rate of a complete respiratory cycle is 12 to 15 per minute. When the victim begins to breathe of his own accord the operation should be synchronized with the natural breathing and continued until he breathes strongly.

4.10 Advisability of Learning Alternative Methods - It is advisable that all concerned know how to apply *more* than one good method, since, when there are injuries due to fall or burn, certain methods may not become capable of application. Next to the Arm-Lift Back-Pressure Method, the Hip-Lift Back-Pressure Method is the best and may be adopted. The Rocking Method may also be learnt and used in Special cases.

4.11 Mechanical Means of Artificial Respiration - A large number of mechanical means of artificial respiration have now been developed and it is recommended: that suitable equipment may also be used for artificial respiration.

ANNEX A

(*Clause* 2.1.2)

DO'S AND DONT'S INSTRUCTIONS

DO	*DON'T*
1. MAINS AND APPARATUS	
Before replacing a lamp or handling a fan, make sure that the supply is switched off.	Do not connect single pole switch or fuse in a neutral circuit, but always connect in the live or phase wire.
Use correct size and quality of fuse wire when renewing blown fuse.	Do not renew a blown fuse until you are satisfied as to the cause and have rectified any irregularity.
When removing fuse, pull out the supply end first and when replacing the supply end should be put in last.	Do not use copper wire as substitute for fuse wire.
Place sign ‘men working’ or other warning boards on main switch before commencing work.	Do not close any switch, unless you are familiar with the circuit which it controls and know the reason for its being opened.
Before working on any circuit or apparatus, make sure that the controlling switches are opened and locked or the fuse holders withdrawn,	Do not touch or tamper with any electrical gear or conductor, unless you have made sure that it is dead and earthed. High voltage apparatus may give leakage shock or flashover even without touching.

Always treat circuit as alive until you have proved them to be dead, the insulation of the conductors may be defective.

Before working on motor or other rotating machine, make sure that it cannot be set in motion without your permission.

Cultivate the habit of turning your face away whenever an arc or flash may occur.

Guard against arcs as well as high voltage, remember that burns from arcs may be very severe.

See that all splices and connections are securely made.

Use extreme care when breaking an inductive circuit as dangerously high voltage is likely to result.

Thoroughly discharge to earth all cables before working on the cores.

Test rubber gloves periodically.

Place rubber mats in front of electrical switchboards.

Prevent accumulation of gases in unventilated manholes. Varnishes emit flammable vapour.

Do not work in live circuits without the express orders of the person-in-charge. Make certain that all safety precautions have been taken and you are accompanied by a second person competent to render first aid and artificial respiration.

Do not disconnect earthing connections or render ineffective the safety gadgets installed on mains and apparatus.

Do not tamper with the meter boards and cutouts, unless you are authorized to do so.

Do not expose your eyes to an electric arc. Painful injury may results even with short exposure.

Do not close or open a switch or fuse slowly or hesitatingly; do it quickly and positively.

Do not turn your face and then grope for switch or fuse.

Do not use metal case flashlight around apparatus which is energized.

Do not place any part of your body in circuit either to round or across the terminal when making a connection or operating.

Do not use wires with poor insulation.

Do not touch an electric circuit when your hands are wet, or bleeding from a cut or an abrasion.

Do not work on energized circuits without taking extra precautions, such as the use of rubber gloves and wooden handles.

DO	*DON'T*

2. PORTABLE LAMPS AND APPLIANCES

Ensure that all portable appliances are provided with 3-pin plug and socket connections and the metal work of the apparatus is effectively earthed.	Do not use a lamp in a metal holder fixed to the end of a loose flexible wire as a portable hand lamp.
	Do not disconnect a plug by pulling the flexible cable or when the switch in ON.
Always use portable hand lamps of the insulated safety type and provided with a rubber, plastic or wooden handle and wire guard.	Do not use kinked or perished cables for portable lamps and appliances.
	Do not plug in any portable lamp or apparatus before making sure that the switch is OFF and that the wall plug is properly inserted in the socket.

3. FIRE

Disconnect the supply immediately in case of fire on or near electrical apparatus.	Do not use fire extinguishers on electrical equipment, unless it is clearly marked as suitable for that purpose. Use sand blanket instead.
Make sure, when using water hose, that the jet of water does not come into contact with live apparatus.	Do not throw water on live electrical equipment in case of fire. It is dangerous to you.
Keep flammable material only in special containers and in fireproof rooms.	
Organize precautionary fire drill.	
Have sufficient number of fire extinguishers located in strategic position, so that they may be available for immediate use in various areas.	
Check firefighting apparatus periodically.	

Wipe up oil as soon as possible; use sand to cover oil spots.

4. ELECTRIC SHOCK

Remove the casualty from the cause, render first aid and send for doctor or take the casualty to a hospital or dispensary.

Report all accidents, whether minor or major, non-fatal or fatal, immediately to the person-in-charge.

Study carefully and practice first aid treatment for injured persons.

Study carefully and practice regularly the instructions for resuscitation (artificial respiration) after electric shock, displayed at every major electrical installation.

Whenever possible, use one hand only when working about an electrical circuit, even though it is supposed to be dead.

Do not take unnecessary risk with electricity. Low voltage, under certain circumstances, can be more dangerous than high voltage.

Do not leave the casualty in contact with live apparatus. Switch off current immediately.

Do not attempt to disengage a person in contact with a live apparatus which cannot be switched off immediately. Insulate yourself from earth by standing on rubber mat, or dry board before attempting to get him clear. Do not touch his body. Pull him by clothes if they are dry or push him clear with a piece of dry wood.

Do not discontinue artificial respiration until recovery or death is certified by doctor. It may take even more than 2 to 3 hours for recovery.

Do not remove the body without the permission of the police even after certification of death by doctor.

5. GENERAL SAFETY PRECAUTIONS

Preach and practice safety at all times. Good work can be spoiled by an accident.

Work deliberately and carefully. Haste causes many accidents, be sure of what you are doing.

Examine before use all safety appliances, such as rubber gloves, mats, ladders, goggles, insulated pliers, etc. for their soundness.

Do not wear loose clothing, metal watch straps, bangles or finger rings while working on electrical appliances. Do not hang clothes and such other things on electrical fittings.

Do not work on a pole or other elevated position if there is a live part on it without safety belt and rubber gloves, and unless a competent person stands on the ground nearby to direct operations and give warning.

Do not use a ladder without a lashing rope; otherwise the ladder should be held firmly by another person.

Always add the acid or soda to water and not *Vice versa* when mixing sulphuric acid or caustic soda and water.

Always report immediately to the person-in-charge or to any other proper authority any dangerous condition or a dangerous practice which you may observe.

Always be cautions while lifting or removing a heavy apparatus battery or material.

Warn others when they seem to be in danger near live conductor or apparatus.

Always be careful and take no chance against any possible accident.

Attend at once to all injuries however slight they may be.

Always obey the safety instructions given by the person-in charge.

Do not go carelessly near running belts on machines.

Do not remove danger notice plates or other signs or interfere with safety barriers or go beyond them.

Do not bring naked light near battery. Smoking in the battery room is prohibited.

Do not allow visitors and unauthorized persons to touch or handle electrical apparatus or come within the danger zone of high voltage apparatus.

Do not enter excavations which give out obnoxious smell, or work in badly lit, badly ventilated and congested areas.

Do not touch a circuit with bare fingers or hand or other makeshift devices to determine whether or not it is alive.