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Electrical Hazards Associated with the Use of Temporary Power
Electrical Hazards Associated with the Use of Temporary Power

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Introduction

• Temporary power comes in many forms
  – Temporary services on a construction sites
  – Portable generators
  – Temporary power distribution centers
  – Distribution boxes with multiple receptacles
    • Typically 120/240 volt single-phase
    • May have 208-volt three-phase
    • Some cases are 480-volt three-phase
Introduction

• Extension cords may be connected to:
  – Permanent power source

• All temporary wiring ...
  – Permanently installed (fixed)
  – Temporarily installed

... must comply with the NEC
Introduction

• NEC Article 590 Temporary Installations
  – 590.6 Ground-Fault Protection for Personnel
    • All receptacles ...
      – 125 volt
      – Single-phase
      – 15, 20, and 30 ampere
    ...
    ... used for temporary power
Introduction

• 590.3 Time constraints - for temporary wiring:
  – During periods of construction
  – 90 days for holiday lighting and similar
  – Emergencies and tests
  – Removal
    • Removed immediately upon completion of:
      – Construction
      – Purpose for which it was installed
Introduction

• When more power is needed
  – Larger gauge (AWG) must be used
    • The smaller the AWG number the larger the wire

• Using too small of a wire
  – Overheat conductors
  – Damage insulation and cord jacket
  – Cause fires
  – Create a shock hazard
Introduction

• U.S. Product Safety Commissions
  – About 4,000 injuries per year
  – Estimated 3,300 residential fires each year
    • Killing 50 people
    • Injuring about 270 others
  – Most frequent causes
    • Short circuits
    • Overloading
    • Damage
    • Misuse
Case History

• NFPA 70B, Annex Q, Case Histories; Section Q.3, Failure to Maintain Extension Cord Causes Fire
  – McCormick Place, Chicago, IL
  – January 16, 1967 @ 2:00am
  – Fire completely destroyed building
  – Caused by temporary power to exhibit booth
  – Estimated loss:
    • $60 million to facility
    • $100 million to Chicago area economy
McCormick Place before the fire
McCormick Place after the fire
Types of Temporary Power Sources

- Temporary Services on Construction Sites
  - Must comply with NEC Article 230 Services
    - 590.4(A) requires conformance with Article 230
  - Same hazards apply to temporary and permanent
    - Overhead lines clearances
    - Equipment ratings
    - Grounding electrodes
    - Protection from physical damage
Types of Temporary Power Sources

• Temporary Services on Construction Sites
Types of Temporary Power Sources

• Portable Generators
  – Extensively used for temporary power
    • Construction sites
    • Industrial facilities during shut-down
    • Severe weather outages
    • Remote areas where no power is installed
    • Homeowners emergency power
    • Farmers for remote areas
Types of Temporary Power Sources

• Portable Generators
  – GFCI receptacles required after January 1, 2011
    • New manufactured
    • Re-manufactured
    • 15 kW or smaller
      • Receptacles rated 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere
  – Wet locations require weather-resistance receptacles and covers
Types of Temporary Power Sources

• Portable Generators
  – Must always be used outdoors – never inside
  – Well ventilated areas
  – If too close to building, carbon monoxide could enter
  – Many industries require generators to be bonded to the system ground
Types of Temporary Power Sources

• Portable Generators
Types of Temporary Power Sources

• Temporary Power Distribution Centers or Distribution Boxes
  – Equipped with multiple receptacles
  – 120/240-volt single phase
  – 208-volt three-phase
  – 480-volt three-phase
  – Typically power from:
    • Permanent power source
    • Portable generator
Types of Temporary Power Sources

- Temporary Power Distribution Centers or Distribution Boxes

![Temporary Power Distribution Center Diagram]

- Individual GFCI Modules
- Gasketed Latching Receptacle Lift Covers
- Flush 50 Amp Inlet
- 6x20 Amp Straight Blade or Twist Lock Watertight Receptacles
- Standard Stab Termination circuit breakers with gasketed lift cover
Types of Temporary Power Sources

• Regardless of the power source ...
  – Permanent
  – Temporary

... temporary power use will be through use of an extension cord
Types and Sizes of Extension Cords

- Available in 2- and 3-wire varieties
  - 2-wire for small appliances, lamps, clock/radios
  - 3-wire for power tools and equipment
    - 3rd wire is a ground – DO NOT DEFEAT with adapters
  - Grounded extension cords for tools or equipment requiring ground
    - Exception is double-insulated
Types and Sizes of Extension Cords

- Large variety of extension cords available
- Too many use the same extension cord for all uses – not always the safest choice
- Extension cord must carry the current
  - Load current greater than rating will overheat
- Must be rated for the application, such as:
  - “Outdoor”
  - The letter “W”
Types and Sizes of Extension Cords
Types and Sizes of Extension Cords

• Not only size but also length
  – Length adds resistance
  – Resistance increases voltage drop
  – Increased voltage drop = increased current
    • Overheating is the result
  – Longer cords require larger size (AWG)
    • Compensates for voltage drop
Types and Sizes of Extension Cords

• NEC Article 400 Flexible Cords and Cables
  – Provides valuable information on types in Table 400.4
    • Outer jacket properties and applications
  – NEC Tables 400.5(A)(1) & 400.5(A)(2) for
    • Maximum allowable ampacity for conductor sizes
    • Insulation temperature ratings
    • Types of outer jackets
    • Based on 30°C (86°F)
### Types and Sizes of Extension Cords

- Recommended wire gauge (AWG) for typical extension cord lengths and load current.

<table>
<thead>
<tr>
<th>Cord Length</th>
<th>Load Ampere (Current) Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-2</td>
</tr>
<tr>
<td>25 feet</td>
<td>16 AWG</td>
</tr>
<tr>
<td>50 feet</td>
<td>16 AWG</td>
</tr>
<tr>
<td>100 feet</td>
<td>16 AWG</td>
</tr>
<tr>
<td>150 feet</td>
<td>16 AWG</td>
</tr>
<tr>
<td>200 feet</td>
<td>14 AWG</td>
</tr>
</tbody>
</table>
Extension Cord Types and Sizes

• Table is based on the NEC, Article 400
• Generally intended for use with:
  – Power tools
  – Lawn and garden tools
• When selecting extension cords
  – Select according to the ampere rating of the tool
  – Select according to distance
  – Always use a GFCI
Extension Cord Types and Sizes

• NEC conductor amperage
  – 16 AWG = 10 amperes
  – 14 AWG = 15 amperes
  – 12 AWG = 20 amperes
  – 10 AWG = 30 amperes
    • 10 AWG is difficult to find
  – Remember voltage drop with distance
Extension Cord Types and Sizes

• Daisy chaining cords and plug strips
  – Each connector or plug adds resistance
    • Generally the failure point
    • Plugs are generally the most worn part of the cord
  – May causes overloading of the cord or plug strip and not the circuit – can cause fires
  – Not listed for this purpose
Inspection Guidelines

• Handled to not cause damage
• Visual inspections required for:
  – Cord- and plug-connected portable equipment
  – Extension cords
• Inspected before use on any shift for:
  – External damage
  – Possible internal damage
Inspection Guidelines

• Grounding type must have a ground
• Conductive work locations must be approved
• Connecting attachment plugs with dry hands or use protective equipment
• Inspection is vital to safety of personnel
Damage & Misuse
Damage & Misuse
Damage & Misuse
Damage & Misuse
Damage & Misuse
Nine things to NEVER do with extension cords

1. Don’t remove the grounding pin to fit a two-prong outlet.
2. Don’t power multiple devices with one cord.
3. Don’t use indoor extension cords outdoors.
4. Don’t plug multiple extension cords together.
5. Don’t run extension cords under rugs or furniture.
Nine things to NEVER do with extension cords

6. Don’t tape extension cords to floors.
7. Don’t attach cords to surfaces with staples or nails.
8. Don’t use if kinked or while looped or coiled. This could potentially be a fire hazard.
9. Don’t use extension cords that feel hot to the touch.
Extension Cord Use

- Remember that extension cords are intended as temporary wiring solutions.
- If you find you’re using them on a permanent basis, consider updating your electrical system to include additional outlets.
Caring for Extension Cords

• Store indoors if possible
  – Protect from physical damage
  – Store away from moisture
• Unplug extension cords when not in use
• Store free of kinks, twists, or knots
• Destroy damaged extension cords
• Pull on the plug – NOT the cord
Additional Considerations

• Extension cords:
  – NEVER repair with tape
  – NEVER use as a rope or hand-line
  – DO NOT USE damaged extension cords
  – DO NOT run through doors or windows
  – DO NOT run over with vehicles or equipment
    • ALWAYS use a cord protector
  – DO NOT USE for permanent wiring
Thank you for attending!

Please remember to submit an evaluation on the mobile app.
Questions

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