

TRAINING BULLETIN #8  
1988  
ELECTRICAL HAZARDS AT FIRES

OVERHEAD ELECTRICAL WIRES

Safety at emergencies involving electrical conductors and equipment cannot be over-emphasized. This bulletin will review some of the electrical problems confronting fire personnel.

1. HIGH VOLTAGE CONDUCTORS: Carry up to 34,505 volts. High voltage signs on cross arms indicate conductors with more than 750 volts.
2. FUSE OR CUTOUTS: Act as circuit breakers in high-voltage circuits.

SERVICE CONDUCTORS: May be high or low voltage. Many commercial and industrial installations have service conductors of 34,500 volts. Service may consist of (a) three separate conductors, (b) three conductors twisted around each other, known as triplex, and (c) three wire-armored cables, used over swimming pools.

4. STREET LIGHT: Dangerous because it may be fed from conductors carrying up to 4,800 volts. Normally,, there is no current flowing in the daytime; however, Department of Water & Power workmen consider them energized at all times. The position of these wires on poles is unusual because they are located on lower cross arms.
5. LOW VOLTAGE CONDUCTORS: Sometimes called secondaries. They carry 240 or 480 volts.
6. TRANSFORMERS: Reduce high voltage to lower voltage, usually 120 to 480 volts. However, in some cases, the low side of a transformer will be 4,800 volts. When this occurs, there will be high voltage signs on both sides of the transformer.

7. HIGH VOLTAGE INSULATOR: Used to handle up to 66,000 volts. Conductors on these insulators must never be cut by firemen until assurance is received from power company that the conductors are de-energized.
8. LINE SECTIONALIZING SWITCH: Usually used to isolate defective service area and is to be operated by power company patrolman only.
9. RACK SWITCH: Controls the voltage to the transformer bank below and is operated by power company patrolman.
10. HIGH LINE SWITCH HANDLE: Never to be operated by firemen. These switches are not designed to drop a high voltage load. Opening them under load may cause conductors carrying 34,500 volts to fall over an extensive area, creating serious life and fire hazards. There are about 2,000 of these switches in Los Angeles, each one numbered and padlocked.

The voltage of a conductor cannot be determined by the conductor's size. Usually, the conductors at the top of the pole carry the highest voltage. The most effective methods of identifying different voltages are: (1) high voltage signs on the cross arms, (2) the size and shape of insulators, remember, the insulators at the top of poles will appear smaller than they really are, and (3) the distance between conductors(i.e. the higher the voltage, the greater the distance between conductors.)

#### PROCEDURES AT EMERGENCIES

Notify the Signal Office immediately when a power company employee is injured at an emergency. Do not depend on the helpers of the power company crews to notify their dispatcher.

SAGGING OR DOWN OVERHEAD WIRES

When overhead electrical conductors are down or sagging dangerously, the first-in company should:

1. Notify the Signal Office and give the correct address and a brief description of the conditions.
2. Clear the area. Keep people at least one span away from the broken or sagging conductors. Spans of wire adjacent to the trouble area may have weakened and any movement of wires could cause them to fall.
3. Protect exposures.
4. Falling conductors often create much sparking, after which the conductors appear de-energized. DO NOT BE MISLED. Circuit breakers in these systems are designed to kick out and then kick back in automatically. The circuits will be energized again unless there is a ground or short circuit. CONSIDER ALL CONDUCTORS TO BE ENERGIZED UNTIL THEIR ACTUAL CONDITION IS DETERMINED BY AUTHORIZED PERSONS.
5. Make certain that the conductors are cleared and safe or that you are properly relieved of your responsibility before you leave the scene.

CUTTING WIRES

There may be occasions when wires must be cut by firemen. Where possible, the cutting of wires by firemen must be confined to low voltage wires. In an emergency when there is a need to cut high voltage lines, call the Signal Office and request the Water & Power line patrolman who is equipped and trained to handle high voltage. Their apparatus operates 24 hours a day, is radio equipped, and can usually reach-any area of the City within ten minutes.

All electrical service within Los Angeles is Department of Water & Power, with the exception of some Edison Company transmission lines. Wires on poles shall not be cut by firemen unless there is an immediate life hazard, and then cutting must be confined to low voltage wires.

When cutting wires attached to a building, consider the following steps:

1. Use electric wire cutters with rubber gloves. Gloves are tested to 10, 000 volts every 60 days by the Department of Water & Power.
2. Stand on a dry object. Lock in when working on a ladder.
3. When possible, cut at the loops attached to the service head. Be sure to cut close to the service bracket in order to make all loose ends dead. Do not reach over charged wires. Cut the closest conductor first. When cutting, do not touch another conductor or a ground. After cutters are in place, turn head to protect eyes from flash and sparks. Be sure all insulated wires leading to the service head are cut.

Many service drops are now triplex cables which is three wires wound around each other. Do not cut triplex cables. This will cause a short circuit, which will destroy the blades of the wire cutter and may cause personal injury. When possible, the loops should be cut at the service head. If it is necessary to cut at the pole, cut one wire at a time before it goes into the triplex. Do not cut the bare wire in triplex unless there is a danger of it falling, or if there is a possibility that it has become energized. It is a ground wire and normally will present no problem. If all three wires in a triplex cable are insulated, consider them all energized.

#### SAFETY PRECAUTIONS

The fact that wires on the ground do not spark or sputter is no indication that they are dead. They may be totally inactive, and yet still be energized and dangerous.

It is not always necessary or possible to cut or de-energize electrical conductors. In all cases, care should be exercised around such hazards. conductors or cables should be considered energized, even though they are not electrical. A fallen electrical conductor in the vicinity may have energized them.

When there is a possibility that conductors may be down, care should be taken getting off the apparatus. To step on an energized conductor or allow any part of the apparatus to touch it may cause disaster.

At night, examine surroundings carefully with a light. Jumping off the apparatus into a pool of water containing live conductors may be just as dangerous as stepping on the conductor itself.

The apparatus is insulated from the ground by its rubber tires, but it may be energized by live wires in the following ways: (1) by touching an object that is in contact with a live conductor, (2) by direct contact with a live conductor, or (3) by an extended aerial ladder touching a live conductor.

If there is any chance that the apparatus is in contact with a live conductor, and it is necessary to get off the apparatus, do not step off. Get above the running board level and jump clear. If you are on the ground, make no attempt to get on an electrically charged apparatus. CIVILIANS MUST BE KEPT CLEAR AT ALL TIMES.

#### TRANSMISSION LINES

Transmission lines are used to carry high voltage electricity from generating plants to distribution stations. Metal transmission line towers may carry eight or more lines, each carrying from 230,000 to 750,000 volts. Under certain conditions, electricity at this voltage will jump several feet to a ground. A person climbing in the tower could easily become a conductor to ground. A charge of static electricity capable of jumping two or three inches may build up in a person's body when climbing a tower. This charge probably would not injure a person; however, the shock or surprise of this charge going to ground could cause a person to lose his balance.

Firemen may be called upon to make rescues on transmission line towers. if the victim is alive, use a loudspeaker to instruct him not to move, since it is safest for him to remain in place. Give the location of the incident to the Signal Office so they can notify the power company. It is possible for the power company to de-energize these lines in a relatively short time -- usually five to ten minutes. DO NOT CLIMB THE TOWER UNTIL ASSURED BY POWER COMPANY LINEMAN THAT IT IS SAFE.

#### DISTRIBUTION STATIONS

The Department of Water & Power maintains about 150 distribution stations in the City. These stations take power from transmission lines and reduce the voltage for use in the distribution system. Some of these stations are enclosed in a structure while others are protected by a chain link fence. Most of them are unmanned and kept locked at all times.

In case of emergency in a distribution station, consider these steps:

- (1) Notify the Signal office of the location and conditions;
- (2) In case of rescue, have victim remain where he is until Water & Power representative gives clearance for rescue; and
- (3) In case of fire, protect exposures until assured by Water & Power representative that the power is cut off. Do not put water on electrical equipment unless directed by Water & Power personnel.

#### UNDERGROUND VAULTS

in certain areas of the City of Los Angeles, the Department of Water & Power has installed underground electrical cables and transformer vaults instead of overhead wires. The purpose of underground-vaults is to contain necessary transformers and other electrical equipment which will reduce high voltage to lower voltage and distribute this lower voltage to consumers. Vaults with manholes are placed at convenient points in underground electrical systems to permit the installation and maintenance of cables, transformers and other electrical devices.

Consider the following Fire Department policies:

Make no attempt to extinguish fires involving underground electrical equipment until notified by the Department of Water & Power or the Signal Office that the electrical current is turned off.

2. Notify the Signal Office of conditions present.
3. Keep yourself and the public a safe distance from the manhole opening. If necessary, stop traffic. Manhole covers often weigh 300 pounds and have been blown 75 feet into the air and a distance of 125 feet. In some locations, there is a second inner, watertight cover under the top manhole cover.
4. If a manhole cover is in place and smoke is issuing from the holes in the cover, do not attempt to remove cover. Gas may be formed in the manhole as a result of burning insulation or oil, which may be toxic or explosive. The entrance of air could cause an explosion.
5. Do not enter a vault or manhole until a qualified member of the Department of Water & Power assures you that it is safe to enter. Troubleshooters from that Department always test for gas before they enter; the same safety precautions are available for Fire Department personnel.
6. Never put water into a vault. Use only non-conducting extinguishers, and only when requested to do so by a qualified Department of Water & Power representative.

**(NOTE: THIS PAGE REFERS TO A PICTURE THAT IS NOT INCLUDED IN THIS T.B.)**

1. Waterproof switch box which control the blower in the vault and also contains fuses for light circuits.
2. Opening from street level to the vault. Note the square manhole which indicates a transformer vault.
3. Oil fuse "cutouts" (similar to a switch panel). This is the fuse between the main line and transformer. If the transformer catches fire and "shorts out," this fuse should cut off the electrical current.
4. One of the transformers within the vault. The main fire hazard within vaults lies in the cooling oil used in the transformers which has a flash point below 3000 F.
5. Oil heat gauge: this gauge indicate the heat of oil within transformers. Excessive heat may cause sufficient pressure to rupture the sides of the transformer, allowing the heated oil to escape.
6. Wooden plank covering a trench containing cables to transformers. A sump hole in trench is directly below the manhole, and is used for pumping liquids from the vault.
7. Cables in the vault. Location of the cables in vault is no longer an indication of voltage. High voltage cables, up to 230,000 volts, may be located close to the floor inside a conduit containing 200 psi oil pressure.

CAPTION BUT NO PICTURE

The underground transformer vault  
Located in front of the Shell  
Building, 1006 W. Sixth Street,  
Los Angeles