

ELECTRICAL SAFETY



ACTIVITY NAME



OBJECTIVES



- **Hazards of Electricity**
- **Isolating Circuits**
- **Testing Circuits**
- **Work on Energized Equipment**
- **Portable Electrical Tools**
- **Electrical Personal Protective Equipment**
- **Work Area Safety**
- **Electrical Systems**

- **Special training is required for work on electrical equipment.**

11.A.01 Electrical work shall be performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements

Appendix Q Definition of Qualified Person (electrical): one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety and health training on the hazards involved

- Only authorized employees may conduct electrical work. *Appendix Q definition of authorized employee: a qualified person who is designated, **in writing by the designated authority**, to request, receive, implement, implement, and remove energy control procedures*

- Training for authorized employees covers:
 - Safe Work Practices
 - Isolation of Electrical Sources
 - Test Equipment
 - Tools and PPE.

- **Electrical hazards include:**

- **Shock**
- Explosions
- Burns

- **These can result in severe injury or death.**

Safe Work Practices



- **BEFORE STARTING WORK...**
- **A sketch of proposed temporary power distribution systems *shall be submitted to the GDA* and accepted for use before temporary power is installed. The sketch shall indicate the location, voltages, and means of protection of all circuits, including receptacles, disconnecting means, grounding, GFCI's, and lighting circuits. (11.D.01)**
- **Temporary electrical distribution systems and devices shall be checked and found acceptable for polarity, ground continuity, and ground resistance before initial use and before use after modification. GFCI shall be tested monthly. The measurement shall be recorded and a copy furnished to the GDA (11.D.02) Must be less than 25 ohms (11.C.02)**
- **WebCM Safety folder is a good place to store or save all safety inspections forms.**

Safe Work Practices



Before starting work

- De-energize, Lock, Tag and Test all circuits of 50 volts or more
- De-energize all power sources
- Disconnect from all electrical energy sources

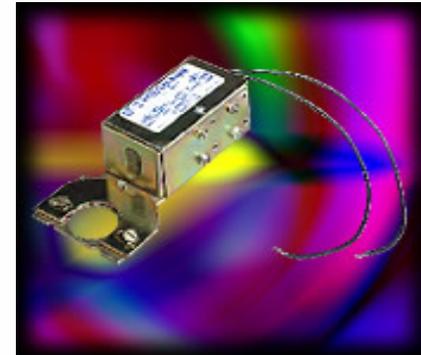
push buttons



selector switches



interlocks



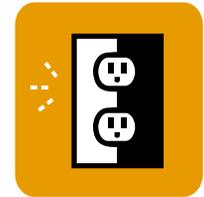
... may not be used as the sole means for de-energizing circuits or equipment

- **The vertical clearance of temporary wiring for circuits carrying 600 volts or less shall be:**
 - 10 ft (3m) above finished grade, sidewalks, or from any platform.**
 - 12 ft (3.6m) over areas subject to vehicular traffic other than truck traffic.**
 - 15 ft (4.5m) over areas other than those specified that are subject to truck traffic.**
 - 18 ft (5.4m) over public streets, alleys, roads, and driveways**



WET LOCATIONS

- Where a receptacle is used in a wet location, it shall be contained in a weatherproof enclosure, the integrity of which is not affected when an attachment plug is inserted.



- All temporary lighting strings in outdoor or wet locations shall consist of lamp sockets and connection plugs permanently molded to the hard service cord insulation.



TEMPORARY LIGHTING

- All bulbs attached to temporary lighting strings and extension cords shall be protected by guards.
- Temporary lighting shall not be suspended by the electric wire.
- Exposed empty light sockets and broken bulbs shall be replaced immediately.
- Portable electric lighting used in confined spaces shall be operated at 12 volts or less.
- Temporary lighting circuits shall be separate from receptacle circuits. Circuits shall be labeled “Lights only” or “Tools only”

HAZARDOUS ENERGY CONTROL LOCKOUT / TAGOUT PROGRAM



- **Contractors shall submit their hazardous energy control procedures, Lockout/Tagout Program, to the GDA for acceptance. No work until plan has been accepted by the GDA. (12.A.02b)**
- **Hazardous energy control plan shall meet, as a minimum, the requirements of Em-385 Section (12.A.07b) all (9) items.**
- **A preparatory inspection with the GDA and Contractor personnel shall be conducted to ensure that all affected employees understand the energy hazards and the procedures for their control. (12.A.03)**
- **A preparatory meeting shall be held and documented. The time and date of the meeting, the subject discussed, and the name of all employees in attendance shall be recorded. (12.A.03b)**

HAZARDOUS ENERGY CONTROL LOCKOUT / TAGOUT PROGRAM



- **Training shall be provided to ensure that the purpose and function of the hazardous energy control procedures are understood by employees.
(12.B.01)**
- **The supervisor shall certify and document all training. 12.B.03**
- **Personal and resources shall not be considered protected until hazardous energy control procedures have been implemented**
- **The GDA and the Contractor designated authority shall fully coordinate their control activities with one another throughout the planning and implementation of these activities.**
- **Daily inspections shall be conducted and documented to include date of inspection, the names of employee performing the inspection and any deficiencies not complying with the plan.**

HAZARDOUS ENERGY CONTROL LOCKOUT / TAGOUT PROGRAM



•6 STEP LOCKOUT/TAGOUT PROCEDURE

- Prepare for shutdown (to include AHA)
- Shutdown equipment
- Isolate all energy sources
- Place locks & tags
- Release stored energy
- Verify equipment isolation

ITEMS NEEDED FOR LOTO



- **Written LOTO schedule**
- **Locks & Tags – identified to the worker**
- **Hasps – for placing locks & tags**
- **Breaker Clips – for electrical LOTO**
- **Blank Flanges (pancakes) – for field lines**
- **Valve Covers – for LOTO of valves**
- **Plug Buckets – for electrical plugs**

•Lock and Tag All Sources.

- - Place lock and tag on each disconnecting means means used to de-energize circuits.
 - Attach lock so as to prevent operating the disconnecting means.
 - Place tag with each lock.

If a Lock Cannot Be Applied,...



- **A tag used without a lock must be supplemented by at least one additional measure that provides a level of safety equal to that of a lock.**

- **Examples:**

- **Removal of an isolating circuit element, such as a fuse**
- **Blocking of a controlling switch**
- **Opening of an extra disconnecting device.**

Re-energizing Equipment



- ❑ Conduct tests and visual inspections to ensure all tools, electrical jumpers, shorts, grounds, and other such devices have been removed**
- ❑ Warn others to stay clear of circuits and equipment**
- ❑ Each lock and tag must be removed by the person who applied it.**
- ❑ Visually check that all employees are clear of the circuits and equipment**

ARC FLASH HAZARD ANALYSIS



- EM – 385 Section 11.A.06
- An electrical arc flash hazard analysis shall be conducted in accordance with NEC (NFPA 70E, Part II, Chapter 2-1) to determine the flash hazard protection boundary before a person approaches any exposed electrical conductor or circuit path that has not been placed in an electrically safe work condition. [24-01.jpg](#)

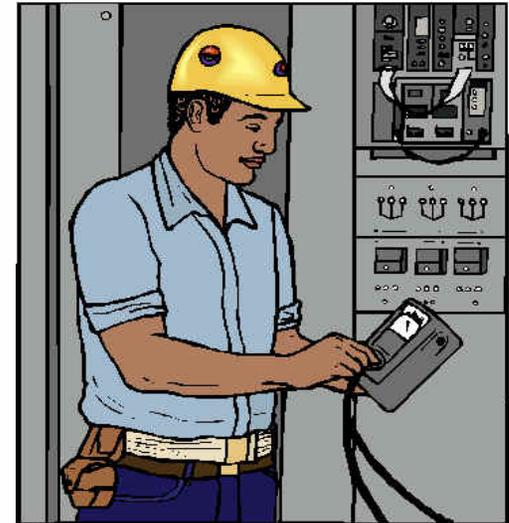
NOTE: For systems that are below 600 volts, the boundary shall be 4 feet.

- EM-385- 05.G.03 Electric Flash Protection shall be provided for any person who enters the flash protection zone (See 11.A.06) [24-03.jpg](#)
- Em-385-05.G.03e Table 3-3.9.1 of Part II of NFPA 70E should be used to determine the Hazard/Risk category associated with each task. Once the Hazard/Risk category has been determined, refer to Table 3-3.9.1 of Part II of NFPA 70E to determine the requirements for protective clothing or other PPE [Arc Flash Suit Classification .JPG](#)

Is It “Dead”?...



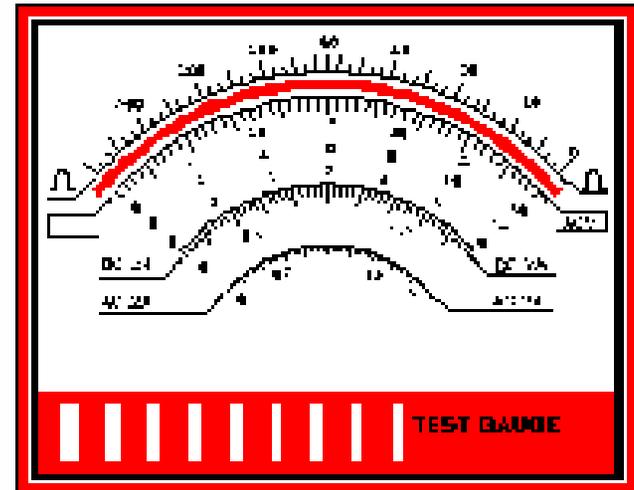
- **Verify system is de-energized.**
 - **Operate the equipment controls to check that equipment cannot be restarted.**
 - **Use test equipment to verify the circuits and electrical parts for voltage and current.**



Check Your Tester...



- Check test equipment (voltohmmeter) on a known live source of same rating to ensure it works before and after verifying the circuit on which you will be working.



- Conduct Tests And Visual Inspections To Ensure Ensure That All Tools, Electrical Jumpers, Shorts, Grounds, And Other Such Devices Have Been Removed.**
- Warn Others To Stay Clear Of Circuits And Equipment.**
- Each Lock And Tag Must Be Removed By The Person Who Applied It.**
- Visually Check That All Employees Are Clear Of Of The Circuits And Equipment.**

Energized...

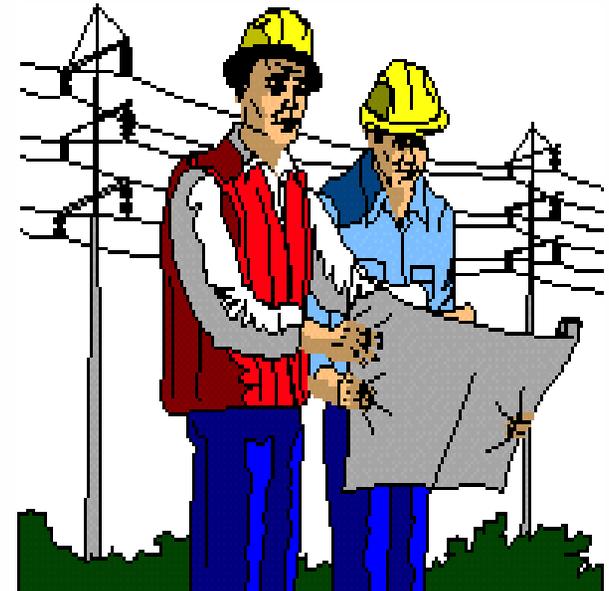


- **Working with Energized Parts**
- **Soon working on Energized Circuits will require Commanding Officer approval and Energized work Permit**

Persons Working On Energized Equipment Must Be Familiar With The The Proper Use Of Special Precautionary Techniques, Personal Protective Equipment, Insulating And Shielding Materials, And Insulated Tools.

05.G.07 ... Live-line Bare Hand Tools Only And Inspected Before Use Each Day

- **Conductive materials and equipment must be handled so as to prevent them from contacting exposed energized conductors or circuit parts.**



Conductive Apparel



- **Remove all conductive articles of jewelry and clothing, such as watchbands, bracelets, rings, key chains, necklaces, metal aprons, cloth cloth with conductive thread, or metal headgear.**

Visually Inspect...

“Commonly called extension cords”



- **Flexible cords shall be marked “Hard Usage or Extra Extra Hard Usage.**
- **Flexible cords shall be continuous lengths without splice except hard service flexible cords No. 12 or larger larger with molded or vulcanized splices**
- **Portable cord and plug connected equipment and flexible cord sets (extension cords) shall be visually inspected before use on any shift for external defects: defects:**
 - **Loose parts**
 - **Deformed or missing pins**
 - **Damage to outer jacket or insulation**
 - **Evidence of possible internal damage.**

Remove from Service...

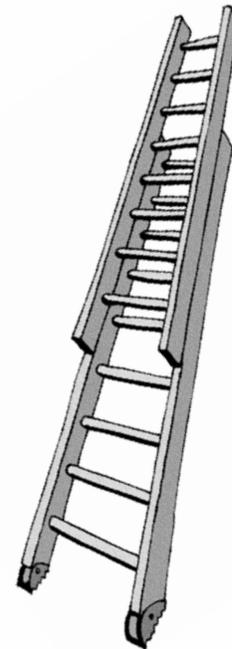


- **If there is a defect or evidence of damage to any electrical tools or equipment,...**
 - **Immediately notify your supervisor.**
 - **Remove the item from service.**
 - **Tell your co-workers.**

Ladders...



- **Portable ladders must have nonconductive side rails rails if they are used where workers or the ladder could contact exposed energized parts.**
- **Keep all ladder parts at least 10 feet away from overhead power lines.**



- **Employees working in areas where there are potential electrical hazards must use approved electrical protective equipment that is appropriate for the work to be performed.**

More on PPE...



- **Use, store, and maintain your electrical PPE in a safe, reliable condition.**
- **Wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.**
- **Wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or arcs or flashes or from flying objects resulting from electrical explosion.**

- **Electrical PPE with any of the following defects may not may not be used:**
 - **A hole, tear, puncture, or cut**
 - **Ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks)**

AND...



- **Any of the following texture changes:
swelling, softening, hardening, or
becoming sticky or inelastic**
- **An embedded foreign object**
- **Any other defect that damages the
insulating properties.**

Don't use defective electrical PPE!

- **Rubber insulating line hose**
 - Upon indication that insulating value is suspect suspect
- **Rubber insulating covers**
 - Upon indication that insulating value is suspect suspect
- **Rubber insulating blankets**
 - Before first issue and every 12 months
- **Rubber insulating gloves**
 - Before first issue and every 6 months
- **Rubber insulating sleeves**
 - Before first issue and every 12 months

- Use insulated tools or handling equipment when working near exposed energized conductors or circuit parts.**
- Use fuse handling equipment to remove or install fuses when the fuse terminals are energized.**
- Ropes used near exposed energized parts must be must be nonconductive.**

Work Area Safety...



- **You must be able to see what you are doing when working on energized equipment.**

- **Do not work on energized electrical parts parts**

- without adequate illumination.

- if there is an obstruction that prevents seeing your work area.

- if you must reach blindly into areas which which may contain energized parts.



Alerting Others...



- ❖ **Use safety signs, safety symbols, or accident prevention prevention tags to warn others about electrical hazards hazards which may endanger them.**
- ❖ **Use barricades to prevent or limit access to work areas areas with uninsulated energized conductors or circuit circuit parts.**
- ❖ **If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect employees.**

System Markings...



- **Electrical equipment may not be used unless the manufacturer's name, trademark, or other descriptive marking is placed on the equipment.**
- **Other markings shall be provided giving voltage, current, wattage, or other ratings, as necessary.**

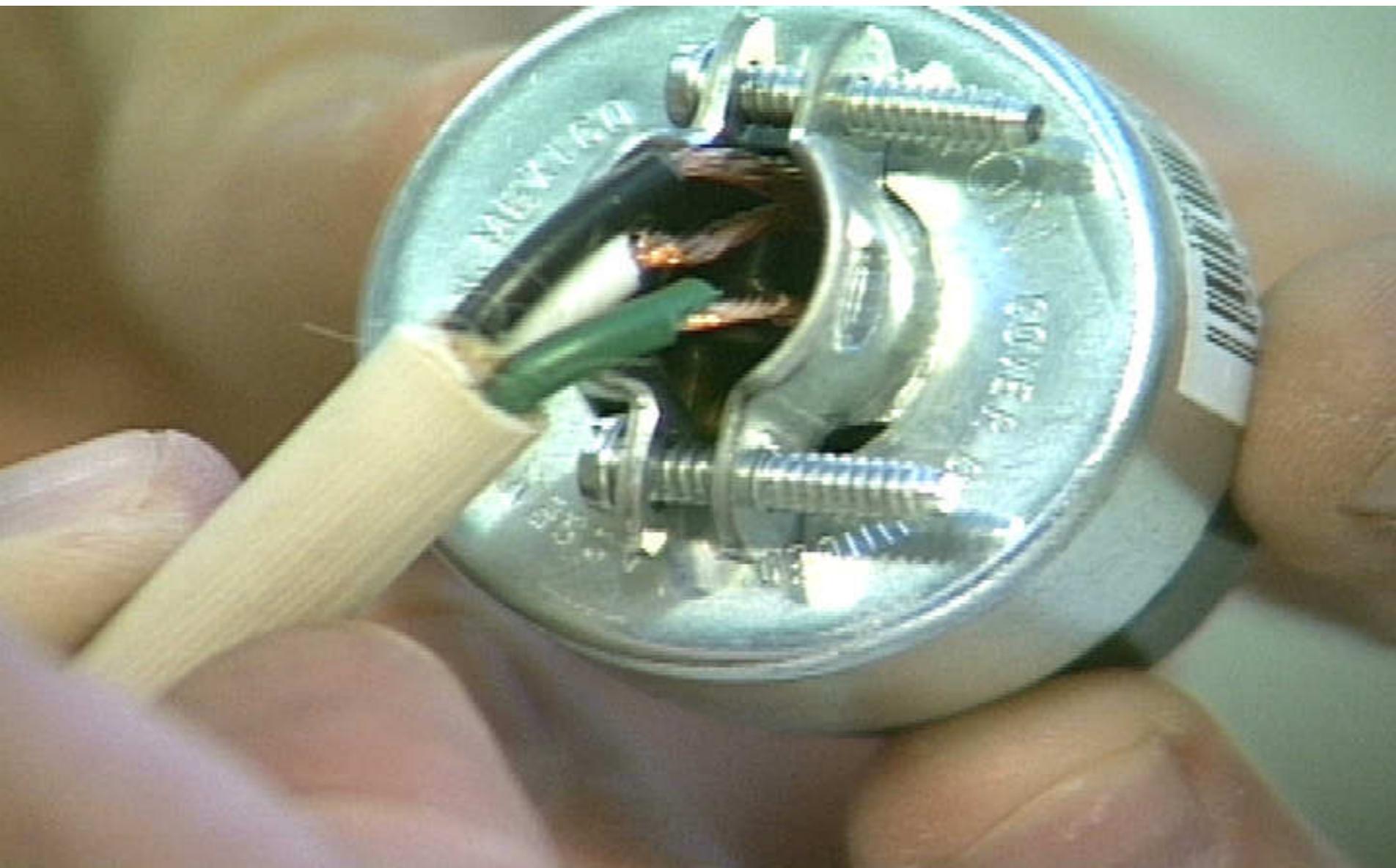
- **Identification of disconnecting means and circuits**
 - **Each disconnecting means for motors and appliances shall be legibly marked to indicate its purpose.**
 - **Each service, feeder, and branch circuit, at its disconnecting means or over-current device, must be legibly marked to indicate its purpose.**

It's the Employee's Responsibility...



- ✓ **Know the hazards of electricity.**
- ✓ **Know the equipment.**
- ✓ **Use safe work practices.**
- ✓ **Inspect your PPE before each use.**
- ✓ **Don't work on energized circuits without permission.**

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DANGER
DO NOT OPERATE
WITHIN 10 FT. OF
POWER LINES

ELECTRICAL SITE PROBLEMS



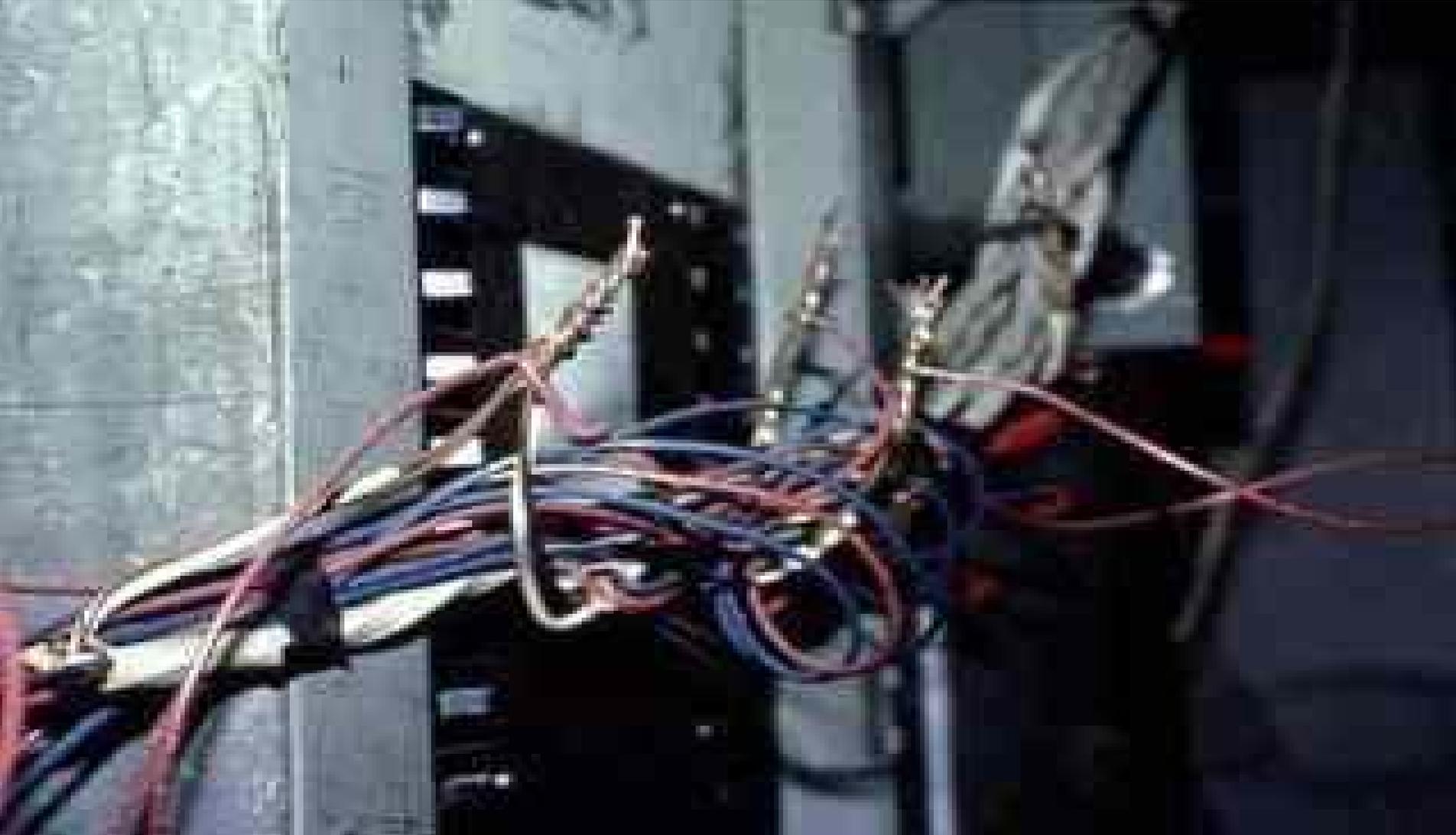
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