Theater Safety for the Non-Professional

John David Stallings II
Charlottesville, VA

BA, Wake Forest University, 2004

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Thesis Committee

Tom Bloom
Steven Warner
Marianne Kubik

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Theater Safety for the Non-Professional

Introduction

For every theatrical organization, the safety of those involved in each phase of the production process should be of paramount concern. This remains true even if the organization itself has few resources available, whether human, financial or educational. For these groups, primarily schools and community theaters, even the most basic safety guidelines, were they easily accessible, could prevent many incidents that result from careless or uninformed practices.

Unfortunately, there is a shortage of comprehensive and easily accessible guidance on theater safety available to those with little-to-no formal education or training on the topic. In particular, teachers and supervisors of middle and high school theater programs, as well as community-based, amateur theater groups are at a disadvantage when it comes to creating and implementing best practices for safety within their organizations.

To say that no safety resources exist for these organizations is not accurate, but most existing theater safety manuals/guides do not meet the criteria of being both comprehensive and accessible for this particular audience. Many available manuals are institution-based and, though helpful, may not be completely compatible with another institution's needs. Others are written in technical terms for an audience with an assumed level of prior training in safety and technical theater; these may prove difficult to navigate or have an overwhelming amount of information for those who are less experienced in these areas. There are a few manuals geared specifically toward secondary school and community theater groups; these should certainly be considered primary resources, if possible, but the purchase price could be cost-prohibitive for some, and others may not easily find them. In any case, those who are not provided with an adequate guide specific to their situation are indisputably in need of additional resources. They can then create and implement effective, specific, safety programs for their own organizations.

To this end, I have endeavored to compile an accessible, comprehensive guide for educational and amateur producing organizations covering the fundamental topics of safe theatrical practice. To make it as accessible as possible, I have broken the information down into easily navigable topics and sub-topics, and have done my best to keep the language and level of technical detail as understandable and approachable as possible. Additionally, I have formatted the guide in such a way that it can be either printed out in booklet form or embedded as quickly navigable pages on a website. My hope is that both of these formats will prove easy to find and convenient to navigate for those who wish to use them in the future.

In deciding on an appropriate level of coverage for each topic, I have kept this question in mind: "Would this safety information be useful to practitioners (students, teachers, volunteers and supervisors) in the majority of secondary school and community theater companies?" If so, I have tried to include it in this guide. I have also included references and links to as many additional resources as possible, so that those who wish to learn more on specific topics will have a good starting point.

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A few important things to remember when using this guide:

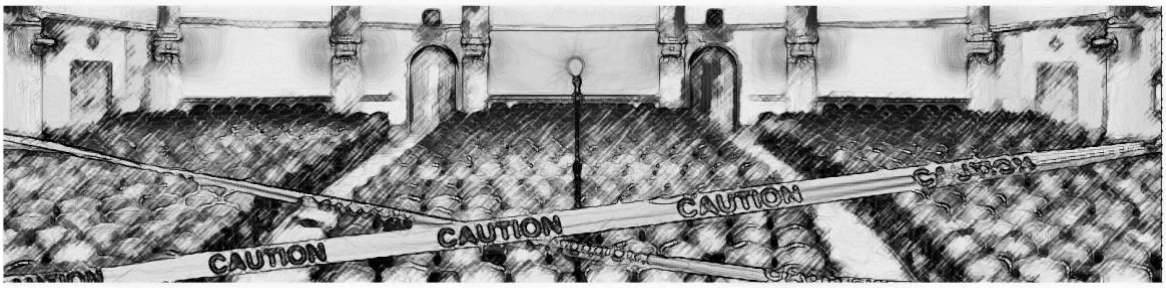
- This guide is meant to be comprehensive, with a wide range of topics covered, but it cannot anticipate every situation which might arise in each specific theater.

- This guide does not take the place of rules and regulations already in place. Federal workplace safety standards as set forth by OSHA, as well as state, local and institutional laws and policies always take precedence. Regulations set forth by entertainment industry advisory bodies such as USITT and ESTA/ANSI should also be heeded at all times. For more information about these, see the Additional Resources section in the Appendix.

- This guide does not serve as a substitute for formal training by a qualified professional. It is meant only to give basic guidance when and where such training is not available, so that theater practitioners can make more informed and safe decisions than they may have otherwise.

- Always seek out and pursue any and all opportunities for further study but, in the meantime, allow qualified professionals to undertake any tasks for which you are not adequately trained or prepared.

- Ultimately, each person is responsible for his/her own well-being, as well as that of those he/she works with. Any instruction is only as good as its application, and no guide or training course can ultimately guarantee anyone's safety. No matter how prepared you are, mistakes will be made and accidents will happen, but you must do everything in your power to minimize risks and create a safe working environment.



1. General Safety Guidelines

In addition to the many specific safety practices that apply to different areas of theatrical work, there are some which are so fundamental or universal that they must be understood and applied from the outset of any endeavor. Please keep these basic principles in mind and adhere to them at all times. This section also serves as a primer/prerequisite to all other sections in the guide, as the guidelines here provide a solid foundation for safety in all other areas.

❖ Common Sense

- ➢ *Think, then act.*
  - Consider both the positive and negative consequences of your potential course of action, and adjust accordingly.
  - There is rarely a perfect solution in theater; find the best one you can with the resources you have at your disposal.
  - Avoid any course of action that involves a potential safety risk, if at all possible.
- ➢ *Know your personal limits, and the limits of those you supervise.*
  - Know your physical limits and do not attempt to exceed them under any circumstances. To do so will almost certainly result in injury. If you are in a supervisory position, you must also take into account the limits of those working under your supervision.
  - It is very common to work long hours in the theater with an inadequate amount of rest and/or nourishment. Take care of yourself and learn to recognize when you need to sleep or eat. The show will go on, and you do not have to get sick or hurt in the process. If you need a break for any reason, communicate with a supervisor and make any necessary arrangements.
  - Know the limits of your own experience and education. It's okay to not know how to do something properly. It's not okay to try to do it anyway.
  - Do not work in the theater alone; always use the buddy system. If you work alone and are injured or incapacitated, you may not be able to help yourself.
- ➢ *Know the limits of your theater spaces.*
  - Every part of every theater is different, and they aren't all meant to do everything.
  - Do not force your theater to perform in ways it wasn't meant to.

- Non-professional modifications to the venues, storage or workshop spaces should not be attempted.

➢ *There are deadlines in theater…but:*

- Safety is more important than deadlines.
- Being in a hurry often leads to unsafe practices; be aware and vigilant.
- Doing things in haste often leads to even more time lost. Shoddy work can lead to sudden or premature failure, which could also lead to accidents and injuries. This is far more costly than taking time to do things correctly and safely from the beginning.

➢ *Theater is supposed to be fun…but:*

- Horseplay leads to accidents and injuries. It must not be tolerated.
- Impairment from drugs (including prescriptions) or alcohol puts everyone at risk. Stay out of the theater if you are under the influence and let a supervisor know if you believe someone else to be impaired in any way.
- Celebrations should take place at the appropriate times and places, not in a working theater environment.

➢ *Nothing we do in the theater is worth the risk of serious injury or death.*

➢ *If it seems unsafe, it probably is. Don't do it.*

❖ Training

➢ *Establish clear training policies and practices for every aspect of your organization.*

- Do not assume that someone has the knowledge and skills needed to perform a given task, unless they have been previously trained in an appropriate and thorough manner. Inexperienced individuals pose a danger to themselves and those they work around and must be trained before being allowed to work in the theater.
- Identify the different training areas and what information and skills will be covered in each. These should include, but are not limited to:
  - Workspace Etiquette and Effective Communication
  - Personal Protective Equipment
  - First Aid and Emergency Procedures
  - Proper Tool Usage
  - Ladder, Lift, Overhead Work and Rigging Safety
  - Backstage Protocol
- Determine who will be responsible for training individuals in each area where training is required.

- Create or adopt a set of clear training practices in each of these areas, and document each one so that the training remains consistent over time. Update the requirements when needed.
- Document completed trainings for each individual. These records will help ensure that each individual has received adequate instruction and practice in the areas relevant to his specific duties. Documents could include quizzes passed or signed certification of trainings completed. Make sure these documents contain:
  - Date of Training
  - Topics covered
  - Name of Trainer
  - Name of Trainee

➢ *Liability Waivers*

- Once adequately trained and assessed, students, volunteer workers, and outside users should also sign liability waivers, acknowledging the completion of training and their awareness of the risks inherent in the work they will be doing.
- Waivers for minors must be co-signed by a parent or guardian.
- *Recommendation*: Have a separate waiver/signature for each area of training.
- The liability waiver does not prevent anyone from suing, but it provides evidence that appropriate steps were taken to educate and prevent accidents.

➢ *Training for supervisors/teachers*

- Though everyone in the theater must be trained in the area(s) in which they work, it is especially critical in non-professional organizations that supervisors and teachers receive adequate training above and beyond that of those persons working under their supervision, whom they must then train. In most cases, these supervisors will be professional employees and, as such, fall under the regulation of OSHA and other governmental laws and regulations.
- The following are areas in which OSHA mandates training for employees, and which certainly apply to theatrical work.. Teachers and supervisors must do their utmost to ensure they have received training in these and any other areas which apply to their duties and those they supervise.
  - HAZCOM training (1926.59, 1910.1200)
  - Respiratory Protection (1926.103, 1910.134)
  - Personal Protective Equipment (1926.28, 1910.132)
  - Emergency Plans and Fire Prevention (1910.38, 1926.150)
  - Fall Protection (1926.500-503)
  - Noise Exposure (1910.95, 1926.52)
  - Electrical Safety (1926.401-405, 1910.301-333)
  - Medical Services & First Aid (1910.151, 1926.50)
  - Bloodborne Pathogens (1910.1030)

General Safety Guidelines

❖ Communication

- ➢ *Clear communication at all times is critical to every aspect of theatrical production, from the initial design conversations all the way through the end of strike and beyond.*
  - ■ The people with whom you collaborate will not always clearly grasp your intentions. Make every effort to explain your ideas, plans, methods, etc. in a way that everyone can understand.
  - ■ Do not be afraid to check in and make sure that everyone is on the same page. This can save a great deal of time and needless frustration.
  - ■ Miscommunication will happen. Try to be gracious and move forward in a productive manner.
- ➢ *Verbal Communication*
  - ■ Efficiency is of great importance in all aspects of theater. Strive to be clear and concise.
  - ■ Consider every verbal communication a professional transaction. Use respectful and collegial language at all times.
  - ■ Communicate, verbally, any information that is necessary to ensure the safety of those around you. Some examples might include:
    - "Coming around behind you"
    - "Loose hardware overhead"
    - "2nd electric coming in to the deck"
    - "Dropping rope"
    - "Thank You!" - Acknowledgement of any of the above
- ➢ *Written Communication*
  - ■ As an organization, determine the method(s) of written communication which will be used to convey certain types of information. E-mail is widely accepted in the industry as an effective means of written communication about official matters. Other means may be used if appropriate and agreed-upon.
  - ■ All concerned/involved persons should be included in each written communique. Try not to clog the inboxes of the uninvolved, if possible.
  - ■ Certain written communications should be posted in easily accessible places for reference. Examples could include:
    - Shop safety guidelines
    - Hazard/warning signs
    - Emergency Exit diagrams and other directional guidance
    - Instructional placards for operation
    - Calendars/Schedules
    - Rehearsal and performance reports

- *Reporting unsafe conditions*
  - Make sure everyone working in the theater knows whom to contact to report anything that is potentially unsafe. For actors, this could be a stage manager; for those working in the scene shop, the technical director.
  - Communicate quickly and efficiently to all who might be affected, in whatever way is most appropriate.
  - Document the issue in some way and ensure that the appropriate steps are taken to resolve it. In the meantime, take steps to keep everyone safe. This could be as simple as discontinuing use of an item or area, or as extreme as evacuating the theater entirely.

❖ Theatrical Spaces and the Items Therein

- *Upkeep of Spaces*
  - Use performance venues, workshops, rehearsal rooms, storage areas, and passageways as intended. Hallways are not storage areas and rehearsal rooms are not welding shops.
  - Use all available resources to maintain facilities in good working order. Allowing parts of the building or performance venue to fall into disrepair creates an unsafe working environment for everyone. This especially applies to theaters with outdated rigging, mechanical, and fire suppression systems, not to mention the potential for lead paint and asbestos insulation. Bring specific needs to the attention of those responsible for the upkeep of the theater facility. Follow up as needed.
  - Inspect buildings and systems as needed or required (see sections on rigging and fire safety for more info.)
  - Keep working areas clean, dry and free of clutter.
    - At the end of each work session, designate time to clean and restore the space.
    - Sweep and mop, as necessary, areas where spills or debris create hazards.
    - Place tools, materials, cords, hoses, etc. in their designated storage areas.
    - With caution tape, cordon off areas where in-progress projects cannot be cleared or where access is temporarily unsafe.
    - Have a clear, known policy about food and drink in each space. It is advisable to restrict these to designated areas because of the hazard that potential spills pose, not to mention the extra clutter that is created in spaces that need to stay as clean and clear as possible.

- All working areas of the theater should have adequate work light available. Theatrical fixtures should not be used as work lighting, as they are either expensive, inefficient, or both.
- If an area is unsafe for any of the above reasons, discontinue its use until the issue(s) are resolved.

➢ *Upkeep of Equipment - This applies to equipment in all areas of the theater.*

- Use equipment only in the manner for which it was designed.
- Keep operating/safety manuals in designated locations and refer to them for any repairs or upkeep
- Do not attempt repairs unless qualified to do so. See manuals for guidance or to find contact information for professional support.
- Keep equipment clean and properly lubricated, if applicable. See manuals for guidance.
- Inspect equipment for good working order before each use.
- Establish a "lock out, tag out" system for equipment that is malfunctioning or in need of repair. Include this protocol in training sessions for those who work in the theater.

➢ *Organization*

- Store materials, tools, supplies, and stock items in designated areas only.
- Clearly label storage areas, as appropriate.
- Store hazardous materials correctly (see section on hazardous materials).
- All those who work in each space should be familiar with storage locations and protocols and should be held accountable for compliance.
- Adjust organization schemes as needed, communicating any changes with all those affected.

➢ *Authorized Access*

- Access to all areas of the theater should be restricted so that only those who are authorized may gain entry.
- A record of access levels should be kept, even if this is as simple a list of who has keys to what.
- Keep all tools and potentially dangerous equipment restricted in additional ways. This could include double locking, password access or removing power sources when supervision is not available.
- Students and volunteers should not be given unsupervised access to the theater.

General Safety Guidelines

❖ Preparedness for Work in the Theater

- ➢ *Physical*
  - Work in the theater should be done by those who are well-rested, nourished, hydrated and in good physical shape.
  - Coming to work sick puts those around you at risk and is not worth the potential fallout.
  - Existing injuries should be taken into consideration by the supervisor. If safe accommodations cannot be made, the worker should recuperate before returning to work.
  - Everyone is different when it comes to his/her physical limits. Given that theater is a collaborative art, we must do the best we can to work safely within the limits of each individual person and the group as a whole. Never force someone to work in a capacity that is uncomfortable or pushes his/her physical limits.
  - Appropriate apparel (not including Personal Protective Equipment)
    - Shoes
      - With very few exceptions, everyone in the theater should wear sturdy, fully enclosed footwear. There are too many potential hazards and to do otherwise would be careless.
      - Steel-toed shoes are not generally necessary, but may be preferable for those constantly working in scenic construction, rigging, or other areas in which heavy objects are used.
    - Clothing (except costumes)
      - Work clothes should be comfortable and practical for the task at hand
      - *Recommendation:* Long pants and sleeves provide more protection against cuts, scrapes, burns, etc.
      - Work clothes should be well-fitted, not baggy, draggy, or restrictive.
      - Avoid dangling or obstructive objects like jewelry, scarves or strings
    - Long hair (for technicians, primarily)
      - Tie up or dress hair under a hat to prevent obstruction of vision, entanglement, and potential ignition.
- ➢ *Mental/Knowledge*
  - No one who works in the theater knows everything about everything. Each person must be willing to honestly assess his/her current base of knowledge and experience and where it falls short.

- It is perfectly okay to say, "I don't know enough about this to do it safely" or "I need more experience/practice first." It is certainly far better to admit your shortcomings than to push past them and risk hurting yourself or others.
- Working in the theater can and should be a tremendous learning experience for all involved. Take advantage of the pool of knowledge and experience surrounding you and absorb as much as you can. At the same time, always be vigilant and make sure that safety is taken into account with each new experience.

➢ *Emotional*

- Those who attempt to work under emotional strain are often both ineffective and unsafe. Look for warning signs and make every effort to assess whether or not someone is capable of working safely and effectively. If there is any doubt, it is better to err on the side of caution and postpone their involvement until they have recovered sufficiently.
- Offer appropriate support, if possible. Have other resources at the ready, especially for students, in the event that they need additional support.

➢ *Psychological*

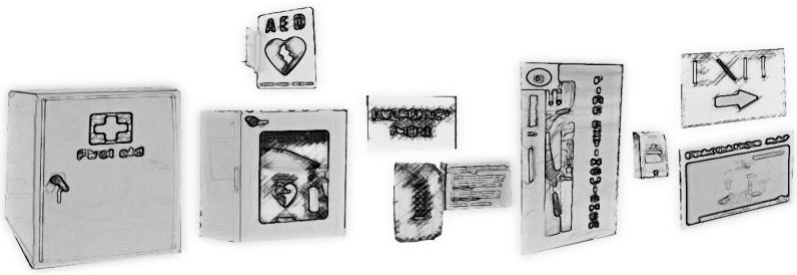
- Working in theater can be very stressful and psychologically taxing; deadlines loom, personalities clash and things seem to go awry at the worst times. If you start to feel overwhelmed, do not hesitate to get help from any and all available resources, which vary depending on your organization. If nothing else, find time to talk to someone with whom you feel comfortable.
- We work in theater because we love it for one reason or another, but it is easy to lose sight of this from time to time. Try to find times to step back, breathe, and re-focus on the big picture.

❖ Breaks and Work Time Limits

➢ *In the non-professional theater, breaks and limits on work must be considered on a case-by-case basis.*

- Typically, the frequency and length of breaks and shifts are determined by unions (in professional theater) and states (in other professions). Since neither applies to students or volunteers, good-faith efforts must be made to ensure work days that are safe and productive.
- Consider following a schedule of breaks that aligns closely with equivalent union workers or state standards if at all possible.
- Rest breaks (10-15 min.) should be given every 3 hours at minimum.
- At the very least, a meal break (30 min.-1 hr.) should be given if the work period exceeds 5-6 hours.

- Shifts of more than 8 hours per day are not ideal but, unfortunately, common in theater. When the workforce consists of students or volunteers, extra consideration should be given for the amount of work asked of them. On school nights, especially, be aware of and sensitive to students' other responsibilities and their need for rest.



ς First Aid and Incident Management

This guide and others like it are meant to provide the fundamental knowledge and practices which, if adhered to, will prevent most accidents and injuries from occurring in the first place. Unfortunately, it is impossible to avoid all such incidents when working in such a complex environment as the theater. That being the case, it is critical that all theatrical organizations have a very clear plan in place for when accidents and emergencies do occur.

❖ Incident Management Plans

➢ *Create a written document*

- This plan outlines procedures to be followed in different types of incidents.
- Consult with building-level administration and local authorities to ensure all appropriate measures are covered.
- Post this document in all theatrical workspaces and make all those who work in the theater aware of them.
- Include instructions for the following:
  - Minor accidents & injuries
  - Medical Emergencies
  - Hazardous Material Release
  - Fire (see section on Fire Safety for details)
  - Severe weather and natural disasters (consult with admin. & local authorities)
  - Intruder in Building (consult with admin. & local authorities)
- Also include:
  - The address of the theater and any auxiliary buildings that may need to be given to 911 responders
  - Emergency contact phone numbers:
    - Instructions to call 911 first
    - Local or Campus Police
    - Local Sheriff's Department
    - Poison Control: National Hotline (800) 222-1222
    - Facilities Management, if applicable
  - Locations of first aid kits and AED's, if applicable

First Aid and Incident Management

❖ Minor Accidents & Injuries

- ➢ *If there is any doubt about the severity of the situation, always err on the side of caution and call 911. See the section on Medical Emergencies for further instructions.*
- ➢ *Regulations*
  - OSHA (1910.151) requires that employers have both first aid kits and people on site trained in first aid procedures. In schools, this is usually a school nurse, but he/she is unlikely to be on duty at all times when there is activity in the theater. Whether in a school or community theater, those working in supervisory capacities are strongly urged to make sure that someone working with students or volunteers has first aid training.
  - Supervisors and those administering first aid should also have received Bloodborne Pathogen training in order to know how to treat injuries in a sterile manner and clean up bodily fluids in a safe and effective manner. This is also required by OSHA (1910.1030).
- ➢ *First Aid Kits*
  - First aid kits should be easily accessible to qualified individuals from every workspace in the theater. Depending on the size of the building(s) there might be two first aid kits or ten. At the very least, each performance venue should have a kit backstage and front of house; additionally, each workshop and rehearsal area should have easy access to a first aid kit.
  - Kits should be well-maintained and kept in a sanitary condition.
  - Kits should not be easily accessible to children.
  - All materials in each first aid kit should be checked periodically, on a regular schedule, for expiration dates and supply levels.
  - Kits should be stocked with materials appropriate to the location. To meet OHSA regulations, kits should be stocked with at least the following, according to ANSI/ISEA Z308.1-2015 - "Minimum Requirements for Workplace First-aid Kits."
    - Adhesive bandages (Band-Aids)
    - Adhesive tape
    - Antibiotic application*
    - Antiseptic
    - Breathing barrier (for CPR)
    - Burn dressing (gel soaked)
    - Burn treatment
    - Cold pack(s)
    - Eye covering (with means of attachment)
    - Eye/skin wash
    - First aid guide
    - Hand sanitizer

        - Medical exam gloves
        - Roller bandage (2 inch)
        - Roller bandage (4 inch)
        - Scissors
        - Splint
        - Sterile pad
        - Tourniquet
        - Trauma pad
        - Triangular bandage
    - Additional items that are useful in theatrical first aid kits:
        - Tweezers
        - Saline Solution (additional eye wash)
        - Antihistamine Cream*
        - Plastic Bags (for cleanup and sterile storage)
        - Pain relievers *
        - Antacids*
        - Antihistamine pills or liquid*
    - Items marked with an asterisk * indicate that parental consent may be needed to administer to minors, depending on school system policies.

➢ *Eye Wash Stations*

- Required by OSHA using ANSI Z358.1-2004 standard in any theater in which corrosive chemicals are used. If at all possible, avoid having these chemicals in non-professional theaters to begin with. Keep in mind that standard paint thinners and solvents are included. If you are unsure whether a chemical meets the "corrosive" criteria, refer to its Safety Data Sheet.
- Eye wash stations must be located within 10 seconds of hazard exposure and clearly indicated with signage.
- Stations must have a continuous flow for at least 15 minutes.
- Stations must be flushed regularly to ensure fluid is clean and free of bacteria growth.
- If corrosive chemicals are not present in the theater, the eye wash kit or saline solution contained in the first aid kit may be sufficient for the flushing of dust and minor irritants.

➢ *Incident Report*

- Even minor accidents require incident reports. A record of the incident will be helpful in case infection or unanticipated worsening of the injury occurs. Turn in incident reports to the appropriate person as soon as possible.

First Aid and Incident Management

❖ Medical Emergencies

- ➢ *Existing policies*
  - Your organization, if it has any paid employees, should already have procedures in place for dealing with medical emergencies. This is required by OSHA (1910.151).
  - Before creating your own procedures, find out what is already in place and follow those guidelines as much as possible.
- ➢ *In case of serious illness or injury:*
  - Do not move the person.
  - Call 911.
  - Ensure everyone who works in the theater knows the address or where to find the posted incident plan with the address.
  - Be prepared to give a description of the situation.
  - Follow instructions from the 911 operator.
  - Send someone to meet the emergency responders and lead them to the person's location.
  - Fill out an incident form as soon as possible and turn it in to the appropriate person.

❖ Hazardous Materials Release

- ➢ *Small Scale and Low Risk*
  - In the case of a minor spill of a material that is not highly toxic and does not pose an immediate threat, consult the Safety Data Sheet for information about cleanup and first aid. If unsure of the toxicity, or the SDS is unavailable, treat the situation as an emergency. See below.
- ➢ *Large Scale or High Risk*
  - Move everyone away from the hazard and to a safe location.
  - Call 911 when safe.
  - Inform facilities management, if applicable.
  - Keep others aware of the situation and clear of the area.
  - Be ready to give as much information to emergency responders as possible, including a copy of the SDS for the material and the nature of the spill.

First Aid and Incident Management

❖ Incident Reporting

➢ *You must keep records of all incidents that lead to injury.*

- Create or obtain a standard form document that can be easily accessed by those in supervisory positions. At the very least, include:
  - Date & Time
  - Location
  - Person injured
  - Description of the incident
  - Witnesses
  - Measures taken
  - Preventative measures needed, if any, for the future
  - Signature of supervisor on duty
- Determine who will be responsible for filling out incident forms in various situations (shop, rehearsals, performances, etc.).
- Determine to whom forms will go once filled out and a set deadline. Recommendation: incident forms should be filled out immediately after the incident and should be turned in no more than 24 hours afterward.
- Keep forms organized and in a secure location, in case they are needed for later reference.

❖ Additional Resources & Works Cited

➢ ***Websites***

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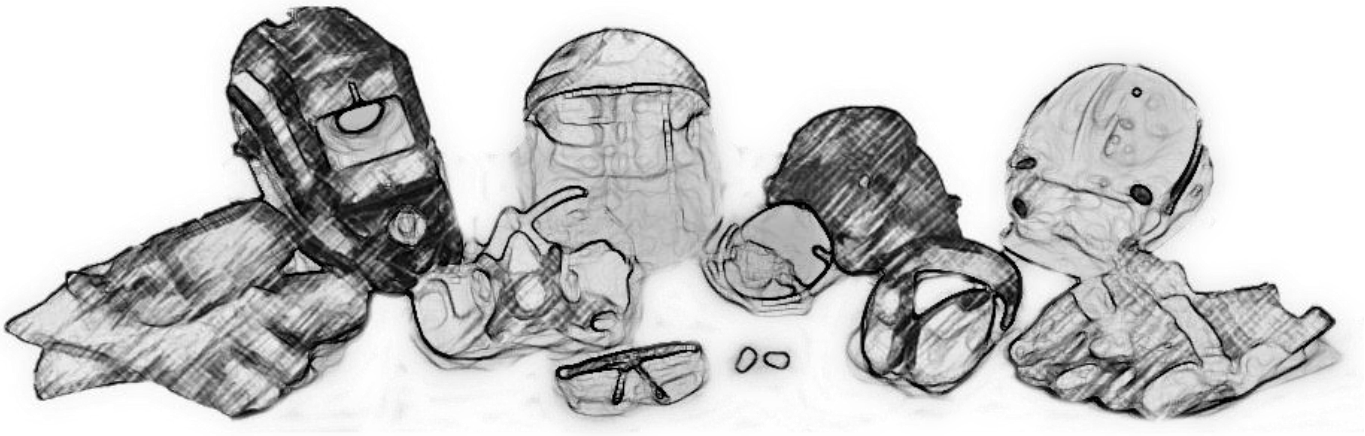

3. Personal Protective Equipment

In addition to wearing appropriate attire at all times, it is often necessary to wear special equipment to ensure that your body is adequately protected against the many hazards that may be present in the workplace. Some may seem clunky or burdensome at times, but the risks far outweigh the inconveniences. PPE use is common sense, but it is easy to forget or rationalize your way out of it in the midst of a hectic production schedule. For your own safety and that of those around you, make it a practice to utilize PPE consistently and correctly.

❖ General

- ➢ PPE standards must be in place for every theater organization, and they must be a part of worker training.
- ➢ PPE should be provided and accessible in workspaces.
  - ■ Keep equipment secure, clean, dry, and in good working order
  - ■ Inspect provided PPE regularly.
  - ■ Replace damaged, worn, or expired equipment.
  - ■ Worker-provided PPE should meet all standards in place.
- ➢ Supervisors should ensure that workers are using appropriate PPE at all times.
- ➢ Post signs in appropriate locations to remind workers of potential hazards and what PPE is required.

❖ Eye Protection

- ➢ Eye protection is necessary in any situation in which foreign objects could be introduced to the eyes.
- ➢ Wear eye protection at all times in all production shops and labs, as well as during load-in and strike.

Personal Protective Equipment

- Different Types:
  - Safety Glasses
    - These must meet ANSI Z87.1 standard. The label should reflect this.
    - Prescription glasses are only adequate if they meet this standard *and* have side shields which also meet the standard.
    - Safety glasses do not provide good protection against liquids or vapors
  - Safety Goggles
    - These also must meet ANSI Z87.1 standard
    - Goggles are appropriate to use *over* prescription glasses
    - Goggles provide better protection against liquids and vapors
    - Goggles may fog up more easily than safety glasses
  - Full Face Shield
    - Use in situations where full face protection is needed; When grinding or cutting metal a full face shield should be worn to protect against sparks or shards.
    - Wear safety glasses or goggles under the face shield as an extra layer of protection.
  - Welding mask
    - Use when welding to protect eyes from extremely bright light and to protect entire face from UV burn, sparks, and spatter.
    - Wear safety glasses under welding mask at all times to protect eyes from debris which may bounce under the mask.

Hearing Protection

- Hearing protection should be worn in any situation in which noise is excessive and/or prolonged. This includes the use of many, if not most, power tools. Failure to use hearing protection could result in permanent hearing damage.
- Audio engineers and those working around sound systems may also need hearing protection at times when speakers are being adjusted or tested.
- OSHA guidelines list 85db as the threshold at which hearing protection should be worn.
  - Louder sounds require less exposure time to do permanent damage. Sound at 110db can do permanent damage in one minute.
- Earplugs
  - Generally, these are made of foam or silicone and are disposable, but there are reusable varieties.
  - Follow manufacturer instructions for proper insertion technique.
- Earmuffs
  - These cover the entire ear and are reusable.

Personal Protective Equipment

❖ Hard Hats

- ➢ Protecting your head from falling objects and unintentional impact when working in confined spaces necessitates the use of a hard hat.
- ➢ Standards are defined in OSHA 29 CFR 1910.135 and ANSI/ISEA Z89.1.
- ➢ Hard hats should be worn at all times in areas where overhead work is occurring or where overhead hazards are present (beams, pipes, etc.).
- ➢ Clear and highly visible signage should be in place to alert those who enter a hard hat zone to comply.
- ➢ Inspect the hard hat for damage or alterations before using it.
- ➢ Follow all manufacturer recommendations and instructions.
- ➢ Make sure your hard hat is sized properly for your head and is secure before beginning work.
- ➢ Most hard hats are not meant to be worn backwards. Those that are should be marked accordingly.
- ➢ Hard hats with chin straps should be worn in "bump" areas (rigging and lighting mostly).
- ➢ Depending on conditions and manufacturer recommendations, a hard hat may have an "expiration date" due to the eventual deterioration of its component materials.

❖ Gloves

- ➢ Your hands are critical to most work in the theater, so you should protect them whenever necessary.
- ➢ Different varieties of gloves may be used for different tasks
  - ■ Canvas, leather, or even Kevlar gloves protect against splinters or cuts when carrying lumber or metal or working with manual cutting tools like box cutters or utility knives.
  - ■ Nitrile, Latex, Neoprene, or vinyl gloves protect against liquid/chemicals or other skin irritants. See chemical and glove manufacturer guidelines.
  - ■ Chemical resistant gloves must be used for harsher materials (see manufacturer info.).
  - ■ Specialty gloves for grip are manufactured and may be used in rigging.
  - ■ Heat resistant gloves are useful when working with lighting equipment.
  - ■ Heat resistant gauntlets are required for welding.
- ➢ Do ***not*** wear gloves when working with power tools or other devices that have moving parts. The gloves could become entangled and pull your hands into the machine.

Personal Protective Equipment

❖ Knee Pads

- ➢ You only get one set of original knees. Take care of them.
- ➢ Use knee pads whenever kneeling for extended periods of time.
- ➢ Many varieties exist. Use whatever type is practical and comfortable.

❖ Additional Welding Gear

- ➢ In addition to a welding mask and welding gloves, be sure all exposed skin is covered.
  - ■ If possible, wear proprietary welding gear made from leather or flame retardant canvas/cotton. This could include sleeves, jackets, chaps, etc.
  - ■ Do not wear synthetic fabrics that can melt. They will cause more severe burns if they melt to your skin.
- ➢ Wear completely enclosed footwear, preferably with no open or mesh surfaces. Leather or similarly durable material is best.

❖ Respirators (including dust masks)

- ➢ Respirators should be used any time there is particulate matter in the air (sanding, spraying, using dyes or chemicals of any sort).
- ➢ Respirators are not a substitute for having adequate ventilation in the workspace; they are a secondary measure of protection.
- ➢ Use the appropriate type of respirator for your application. Follow manufacturer guidance if unsure of applicability in a certain situation.
  - ■ NIOSH issues recommendations about respirator use (see additional resources).
  - ■ Store reusable respirators in a clean, dry, sealed bag between uses.
- ➢ Dispose of respirators which:
  - ■ Have reached the end of their intended lifespan
  - ■ Are dirty, wet or otherwise contaminated
  - ■ Are difficult to breathe through
  - ■ Are damaged in any way
- ➢ ***Dust Masks*** (a.k.a. Filtering Facepieces)
  - ■ Dust masks are primarily used for larger particulates in the air. They are not effective in the presence of chemical fumes or vapors!
  - ■ Masks may contain a filter in the mask or the whole mask may, itself, be a filter.
  - ■ Particulate filters are classified as follows:
    - N = Not oil proof, use up to 8 hours
    - R = Oil proof up to 8 hours

- P = Oil proof over 8 hours
- 95, 97, 100 = the % of .03 micron particles filtered by the mask
- When in doubt, a P100 filter is the most efficient, oil-resistant, and long-lasting.

■ Use N95 rated mask for low/non-toxic large particles (wood/plaster dust, etc.).
■ Use R95 or above for spray paints and other liquid particulates. Check manufacturer guidelines if unsure.
■ Masks with multiple elastic straps, foam padding, and adjustable nose pieces will be tighter fitting and more comfortable.

➢ ***Chemical Cartridge Respirators***

■ These must be used when chemical fumes and solvents are in the air.
■ Different cartridges are installed depending on the hazard present. Using the wrong cartridge will render it useless. See manufacturer guidelines to ensure you are using the correct cartridge(s).
■ These respirators must fit tightly against the face and must form a seal to be effective.
- No facial hair must be present in the area of the seal.
- Perform a user test each time the respirator is used to ensure there are no leaks when inhaling or exhaling.

■ Clean respirators after each use and replace cartridges as directed.
■ For employees, respirators are required to be fit tested annually by a professional, and the employee is required to be medically cleared and trained on proper usage.
■ Use of chemical cartridge respirators by non-professionals:
- Though laws applying to employees do not apply to non-professionals, the same standards should be followed for the safety of the individual. Some people may be medically unfit to wear a respirator for a variety of reasons, including asthma or other respiratory issues. Great risk also comes with the use of ill-fitting or improperly used respirators.

■ Respirator use for employees is governed by OSHA 29 CFR 1910.134.

❖ **Fall protection devices**

➢ See Fall Protection section in Ladders, Lifts, and Overhead work

Personal Protective Equipment

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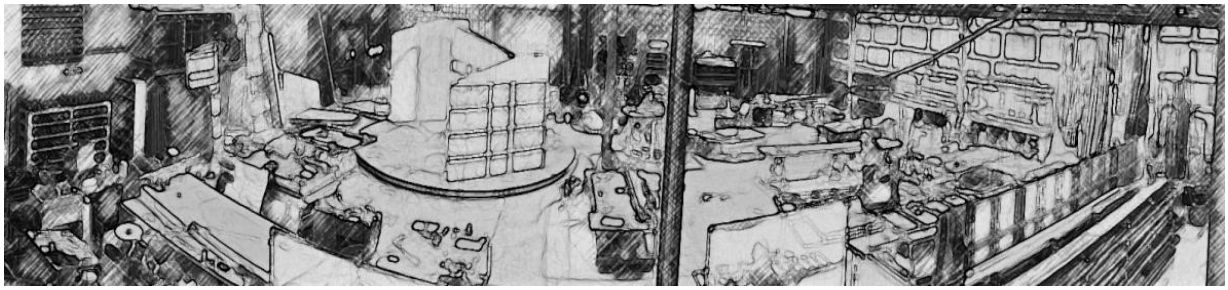

τϑ Scenic and Prop. Construction Safety

The average audience member at a theatrical performance probably doesn't spend much time thinking about the stage as a recent construction site, though it certainly is. In the same way, the parents of theater students and families of community theater volunteers don't often appreciate the many similarities between building scenery and props for a play and building a house or any other permanent structure. They also may not realize that the skills learned in scenic and prop. shops can very often be applied to real-life problem solving and do-it-yourself handiwork! There are, of course, differences in design and technique between the two industries, but the same materials, hardware, and tools are utilized in both. This being the case, it is very important to maintain the same (or better) standards of safety and health in theatrical construction as are adhered to in the general construction industry. This section contains safety information that can be applied broadly to various tools and workshop practices, but it is ***not*** *a training manual or guide for the proper use of any particular tool or construction method.*

- **Prior Knowledge**

  - *If you haven't already, read the section on General Safety Guidelines before continuing in this section. Many of the topics covered there provide the groundwork for a safe workshop environment.*

- **Safe Construction Practices**

  - *In the non-professional theater, having access to a structural engineer or even a technical director with a basic knowledge of safe structural design is rare, so other measures must be taken to ensure the safety of scenic components. Many textbooks and other guides are available which cover basic scenic construction techniques. They should be the starting place for those unfamiliar with accepted methods of scenic construction (see appendix for resources). The following considerations always apply in the construction of structurally sound scenery:*

- Use appropriate hardware and materials. If you are unsure about what is appropriate, consult someone with a higher level of training who can make an assessment and provide guidance.
- A supervisor should inspect all work done by students and volunteers to make sure it was built appropriately and is without defect. Supervisors should also "walk" the set before anyone else to check for any instability.
- Scenery that will support performers or be over their heads must conform to even higher standards. "Overbuilding" is sometimes an option, depending on space requirements, but it is usually not ideal. Again, follow common scenic construction practice and, when in doubt, do not proceed without professional consultation.
- Simple, safe scenery is always better than complex scenery that might collapse at any moment due to amateur construction.

❖ Workshop Upkeep, Organization and Etiquette

***Note:** You may notice that the guidelines in this section may also be found (with slight differences) in the earlier section: "Theatrical Spaces and the Items Therein". This section differs only in its specific application to scenic workshops and other construction areas.

➢ *Upkeep of Workshops and Construction Areas*

- Use workshops, storage areas, and passageways as intended. Hallways are not storage areas and rehearsal rooms are not welding shops. If construction must take place in areas not specifically designated as workshops (on stage, for instance), extra care must be taken to ensure that the construction area meets the same criteria as a designated workshop.
- Use all available resources to keep workshops in good working order. Storage and transportation systems for tools, materials and stock goods should be inspected and repaired on a regular basis.
- The workshop's mechanical, HVAC, auxiliary ventilation, dust collection, and fire suppression systems (including all fire extinguishers), should also be inspected regularly. Bring specific needs to the attention of those responsible for the upkeep of the theater facility. Follow up as needed.
- Keep working areas clean, dry and free of clutter.
    - Always maintain designated pathways in construction areas, including permanent pathways in workshop areas. If necessary, tape out or paint the boundaries of these pathways on the floor, and ensure that they are never used for construction or storage.

- Never block or in any way obstruct an exit pathway or door.
- At the end of each work session, designate time to clean and restore the space.
- Sweep and mop, as necessary, areas where spills or debris create hazards.
- Keep tools, materials, cords, hoses, etc. in their designated storage areas when not in use.
- With caution tape, cordon off areas where in-progress projects cannot be cleared or where access is temporarily unsafe.
- Have a clear, known policy about food and drink in each space. It is advisable to restrict these to designated areas because of the hazard that potential spills pose, not to mention the extra clutter that is created in spaces that need to stay as clean and clear as possible.

  - All workshops, as well as any auxiliary paint and construction areas should have adequate work light available. Be aware that eye strain and headaches may result from poorly illuminated workspaces as well as fixtures of a certain type and/or color temperature. Theatrical fixtures should not be used as work lighting, as they are either expensive, inefficient, or both.
  - If an area is unsafe for any of the above reasons, discontinue its use until the issues are resolved.

➢ *Upkeep of Tools & Equipment - This applies to equipment in all workshops.*

- Keep operating/safety manuals in designated locations and refer to them for any repairs or upkeep
- Do not attempt repairs unless qualified to do so. See manuals for guidance or to find contact information for support.
- Keep tools and equipment clean and properly lubricated, if applicable. See manuals for guidance.
- Inspect tools and equipment for good working order before each use. Make sure that corded tools are either properly grounded (three-prong plug) or are double-insulated.
- Tools which have malfunctioned or are in need of repair must not be used. Establish a "lock out, tag out" system for equipment that is malfunctioning or in need of repair. Include this protocol in training sessions for those who work in the theater.

➢ *Organization*

- Store materials, tools, supplies, and stock items in designated areas only.
- Clearly label storage areas, as appropriate.
- Do not overload storage shelves or racks.
- Ensure shelves and racks are secured against tipping.

- Never climb storage shelves. Have appropriate stairs, ladders, etc. available for accessing anything stored overhead.
- Do not store materials within 18" of sprinkler heads.
- Keep PPE stored in a clean, dry area, designated solely for that purpose.
- Store hazardous materials correctly (see section on hazardous materials).
- Ensure that all who work in each space are familiar with storage locations and protocols and are held accountable for compliance.
- Adjust organization schemes as needed, communicating any changes with all those affected.

➢ *Authorized Access*

- Access to all areas of the theater should be restricted so that only those who are authorized may gain entry. Workshops are not the place for casual bystanders, especially children.
- Keep a record of who has access/keys to each building/area.
- Establish protocol for supervision of workers and spaces when workshops are in use. Also establish procedures to ensure that workshops and equipment are properly secured at the end of each work day or session.
- Keep all tools and potentially dangerous equipment restricted in additional ways. This could include double locking, password access or removing power sources when supervision is not available.
- Students and volunteers should not be given unsupervised access to the theater.

➢ *Working collaboratively with respect for the safety and health of others*

- Keep each other accountable for safe practices:
  - Remind co-workers to use appropriate PPE at all times. See section on PPE for more specific information.
  - Give kind but firm reminders when unsafe practices are being employed by anyone in the work area.
  - Involve a supervisor in instances of repeated unsafe activity or if there may be a need to implement additional safety protocol.
- In active workshops, multiple projects may be sharing the same spaces and tools.
  - Be aware of what is going on around you and the potential hazards in the workspace at all times, including:
    - Materials or workers moving behind or above you - In crowded workspaces, always look before turning, stepping backwards or standing up.
    - Trip hazards, including cords, hoses, and materials and tools
    - Slip hazards, including sawdust, spilled paint, and oils
  - Communicate clearly with those working around you. Notify others verbally if you are:

        - Moving behind someone
        - Moving large materials or scenic units near their workspace
        - About to create a loud or sudden noise
        - Lowering or moving something overhead
        - Acknowledging a notification by saying "thank you".
    - Clear scraps and debris accumulated around tools after each use.
    - Keep cords and hoses routed to the outside of work areas whenever possible. Tape down or carpet over cords and hoses in high-traffic areas.

- **Tool Safety**

    - *Training*
        - As with other types of training, document the nature of tool trainings and the successful completion by each worker. Save training documentation files, either physically or digitally.
        - Trainings should cover proper operation, adjustment, and troubleshooting, as well as what to do when a tool is not working properly.
        - Only use tools on which you have been trained *and feel comfortable.* Do not be afraid to inform a supervisor if you are uncomfortable using a particular tool.
    - *Safe Usage*
        - Use the right tool for each task. If the right tool is not available, look for a workaround using appropriate tools.
        - Inspect tools for good working condition before use (and before connecting to power). Make sure all hardware is tight, moving components are free to move smoothly and that all guards and safety features are functioning correctly.
        - Never intentionally remove or defeat a guard or cover. These are designed to keep the user safe and must be used as designed.
        - Blades and bits should be clean and sharp to ensure clean, smooth cuts and holes. Clean, sharpen, or discard bits and blades that are dull or grimy.
        - *Never* put body parts in the path of a tool.
        - Keep a firm grip and control of the tool at all times. When using power tools, use two hands whenever possible. If both hands are on the body of the tool, they cannot be in its path.
        - Remove tool power before making adjustments or changing accessories. On battery-powered tools, remove the battery.
        - When using hand tools (power or otherwise), tightly secure the workpiece before operating the tool. Use clamps when needed. Do *not* attempt to use one hand on the tool and the other hand to hold the workpiece in place. Use clamps, vices, etc.

- When moving the workpiece through a stationary tool, such as a table saw or band saw, keep both hands securely on the workpiece but never in the feed path and never within 8-10" of the blade. Use accessories such as push sticks and fingerboards, to keep body parts clear of the danger zones.
- Maintain good balance and footing when using any tool so that you are not thrown off if there is a sudden, unexpected movement of the tool or material.
- For tools which create airborne particles of any kind (sawdust, plaster dust, etc.), always use a dust collection system and/or local suction device (vacuum) to keep as many particles out of the air as possible. Dust masks should also be used in this scenario. Do not use dust-producing tools in non-ventilated areas with no collection system.
- If possible, have an emergency shutoff system in place for stationary tools. This could include kill switches on the individual tools and/or a master shutoff switch for all tool power.
- ***Beware of Complacency!!!*** Most major power tool accidents occur when the worker loses focus and/or gets too comfortable with the tool or task. Stay focused and take breaks when doing a monotonous task like running strips of wood through a table saw or cross cutting countless pieces on the miter saw.

➢ *Tools with heating elements*

- When working with tools that generate heat, a few extra precautions must be taken. This includes working with soldering irons, hot glue guns, and hot knives and wire cutters for work with foam.
- Keep fingers and other body parts clear of the heating element.
- Never use a hot tool on a flammable surface or near flammable materials. Always assume it may tip over, but take steps to ensure that it doesn't.
- Never leave a hot tool unattended.
- Only solder in a ventilated area. Soldering produces toxic fumes.
- When finished, remove power (unplug) and give the tool time to cool to room temperature before storing. Do not put a hot tool in storage!

➢ *Welding and Metalwork*

- Building scenery with metal (steel in particular) has become a more common practice in educational and community theater in recent years. It is not within the scope of this guide to go into great detail in this area, so only fundamental safety guidelines follow.
    - As with other tools, only persons trained to work with metal cutting and welding tools should attempt to do so.
    - Work areas must be completely free of flammable and explosive materials. Cutting, grinding, and welding all produce sources of ignition which can travel far and in unexpected directions. Keep a water sprayer

on hand to extinguish sparks and cool recent welds, and a fire extinguisher nearby at all times.

- Work areas must be dry and free of electrical hazards. See section on electrical safety for more info.
- Work areas must be properly ventilated. Most theater shops are not equipped for welding ventilation, so welding must be done with a proprietary ventilation attachment, outside in a suitable area or not at all.
- Cutting, grinding, and welding require additional PPE beyond that of carpentry work. The worker's entire body must be protected against sparks, molten metal, blinding light and UV rays. See section on PPE for more information.
- Keep welding gas tanks secured in an upright position so that they cannot accidentally fall over.
- Use welding screens around the work area to keep the eyes of bystanders protected from the bright light produced in the welding process. *Welding should not be observed through these screens. They are only meant to protect against quick, incidental exposure.*
- Always weld with a partner nearby in case of emergencies.
- Before each weld or series of welds, inform those around you with a clear verbal signal: "Welding!"
- When finished, clean the area, properly store all tools and equipment, and then *stay nearby for at least an hour* to ensure that no flammable materials are smoldering and may catch fire.

❖ Hazardous Materials

➢ *Materials are considered to be hazardous if they are a health or safety risk. This includes materials and substances that could potentially:*

- Irritate the skin, eyes, or mucous membranes
- Cause respiratory problems through the inhalation of dust or fumes
- Pose serious health risks if accidentally ingested
- Ignite/combust or explode
- Interact chemically or physically with other materials in the workspace to create one of the above hazards

➢ *Some common examples of Hazardous Materials found in theater workshops:*

- Dusts created by sanding wood, joint compound, etc.
- Spray paints (aerosol)
- Oil-based paints and coatings (including polyurethanes, lacquers, etc.)

- Solvents (paint thinner, acetone, acetate, turpentine, denatured alcohol)
- Chemical cleaners and degreasers
- Some lubricants and oils
- Liquid adhesives (aerosols, contact cements, two part epoxies)
- Casting resins (fiberglass, auto body filler, urethane resins or foams)

➢ *Initial Risk Assessment and Training*

- The use of hazardous materials in a non-professional setting comes with even greater risks than usual because facilities are rarely equipped for the safe storage and use of these items.
- Avoid using hazardous materials to begin with. If a less dangerous, suitable substitute exists, use it instead.
- Any persons authorized to access and use hazardous materials must be properly trained and the training should be documented.

➢ *Proper Labeling and Safety Documentation*

- Hazardous materials should have all information from the original manufacturer's label. If they are not in the original container (preferred), all information must be transferred to the new container.
- Material manufacturers are required to provide/make easily available a Safety Data Sheet (formerly MSDS or "Material Safety Data Sheet"). If one does not ship with the material, go to the manufacturer's website or call for a copy.
- Safety Data Sheets include a wealth of information about the material/substance (see OSHA Standards and sample SDS in appendix) which include:
  - Name
  - Potential Hazards
  - Composition/Ingredients
  - First Aid Measures
  - Degree of flammability and how to extinguish if ignited
  - Storage & Disposal
- Safety Data Sheets for all hazardous materials must be on file and accessible to anyone who may be working with them. All workers should know where to find the SDS for any given material.

➢ *Hazmat Storage*

- Keep all hazardous materials secured and out of reach of unauthorized personnel, especially children. Locking cabinets, closets, etc. are highly recommended.
- Any materials which are combustible or explosive should be secured in a specifically labeled cabinet or storage unit. An official "flammables" cabinet is best. See OSHA & NFPA standards at the end of this section for more info.
- Flammables cabinets should be as far from walkways and exits as possible.

- Never store combustible/explosive materials near sources of heat or flame (matches, lighters, etc.).
- Make sure containers are in good condition, do not leak, and are properly sealed.
- Materials that should ***not*** be stored in a flammables cabinet include:
  - Oxidizers such as oxygen gas, hydrogen peroxide, nitrous oxide, chlorine
  - Acids such as Nitric Acid, Sulfuric Acid, Muriatic/Hydrochloric Acid

➢ *Working with Hazardous Materials*

- Wear appropriate PPE at all times. See section on PPE for more info. Some common PPE for working with Hazardous chemicals includes:
  - Goggles/Face shields
  - Gloves rated for chemical protection (see manufacturer guidelines)
  - Chemical cartridge respirators with appropriate filter cartridges (see manufacturer guidelines)
  - Protective clothing
- Have easy access to first aid, especially water to flush the skin and eye wash stations. See section on First Aid for more info.
- Do not eat or drink near hazardous materials, as they may end up in your food or beverage.
- Ensure the workspace has adequate ventilation:
  - ***Reminder***: In a non-professional theater environment, it is best to simply avoid the use of chemicals and compounds which put toxic fumes and particles into the air in your workspace. Take all steps possible to make the use of these materials unnecessary in the first place.
  - Opening a window or relying on a standard building ventilation system to remove toxic substances in the air is not an adequate measure of protection, but may help in low-risk situations.
  - If you can smell or, worse, *see* fumes in the air, your workspace is not adequately ventilated and your respirator is not functioning correctly. Leave the space immediately and find a way to clear the air of the hazardous fumes/particles.
  - Types of ventilation for hazardous materials include:
    - Dust collection (for particles like sawdust)
    - Exhaust Fans (not always adequate)
    - Spray booths (for aerosol spray paint, etc.)
    - Fume Hoods
    - Flexible fume ducts (for easy positioning near small projects)
    - Glove Boxes (for highly toxic substances)
  - If you are unsure which type of ventilation is adequate/appropriate, consult the SDS and, if all else fails, contact the manufacturer for guidance.

- If adequate interior ventilation is unavailable, you may be able to complete the task outside. Be cautious and use common sense. Stay upwind of the fumes and take the safety and health of bystanders into consideration.
- Be prepared to clean up spills. The SDS for each material/substance will tell you the proper methods, so make sure they are on hand and easily accessible. Have an appropriate respirator nearby in case of accidental spills in the work area.
- Watch for symptoms of short- and long-term exposure to toxic chemicals and seek medical attention if any occur. These could be warning signs or indications of potentially larger health problems caused by exposure:
    - Headaches
    - Dizziness
    - Breathing problems
    - Skin irritation
    - Abnormal fatigue
    - Digestive problems
    - Depression
    - Memory issues

➢ *Disposal of Hazardous Materials*

- It is rarely okay to dump a hazardous chemical down a sink drain or into a trash can.
- Refer to the Safety Data Sheet for the material/substance and follow manufacturer guidelines for safe disposal.
- Contact local authorities to find disposal sites and/or methods.

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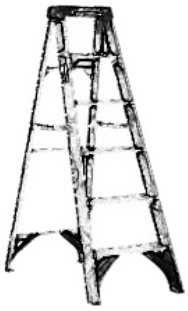
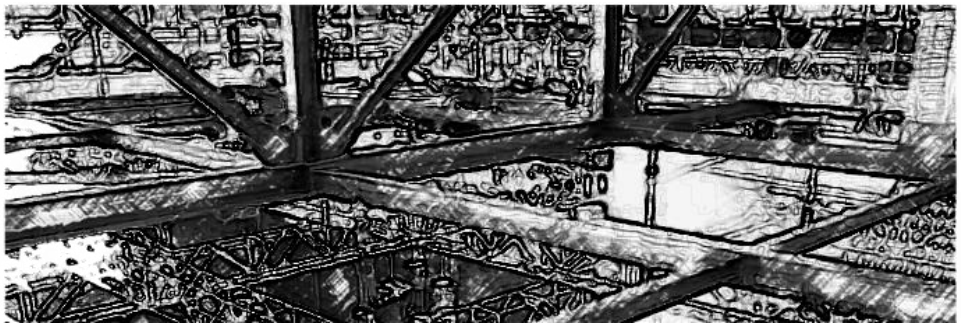
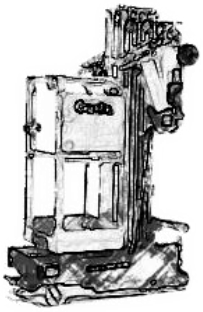

5. Ladders, Lifts & Overhead Work

The need to access places that are out of reach is a constant concern when working in the theater. Whether installing crown molding on a flat, painting the top of a tall scenic unit, focusing lights, or rigging a flown piece of scenery, technicians of all sorts always seem to be up in the air in one way or another. Of course, any activity that removes the worker from the ground instantly brings an additional set of concerns, beyond those associated with the task itself. Using a drill is one thing, but using a drill while standing ten feet above the stage on the rung of a ladder is quite another. By adding height to any task, we compound the risks and, consequently, the safety measures which must be in place to minimize them.

❖ Ladder Safety

Ladders are such a ubiquitous feature in most theaters that it is easy to become complacent with their use and fail to take all safety considerations into account. This carelessness leads to countless injuries in all types of theaters with all types of ladders. Ladders are not inherently unsafe, but they certainly come with a high level of potential risk and must only be used in the manner for which they were designed.

- ➢ Inspect ladders before each use for damage or malfunction. Look for:
  - ■ Cracks
  - ■ Loose rungs
  - ■ Missing or loose hardware
  - ■ Damaged feet
  - ■ Warping or bending
  - ■ Grime on the treads or side rails, especially oil or grease.
- ➢ Do not remove, cover, or paint over manufacturer labels and safety instructions. The labels will tell you the weight limit of the ladder, as well as the highest step you can safely stand on.
- ➢ Know the weight capacity of the ladder and do not exceed it.

- ➢ Only use ladders on level, non-slippery surfaces. Ladders may slide or tip when set up on a slope. There are a few varieties manufactured for working on stairs or multi-level surfaces, but those are the exception, not the rule.
- ➢ Do not add wheels or place ladders on rolling platforms. Ladders must be completely stable and in a fixed position when in use. Some manufacturers make ladders with spring-loaded, retractable wheel systems; use these with caution and ensure that the wheel systems are working properly and that the legs of the ladder fully engage with the ground when stood upon.
- ➢ Place ladders so that you do not have to overreach
  - ■ Ladders should be as close to the work area as possible.
  - ■ Your body's center of gravity should always be directly over the rung on which you are standing. If you lean too far in any direction, you could lose your balance or the ladder could topple out from under you.
  - ■ Never lean off the side of a ladder. ***Use the belt buckle rule***. Your belt buckle should never be outside the side rail of the ladder.
  - ■ If a ladder is either too short or cannot be positioned to complete a task without overreaching, choose a different ladder or use another safe method to access the area. No project or goal in theater is worth the risk of serious injury from falling.
- ➢ Always have a spotter stabilizing the base of the ladder.
- ➢ Always face the ladder when climbing up or down.
- ➢ Always have three points of contact (hands or feet) when climbing, descending, or working on a ladder.
- ➢ Do not carry any tools or other items in your hand while climbing a ladder. Use a tool belt, or have someone hand things up to you, if possible.
- ➢ When using power tools on ladders, be very careful to route cords in such a way that they are not tripping or entanglement hazards. Use battery-powered tools if at all possible.
- ➢ Do not mount a ladder if you are tired, lightheaded, dizzy, are not comfortable working at heights, or have balance/equilibrium issues.
- ➢ Only one person at a time should climb a given ladder.

❖ Choosing the right ladder

- ➢ *There are many different types of ladders and ladder-like devices for different scenarios. When in doubt, see manufacturer guidelines to ensure that you have chosen the appropriate ladder for the job.* ***Never stand on any item (bucket, desk, chair, etc.) that was not specifically designed to be stood upon***.

- Step ladders/A-frame Ladders
  - Remember that step ladders are meant to be free-standing. Step ladders should not be used as single ladders (leaning).
  - Choose the correct height. Never stand on the cap or last step of a stepladder (see stickers/labels).
  - All four feet must be ***securely*** on the ground. Check for wobble before mounting the ladder. All four feet should have anti-slip treads.
  - Rail spreaders must be fully open and locked.
  - Do not attempt to move the ladder without first dismounting.
  - Only step on designated steps, not on the rear, non-climbing rails.
  - ***Never place/leave loose items on the tops of stepladders!*** This is a very common careless act in the theater and has caused countless injuries, especially to those holding or moving the ladder.
- Extension/Single Ladders
  - These non-free-standing ladders must lean against a wall or other support structure.
  - Choose the correct height:
    - Workers should not stand on the top three rungs of an extension/single ladder. In cases where workers need to access the upper level/roof, ladders should extend 3' beyond the upper support and the ladder should be tied off to the upper support before dismounting.
    - Ladders are too tall if they cannot be set up at the correct angle of roughly 75°. ***Rule of thumb***: Stand with toes against ladder feet. Extended arms at shoulder height should leave palms resting on a rung.
  - Both feet must be level and on solid ground. Feet should have anti-slip pads.
  - The two rails should be supported *evenly* at the upper support.
  - Rung locks should be securely engaged before mounting an extension ladder.
  - Do not attempt to further extend or move the ladder in any without first dismounting.
- Articulated, Combination and other specialty ladders and scaffolding devices
  - These combine the features of single and stepladders.
  - Follow manufacturer guidelines for safe and proper operation.

Ladders, Lifts & Overhead Work

❖ Lift Safety

Few non-professional theaters are fortunate enough to have access to an aerial lift, but those who do should exercise extreme caution in their use, especially with and around students, ***who should only use lifts under direct supervision.*** *This section primarily applies to personnel lifts such as those made by Genie and JLG, but most of the guidelines also apply to scissor lifts and small boom lifts. The primary risks associated with using lifts are falling, tipping, and dropping objects on those below, but these can be mitigated using the following guidelines.*

- ➢ Training
  - ■ Create or adopt a lift training program which covers ***at least*** the same amount of training that would be required by OSHA of an employee using an aerial lift. Training should include at least the following topics:
    - Recognizing and avoiding hazards in the workspace
      - ◆ Overhead obstacles
      - ◆ Power/data cables (be careful not to run over these or become entangled in them!)
      - ◆ Floors not designed to hold the weight of a lift
      - ◆ Uneven/non-level floors
      - ◆ Debris, slip hazards, etc.
    - Knowledge of the characteristics of the lift
      - ◆ Weight limit
      - ◆ Height limit
      - ◆ Moving parts
      - ◆ Power source (battery vs. corded)
    - Inspection for good working order before each use (create a checklist) - OSHA recommends inspecting the following, among other things:
      - ◆ Proper fluid levels (oil, hydraulic, fuel and coolant)
      - ◆ Wheels and tires
      - ◆ Battery and charger
      - ◆ Horn, gauges, lights and backup alarms
      - ◆ Steering and brakes
      - ◆ Lift components
      - ◆ Operating and emergency controls
      - ◆ Personal protective devices
      - ◆ Missing or unreadable placards, warnings, or operational, instructional and control markings
      - ◆ Outriggers, stabilizers and other structures

- Loose or missing parts
- Guardrail systems.

- Correct operation of the lift:
  - Moving the lift into place (manual or motorized)
  - Charging/powering up
  - Leveling
  - Stabilizing (outriggers or weighted base)
  - Securing the basket/platform gate
  - Moving up and down
  - Emergency stop operation
  - Power failure operation (manual descent)
- Communication
  - Notify others working in the area of actions being performed and potential hazards. Speak loudly and clearly and wait for a response from those around. Never assume everyone knows what you are doing above them.
    - "Lift going up/down"
    - "Lift moving"
    - "Loose hardware overhead"
    - "Heads!"

- Document both the nature of lift training and the successful completion of training by individuals.
  - Include dates and times of training.
  - Include some written formal assessment, especially for students.
  - Documentation for student trainees should include the caveat that students are only to use lifts under the direct supervision of a trained adult.

- Maintenance
  - Lift repairs and maintenance should be completed by a trained professional. Local distributors for the lift manufacturer are usually a good resource in finding a qualified technician.
  - Lifts should be professionally inspected and given general maintenance on a regular basis to ensure they are in proper working order.
  - Do not use a lift that appears to be malfunctioning in any way.
- Use the lift's stability system as intended. Do *not* defeat safety features for convenience.
  - Only use lifts on level ground.
  - Make sure lifts' leveling safety systems are functional (lifts should not raise if they are not level).

- On outrigger lifts, use all outriggers as intended at all times. If ***all*** of the outriggers cannot fit where the lift needs to be used, an alternative solution must be found. Always plan ahead in situations where access to high areas will be limited later in the production process.
- On weighted base lifts, ensure that the base leveling and stability system is in good working order before each use.

➢ Stay completely inside the cage/rail of the bucket/platform.
- Both feet should be on the floor of the bucket/platform at all times.
- Do not overreach. Shifting body weight to the outside of the bucket/platform increases the likelihood of tipping.

➢ Secure loose objects, including tools and hardware, if possible.
- Lanyards may be a good solution for tools
- Keep hardware in containers in the bottom of the bucket whenever possible
- Do not lift items in the air that will not fit inside the bucket.

➢ Wear appropriate fall protection gear as required when working in the lift.
- Check with local authorities to confirm regulations re: restraint belt or harness use in lifts.
- Typically, a restraint belt or harness is ***not*** necessary in a personnel lift or scissor lift ***if*** the lift has an adequate guard rail and gate system ***and*** the occupant is using the bucket/platform correctly. Restraint belts or a harness ***must*** be worn in boom lifts, which are not common in theaters.
- If wearing a harness, do not tie off to permanent structures above the ground; tie into a designated harness point on the lift bucket.
- See section on fall protection for more information on harnesses.

➢ Do not move the lift with someone in it, especially if they are above ground level. Doing so would require defeating the safety systems and would put the person in the lift at great risk.

➢ Be aware of others working in the area who may not realize what is happening with the lift.

➢ A hard hat zone should be instituted if loose tools or hardware will be used in the lift when other workers may be nearby on ground level.

Ladders, Lifts & Overhead Work

❖ Overhead Work

This section applies broadly to any work that involves the movement of people or equipment above the stage or workplace, potentially over the heads of others. This could include work done from ladders and lifts, catwalks, raised platforms, and fly systems (loading rails, grids, etc.). Protocol for overhead work should be followed at all times when such work is being done, whether or not others are actively working below. There is always a chance that someone will walk into the workspace and be unaware of the hazards overhead.

- ➢ Communication
  - ■ Verbally communicate immediate hazards due to overhead work using clear, concise, language. Verbal communication must be projected at such a volume that all others in the space can hear and respond. Examples could include:
    - *"Loose hardware overhead!"* (when anything that could potentially be dropped is overhead)
    - *"Dropping/lowering rope!"* (or any other item that must be dropped or lowered). See section below on dropping items from height.
    - *"Heads!"* (when things are dropped *accidentally*)
    - *"Thank you!"* (always acknowledge that you've heard whatever is being communicated)
  - ■ Use written signage to inform those entering the work area of overhead hazards.
    - "Hard Hat Area" signs at every entrance whenever overhead work is done
    - Temporary signs with specific information about overhead projects, as needed. (i.e. "Rigging inspection in progress", "Light hang 3-5pm", etc.)
    - Caution signs in "head bump" areas
    - Reminders to keep gates closed, items clear of catwalks, etc.
    - Notices in areas requiring fall protection equipment
    - "Authorized Personnel Only" signs for restricted areas
- ➢ Securing loose items
  - ■ Tools should be on leashes whenever possible. The leash could be connected to the worker (in the case of lighting wrenches, for instance) or to a secure tie-off point. Use common sense when deciding whether a leash poses a greater hazard than benefit.
  - ■ Dress cords, ropes, etc. in such a manner that they do not pose a trip or entanglement hazard to those working with/around them.
  - ■ Store loose items such that they cannot easily be dropped. Use containers when possible and never lay loose tools, hardware, etc. near edges without kick plates/toe guards or other barriers.

- Promptly and thoroughly clear and clean overhead work areas once the work is completed. Do not leave loose items behind.
- ***Never place/leave loose items on the tops of stepladders!*** This is a very common careless act in the theater and has caused countless injuries, especially to those holding or moving the ladder.

➢ Intentional dropping/lowering of items from height
- In almost all circumstances, items should not be dropped from height, due to both injury risks for those below and damage to the item or facility.
- Lower items in a controlled fashion whenever possible using appropriately rated rope, pulleys, etc.
- On rare occasions, it may okay to drop lightweight items (tieline, short lengths of rope, etc.) if they pose a trip or entanglement hazard to those working above. In these cases, always make sure that the area below is completely clear within a large radius of the item's destination on the floor. Communicate clearly before dropping or lowering anything.

➢ Personal Protective Equipment
- ANSI approved hard hats (Standard Z89.1) should be worn at all times when work is being done overhead. Hard hats protect workers below from falling objects and workers above from impact hazards (pipes and beams, for instance).
  - Hard hats should be inspected for good working order and any damage before each use.
  - Hard hats must be worn as intended by the manufacturer. Only hard hats which specifically indicate they can be worn forwards and backwards should be used in such a manner.
  - There is currently no specific regulation about the use of paint, stickers, etc. on hard hats but these may impede inspection and the detection of flaws and are not recommended for that reason.
  - Some hard hats have expiration dates. See specific manufacturer info. for details.
  - Store hard hats in a clean, dry, designated location and have them easily accessible for workers.
- Eye protection should also be worn by workers above and below in case of dropped items which could bounce or break unpredictably.
- As always, wear practical clothing for the task. See section on proper attire for more info.

Ladders, Lifts & Overhead Work

❖ Fall Protection

The prevention of falls in theatrical work is a topic of great concern in the industry (think about elaborate concert touring rigs and high-flying circus shows) but it is not as often discussed or dealt with adequately in the non-professional realm. As with many topics covered in this guide, the best advice remains: ***minimize the initial risk level by eliminating the need to have workers and performers at dangerous heights to begin with.*** *Apart from permanent railing systems in the buildings themselves, most amateur and school theaters are simply not equipped to keep people safe in these scenarios. Keep this in mind and always put worker/student lives ahead of theatrical ambition.*
This section is primarily concerned with fall protection for those working at height in the theater. For more information about fall protection on stage for performers see performer safety.

- ➢ Structural fall protection (railings)
  - ■ Permanent guardrails (OSHA standard CFR 1910.29):
    - Should be at least 39" high (36" if they are also used as a handrail for stairs)
    - Should have no openings greater than 19" wide
    - Must withstand a force of 200lbs applied to the top rail from any direction
    - Should be fitted with self-closing gates anywhere there is an opening, or a latching chain if a gate is not practical
  - ■ Temporary guardrails for theater (ANSI E1.46 - 2018)
    - These may be built into the scenery and provide a measure of safety for crew and performers navigating backstage on temporary stairs or raised platforms.
    - Railings should be installed on any platform with a height over 4' from the stage deck.
    - The guidelines above for permanent guardrails should be followed as closely as possible for temporary guardrails.
  - ■ Workers must never defeat a guardrail by climbing on it, leaning over it, or standing at a level higher than the intended floor.

- ➢ Personal Fall Arrest Systems (PPE for work in areas without guardrails)

  In non-professional theaters, the use of Personal Fall Arrest Systems should be viewed as a last resort, where no other fall protection plan can be put in place. Students, especially, should only use such systems after extensive training and under close, professional supervision. Please utilize any and all resources at the end of this section to ensure that all necessary precautions have been taken.

Ladders, Lifts & Overhead Work

- Training
  - A program must be put in place to ensure all who use fall arrest equipment are knowledgeable and proficient in its use.
  - Include documentation of topics to be covered and minimum proficiency levels, including assessments.
  - Keep records of trainings and assessments, including the type of training, date, and names of trainer and trainees.
  - Training may include:
    - Types and correct fitting of harnesses
    - Types and correct attachment of lanyards
    - Care and maintenance of equipment
    - Appropriate anchorages
    - Guidelines for use of equipment at height
- Equipment
  - Keep fall protection equipment stored in a clean, dry, secure location.
  - Inspect fall protection equipment for good working order and damage ***before*** putting it on.
  - Dispose of/destroy equipment that has been involved in a previous fall.
  - Use only full body fall arrest harnesses. See manufacturer for more info. Body belts and harnesses designed for other industries (rock climbing, aerial work, etc.) are ***not*** adequate for fall protection.
  - Harness attachment point should be on the user's back, between the shoulder blades, in the form of a dorsal ring.
  - The lanyard connecting the harness to the anchorage point must have a minimum breaking strength of 5000 lbs (including both webbing and hardware). The lanyard must have a built in shock absorption system.
  - The lanyard should be of such length that it limits freefall to a maximum of 6ft. when connected to the appropriate anchorage or horizontal lifeline. After the construction phase of production, the OSHA prescribed limit is a maximum of 4ft. freefall.
  - Snaphooks must be double-locking and designed/compatible with the rest of the fall arrest system.
- Use
  - Once equipment is put on/in place, double check everything for proper fit and reliable connections before ascending to height.
  - Only hook into anchorages or horizontal lifelines capable of supporting 5000 lbs per person, or specifically designed and professionally installed as part of a fall arrest system. Guardrails are ***not*** suitable anchorages.
  - Have a plan to promptly rescue the worker in the event of a fall.
  - Never use a personal fall arrest system alone in the theater.

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6. Fly Systems and Rigging Safety

In the non-professional theater world, the ability to raise and lower scenery, lights, and even performers above the stage may be either coveted or feared. For those who desire such capabilities, challenges are often posed by the lack of a fully functioning fly system or proper rigging points over the stage. There are others, though, who have such a fly system but wish they didn't because of the inherent risks and potential liabilities. Whether this reluctance is due to a lack of training, qualified supervisory personnel or funding to keep the system in good working order, there are certainly many disused rigs gathering dust and rust for one reason or another. In secondary school theaters, the ability to train students on the safe use of fly systems and basic rigging practices can be a tremendous asset, both to the program and to the students, whose future career prospects may be enhanced significantly by the attainment of those skills prior to further university or industrial training. Teachers and supervisors must, however, have a thorough understanding of how such systems function and how to properly implement a safety program for those who will use them. It is outside the scope of this guide to explain the components and operation of each type of fly system. The following are general safety guidelines which can be applied in most scenarios. They do ***not*** *take the place of a trained and qualified rigger or rigging inspector.*

❖ Training

- ➢ A program must be put in place to ensure all who use the fly system are knowledgeable and proficient in its use.
- ➢ Include documentation of topics to be covered and minimum proficiency levels, including assessments.
- ➢ Keep records of trainings and assessments, including the type of training, date, and names of trainer and trainees.
- ➢ Training sessions may include:
  - Communication protocols
  - Raising and lowering of battens
  - Loading and unloading of counterweight/loading and unloading battens
  - Operation of automated/motorized components
  - Correct use of common rigging hardware

- Weight capacities (working loads, breaking strengths, etc.)
- Basic inspection protocols
- Lock out-tag out procedures for malfunctioning equipment

➢ Even after completion of training, ***students must be supervised*** by a qualified person whenever the fly system is in use or overhead rigging is being performed. This person should ensure safe practices and inspect any and all work done before approval for use.

❖ Fly System Safety

The types of fly systems encountered in non-professional setting vary greatly from theater to theater. Many schools and amateur companies use spaces with no overhead rigging capability whatsoever, while others are limited by a stage or black box theater with a dead hung rigging system. Other types of fly systems which might be encountered include hemp/pin rail systems, single purchase counterweight systems, double purchase counterweight systems, manual winch systems, and fully automated/motorized systems. A number of stages are even be equipped with a hybrid system integrating multiple types into one space. Some of the guidelines in the following section are geared toward the use of a counterweight system (single or double purchase) because those are the most commonly found operational fly systems that require very specific safety protocol. It is beyond the scope of this guide to detail the full operation of each type of fly system, but most guidelines can be applied to other types of systems with slight modifications.

➢ Access
- Regardless of the venue or institution type, access to fly systems must be tightly controlled, as there extremely high risks associated with careless or improper use of their components.
- The fly rail(s), loading bridge, grids, and catwalks should be physically restricted either by keeping the venue itself securely locked or by secondary means such as a locked cage around the fly rail and access ladders/stairs.
- Only qualified personnel should be given keys/access to the working parts of the fly system and, once unlocked, must remain in the immediate vicinity when any untrained individuals or those in need of supervision have access.

➢ Communication
- Verbal Communication
  - When operating or making adjustments to the fly system, verbal communication should be clear, concise, and loud enough to be heard and understood by all in the space.
  - No actions should be taken before receiving a clear "Thank you!" or other verbal acknowledgement from **all** others in the space.

- Supervisors and instructors must ensure that those working around operating fly systems understand their responsibility to not only acknowledge what is happening, but to be aware and vigilant as the action progresses.
- ***Best practice:*** (especially in secondary school theater) When a fly system action is communicated, everyone in the vicinity should stop what they are doing and keep eyes on the activity from a safe location. More eyes and voices are better, especially when moving linesets that may foul.
- Examples of fly system communications:
  - "Lineset 6 coming in/going out!"
  - "Clear the rail!" (preparing to transfer weight from the bridge)
  - "Rail is clear!" (no one is near the fly rail/under the bridge)
  - "Loading weight on lineset 6!"
  - "Loading complete!"
  - "Testing weight on lineset 6!"
  - "Thank you!"

■ Written Communication

- Signs with clear, large lettering and clear information should be posted as necessary. Examples could include:
  - Authorized Personnel Only
  - Restricted Access
  - Load limits for linesets (in counterweight systems)
  - Leave loose items on deck when loading weight
  - No climbing on guardrails
  - Load limit for loading bridge
  - Personal Fall Arrest System Required in this area
  - Keep gate/chain closed and latched at all times
  - One person at a time on ladders
  - Keep weight stacked evenly alongside of bridge
  - Stack weight on bridge no higher than toe boards
  - Temporary signage about status of linesets:
    - "Lineset 6 tied off to grid"
    - "Linesets 6 & 7 married"
    - "Lineset 6 temporarily out of weight"
  - Contact info. for manufacturer/installer of system

Fly Systems and Rigging Safety

- Fly System Operation
  - Batten loading safety
    - All batten attachments should be made with rated hardware and, in the case of lighting equipment (and wherever possible), rated safety cables should be utilized as a failsafe.
    - Battens should ***always*** be loaded at deck level (when the arbor is all the way at the grid).
    - Load battens ***before*** loading the corresponding counterweight to the arbor. ***Failing to do so will result in an imbalance of weight and a potential crash.***
    - Do not overload battens. Each batten is limited to the posted weight limit for the lineset.
    - Do not unevenly point load battens in between lift lines. Find a way to load near lift lines or to distribute the load evenly across a greater span.
    - Noticeable batten deflection indicates overloading and should be avoided.
    - Battens should have brightly colored ends or end caps to prevent accidental collisions.
  - Counterweight loading safety
    - Counterweight loading at the arbor should always take place at the loading bridge. There are a few exceptions when a small amount may be loaded at ground level, but these should only be employed when absolutely necessary and in the presence of a highly qualified supervisor.
    - Before ascending to a midrail or the loading bridge, empty all pockets and ensure no loose articles are on your person. The only loose items on the loading bridge should be the counterweights themselves.
    - Loading bridges must be equipped with adequate guardrails (see section on guardrails) with toe boards and fall arrest systems, where necessary.
    - Never stand on toeboards or railings to increase reach, unless attached to a fall arrest system (and avoid it even then).
    - Keep all ladder and access gates closed when working at the loading bridge.
    - Counterweights stored on loading bridge should be evenly distributed along the bridge and stacked below the level of the toeboard.
    - Always load the batten at deck level ***before*** adding counterweight to the arbor at the loading bridge. ***Loading the arbor first will result in a dangerous imbalance and the potential for a crash.***
    - Conversely, always unload the arbor first, ***before*** unloading the batten at stage level. Again, this maintains balance in the system and will prevent an out-of-weight batten and/or arbor from crashing.
    - Communicate clearly at all times throughout the weight loading process.

        - Ensure the fly rail and surrounding areas are clear and that access to it is prohibited during weight loading. Post signs as necessary to let people know as they enter the space during loading.
        - Once the rail is clear, let everyone in the space know that weight loading has begun by saying: "Loading weight on lineset 'x'!" Wait for a response before continuing.
        - Inform everyone that weight loading has been completed after the last weight has been loaded and the top plate has been lowered and secured: "Loading complete!"
        - Continue to communicate with those on the ground as weight is tested and adjustments are made.
    - ***Never*** move anything at the loading bridge level unless the area below is completely clear of other workers!
- Fly rail Operation
    - Only trained and supervised individuals may operate the fly system at the fly rail (a.k.a. "Pin rail" a.k.a. "Lock rail").
    - In single- and double-purchase counterweight systems, the rope locks and corresponding safety rings must be in place at all times except when an operator is actively and safely moving the lineset. In hemp/pin rail systems, the ropes should be properly tied off to the pin rail.
    - Before entering the fly rail, confirm that there is no one working at the loading bridge level.
    - Confirm that the lineset is balanced/ in weight.
    - Make a visual inspection of the lineset you are about to move before proceeding. Ensure that there are no entanglement hazards or obstacles in the path of travel.
    - Maintain a line of sight to the moving components if at all possible. If not, designate people to keep an eye on the movement and to communicate any potential problems quickly and effectively by saying "Hold!" when any issue arises.
    - Grasp the hand line (a.k.a. "Operating line" a.k.a. "Purchase line") firmly with one hand to ensure control once the rope lock is released.
    - Before removing the safety ring and releasing the rope lock, communicate loudly and clearly with all other workers in the area, informing them of the upcoming action. For example: "Lineset 6 coming in to the deck!"
    - Wait for an appropriate response from all workers in the area: "Thank you!" or "Thank you Lineset 6!"
    - Maintaining a firm grip on the hand line, remove the safety ring and release the rope lock slowly, being ready to re-engage it at any sign of imbalance.

- Once balance is confirmed, move both hands to the hand line and pull it in the desired direction, steadily and at an appropriate and controlled speed. Hand-over-hand pulling is best, if possible. Keep at least one hand at a time on the line until the move is completed.
- Slow the move as it approaches completion, especially if reaching the upper or lower limit of the lineset. This will prevent a minor crash as the arbor hits the top or bottom stop block.
- When the move is completed, re-engage the rope lock and replace the safety ring.
- In some rare instances, methods may need to be employed to lock or tie off an out-of-weight lineset at the fly rail. ***However***, this should only be attempted with a highly qualified supervisor present.

■ Fly Systems in Performance

- During technical and dress rehearsals, and throughout the run of a show, protocol for the moving of linesets changes out of necessity. The magic tends to be ruined if the audience hears, "Lineset 6 coming in!" during the performance.
  - ◆ Before the first technical rehearsal during which the fly system will be employed with performers and crew present on the stage, the stage manager or designated person of authority should explain the procedures to the cast and crew.
  - ◆ Practice each fly system shift in a controlled and methodical way during the first technical rehearsal so that all those nearby understand exactly what will be happening and when. Performers and crew must know exactly when and where to be (and not be) as these actions take place.
  - ◆ The speed at which fly cues need to happen will vary in each cue, but always decelerate at the end of the move, especially if the lineset will reach its upper or lower limit and may crash noisily.
  - ◆ An ASM or other designee should be in constant communication with the stage manager and should relay information about onstage readiness for fly system movements.
  - ◆ A typical rail communication in performance might look like this:
    - ➢ *SM: "Warning Rail 5" (about a minute prior)*
    - ➢ *ASM or Rail: "All clear for Rail 5"*
    - ➢ *SM: "Standby Rail 5" (about about 10 seconds prior)*

- ➢ *Rail: "Rail 5 Standing by"* (undo safety ring and release lock while maintaining control of the hand line)
- ➢ *SM: "Rail 5 GO"*
- ➢ *Rail: "Rail 5 Complete"* (once batten is in place and locked)

- ◆ Continue to rehearse the fly cues in a consistent manner throughout dress rehearsals, with the stage manager making calls to the fly rail.
- ◆ Designate ASMs or other spotters on the backstage crew (preferably on both sides of the stage) to alert the stage manager or fly rail crew of any potential issues or emergencies so that the action can be stopped as quickly as possible.
- ◆ Have an emergency plan in place so that the stage manager and crew know what to do in the case of a major malfunction.

➢ Inspections and Maintenance

- ■ Inspect permanent/system components regularly for wear and tear.
  - Ropes and cables should have no loose fibers, kinks, or abrasions.
  - Follow manufacturer guidelines concerning expiration dates on ropes, whose fibers will degrade over time with exposure to light, heat, and humidity.
  - Pipes should be straight and level.
  - All hardware should be free of damage and deformation, tightened and moused as needed.
  - Arbors should move freely in their tracks.
  - Arbors should be free of deformation and damage and should be fitted with spreader plates at appropriate intervals and locking collars above the top plate.
  - All blocks and pulleys should move smoothly and not rub on cables, with all hardware tightened.
  - Rope locks should be adjusted to hold a maximum of 50lbs of excess weight before slipping.
  - Rope lock safety rings are required for each lock.
  - Hand lines/Purchase lines should be tight, securely knotted at each end, and free from damage or excessive wear and tear.
  - Spike tape should be removed from hand lines regularly to keep it clean and the intent of the labeling clear.
  - In the case of motorized/automated components, a professional technician should be consulted for inspection and maintenance.

- In addition to rigging components, regularly check fly system work areas for cleanliness and sufficient lighting. This includes the fly rail, loading bridge, and any grid or catwalks accessible to workers.

- Fly systems should be inspected annually (ANSI E1.47-2017) by a qualified professional. For schools with limited funding, the USITT Rigging Safety Initiative is a tremendous resource. A professional inspection will come with a thorough report at the end, detailing any potential hazards/risks and needs for repair.
  - Fire curtains, where present, should be inspected annually and checked regularly for proper working order. Contact local authorities for specific requirements and regulations on testing and whether the curtain should be left open or closed when the venue is shut down at the end of each workday.
  - Smoke hatches, though separate from the rest of the fly system, also fall under rigging inspections. They should be professionally inspected at least every two years and tested regularly.
- Damaged or otherwise unsafe components must be taken out of service. Use physical means and signage to prevent access and clearly indicate that such components are not to be used.
- Use common sense when diagnosing potential issues with the fly system. If there is an abnormal noise (rubbing, grinding, clicking, rattling) discontinue use of the component until the problem has been resolved.

❖ **Rigging Safety**

➢ Training
- See above

➢ Inspections and Maintenance
- Inspect temporary ropes and cables prior to each use.
- Store rope, cable, and all related hardware in a clean, dry and secure location. Ropes are especially susceptible to degradation due to dirt, grime, and improper use.
- Discard/replace any equipment that is worn, damaged, or has been involved in a shock load incident.

➢ Rigging Hardware and Equipment
- All hardware used for overhead rigging should be rated and stamped with the WLL or SWL, as well as the manufacturer mark . ***Avoid hardware of unknown origin.***

- Use only hardware and attachment methods for which you have been trained, unless a qualified supervisor is on hand to ensure the proper hardware is selected and used appropriately.
- Remember that a series of connected rigging hardware is only as strong as its weakest component.
- Do not separate components of a piece of rigging hardware. For example, shackle bells/bows and pins should always be kept as an original pair.
- All threaded hardware (nuts, bolts, etc.) should be rated (at least Grade 5) and have a locking mechanism (lock washer, lock nut, etc.) to prevent unintended loosening.
- The use of advanced rigging techniques and equipment, including bridles, chain motors/hoists, truss assemblies, etc. should only be attempted by qualified professionals.

➢ Temporary Rigging

- *Non-professional theaters should not engage in temporary overhead rigging, if at all possible.*
- Any temporary rigging (pulleys or pick points from the grid, chain hoists, etc.) must be done by a trained and qualified individual with accurate and specific knowledge of all components.
    - Beams, structural steel, truss, and other designated rigging points must be rated for the desired load. If the weight rating is unknown, the rigging point ***should not be used***. If necessary a structural engineer may be employed if no documentation is available.
    - Pulleys and related hardware must be appropriately rated and compatible with temporary rigging points (beams, truss, etc.) and the cables or ropes with which they will be used.
    - All cables, ropes and attachment hardware must be appropriately rated. Again, the system is only as strong as its weakest component.
    - When using rope, remember that knots de-rate the rope's load carrying capacity significantly. The exact amount depends on the knot efficiency.
    - When in doubt, use a design factor of at least 5:1 for all components in temporary rigging installations.

Fly Systems and Rigging Safety

❖ Performer Flying

There are a few shows within the theatrical realm which all but require performers to rise above or descend to the stage in spectacular fashion. At times, spinning, flipping or tracking around the stage is also part of the desired effect. Other shows, including devised pieces, may also suggest or request such flying effects. ***In short, these effects which require performers to be lifted bodily off the stage through means of a flying rig are to be left to professionals only.*** *Those without specific, thorough, and comprehensive training in this area should not attempt such effects; the risks and potential liabilities are simply too great. If a non-professional company has chosen a show with a requisite performer flying effect, the services of a company or individual specializing in such effects should be contracted to set up, train, and possibly supervise the use of the rig with performers. For secondary school theaters, this is both an exciting and daunting prospect. From an educational standpoint, the learning and training opportunity provided by a flying professional is tremendous, but the financial commitment is significant and often prohibitive. All of these factors should be taken into consideration in the show selection process.*

- **For those who want to learn more about performer flying standards adopted by ESTA/ANSI, they are published online for reference:**
  ANSI E1.43 - 2016 : Entertainment Technology - Performer Flying Systems

- **For those who are ready to pursue a flying effect seriously, the following companies (among others) offer performer flying services:**
  - ZFX
    - https://www.zfxflying.com/
  - Tait Towers
    - http://www.taittowers.com/capabilities/performer-flying/
  - D2 Flying Effects (a division of PointWright Entertainment Rigging)
    - http://www.pwrigging.com/d2flying
  - Flying by Foy
    - http://flybyfoy.com/
  - On the FLY Productions
    - http://www.ontheflypros.com/flying-effects.html
  - Chicago Flyhouse
    - http://www.flyhouse.com/industries/performer-flying
  - POET Technical Services
    - https://poet.co/poet-technical/theatrical-flying

Fly Systems and Rigging Safety

❖ Additional Resources and Works Cited

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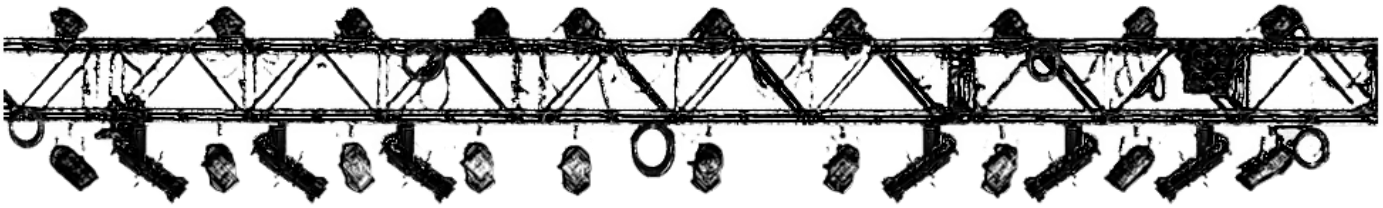

7. Electrical Safety

Working with electricity is dangerous. *(←**period**) It is critical to remember that the vast majority of electrical modifications or repairs must be carried out by a licensed professional. This alone will go a long way toward keeping you and those working in your theater safe around potential electrical hazards. That being said, electrical equipment is omnipresent and plays a big part in creating the magic in all areas of the modern theater. From lighting, sound and special effects, to the tools used every day in the production shops, we must be familiar with best practices regarding the use and maintenance of these systems and devices.*

❖ General Guidelines

- ➢ In most localities, the NEC (National Electric Code) is the authority when it comes to electrical standards. The NEC is part of NFPA (National Fire Protection Association) and is recognized by OSHA as the standards organization for this area of the industry.
  - ■ *NFPA 70 - NEC Article 520* is the section which covers most electrical standards specifically for the performing arts.
  - ■ Certain localities may have different or more strict regulations. Always check with local authorities to confirm.
- ➢ Only a licensed professional electrician may perform any work involving the infrastructure of the theater. This could include, *but is not limited to*, supply lines, breaker boxes, disconnects, permanent fixtures and receptacles, large/high voltage tools, dimming systems, etc.
- ➢ ABC Fire extinguishers (see section on fire safety) should be readily accessible and in good working order in areas where electrical equipment is in use. Only "C" type fire extinguishers are rated for electrical fires.
- ➢ Breaker boxes and other electrical panels must have clearance 30" to each side and 36" in front. *Recommendation*: tape out the areas which must remain clear with bright tape.
- ➢ Breakers should be protected (breaker box closable w/latch), and individual breakers should be clearly identified.
- ➢ All receptacles (outlets) and switches must have appropriate cover plates.
- ➢ Receptacles in wet or underground locations (near sinks, showers, in basements, etc.) should be GFCI protected.

- ➢ Electrical and lighting equipment must be kept away from combustibles and other flammable materials including:
  - Flammable liquid and gas containers
  - Sawdust
  - Soft goods
- ➢ As much as possible, use industrial grade electrical devices and accessories including:
  - Tools and devices (no $15 fog machines or $5 hot glue guns)
  - Cables and extension cords
  - Adapters and connectors

❖ Training

- ➢ Train all personnel who will work with electrical equipment on topics specific to electrical work. Document all training completed and keep documentation accessible.
  - Never work alone around electricity.
  - Only perform tasks for which you have been specifically trained.
  - Only perform work on devices and accessories which are entirely disconnected from the power source.
  - Know where primary power shut offs are, or have immediate access to someone who does.
  - Communicate clearly the work that is being done with all those in or near the workspace.
  - Immediately report incidents involving:
    - Damaged equipment (use lock-out, tag-out procedure)
    - Abnormal operation or malfunction (use lock-out, tag-out procedure)
    - Electrical shock injuries, no matter how mild
  - Have someone on hand trained in first aid for shock victims, including CPR.
  - Wear rubber-soled work shoes.
  - When working on lights overhead, apply all necessary safety practices (see sections on overhead work and fall protection).

❖ Grounding

- ➢ Electrical devices should be grounded, except in the case of double-insulated tools and devices.
- ➢ Grounded tools have a three-pronged plug which must be plugged into a three-pronged receptacle.
  - Never "defeat" the ground either by breaking off the ground prong or using an adapter.

- Discard or repair tools and cords on which the ground has been damaged or broken. Repairs should only be made by qualified professionals.

➢ Double insulated tools have two-pronged cords, but have an extra layer of insulation encapsulating the motor housing and including any grips or handles. This extra layer protects the user in the case of a short circuit or other malfunction

➢ NEC 520.81 relates to grounding of devices in the theatrical environment.

❖ Electrical Cords

➢ Cords and plugs should be inspected for good working condition upon each use.
- No nicks in insulation
- No exposed wires
- No taped wires
- No loose connections at plugs

➢ Extension cords are considered by OSHA (1910.305(a)(2)) to be "temporary wiring" and all applicable standards apply.

➢ Never pull on the cord to unplug it. This will damage the connection to the plug. Always pull on the plug, itself.

➢ Extension cords should not be plugged into surge protector strips.

➢ Keep extension cords out of pathways in work areas. Route and coil them so they are not trip or entanglement hazards.

➢ Neatly coil and store extension cords in a clean, dry area when not in use.

➢ Electrical cords/cables backstage:
- Should be routed neatly and taped securely, carpeted, or passed through a proprietary cable cover such as a "yellow jacket".
- Should have excess cable neatly coiled and placed out of the way.
- Should never be placed in exit pathways or through fire doors.
- Should be listed for "extra hard usage"NEC 520.68 (1)
- Should not be placed in the path of scenery without adequate protection - *Do not run over electrical cords with scenery!*

➢ Extension cords and electrical cables should be of appropriate type, gauge and length for the application.
- **Type** - The jacket/insulation of the cord will tell you its characteristics.
  - **S** - Indicates "Service" grade (Extra Hard Use). Flexible cord designed for general use up to 600 volts (unless followed by "J").
  - **SJ -** Indicates "Service Junior" grade (Hard Use), Flexible cord designed for general use up to or 300 volts.
  - **W** - Indicates the cord is rated for outdoor use.

        - **P** - Indicates parallel wire construction, used in air conditioner cords and household extension cords.
        - **T** - Indicates the cord jacket is made from vinyl thermoplastic.
        - **E** - Indicates the cord jacket is made from thermoplastic elastomer rubber (TPE).
        - **O** - Indicates the cord is oil-resistant.
    - **Gauge** - The jacket/insulation will also tell you the gauge (diameter/size) of the wires inside the cord.
        - For example: 12/3 means that there are three 12 gauge insulated wires inside the outer jacket.
        - The smaller the gauge number, the larger the wire.
        - Wire must be of sufficient size to carry the required amount of electricity (amperage) to the tool or device, so it is critical to use a cord that is of a large enough gauge to avoid overheating. The device will not work efficiently and the risk of fire increases substantially.
    - **Length** - The longer a cord is, the less efficiently it carries electricity due to voltage drop.
        - Use the shortest cord available that is of the appropriate type and gauge for the application.
    - See resources at the end of this section for guidance on appropriate cord gauges and lengths, depending on the current draw of the device.
    - Lamp or "zip" cords are almost never appropriate for use on stage, as they are low-capacity, ungrounded, and not very durable..

❖ **Stage Lighting Equipment**

- ➢ Inspect lighting equipment before each use. Make sure the device is disconnected from power and check that:
    - All connections are tight, both hardware and electrical
    - There is no visible damage and all components are accounted for
    - The device is clean and free of rust, dust and debris
- ➢ Each device should have an approved safety cable. Multiple cables may be necessary for larger devices such as moving lights and cyc/border lights.
- ➢ Cables feeding lighting equipment should be heavy duty (S or SJ type), 12 gauge, grounded, high temp. rated, and insulated with a non-asbestos jacket.
- ➢ Never place cables directly on or near lighting instruments or equipment.
- ➢ All metal-framed equipment should be connected to an equipment grounding conductor.
- ➢ Changing Lamps (incandescent)

- Ensure that the device is disconnected from power.
- Do not touch the glass of theatrical lamps. The oil from your skin will cause early and sometimes catastrophic failure. If you accidentally touch the glass, clean it with denatured alcohol before installing.
- Make sure the lamp is securely seated in its base.
- Remember, a lamp which has recently been on will be *very hot*. Give it time to cool down before attempting to remove or adjust it.

➢ Changing Connectors and Making/Using Adapters

- Ensure that the device is disconnected from power.
- Use only industrial-grade connectors, adequately sized for the maximum voltage and current possible for the device(s) that will be connected.
- If using adapters, two-fers, or multi-outlet devices, Do not reduce the current carrying rating of the plug supplying it. (NEC 520.69 (A)). In other words, don't connect a smaller cord/adapter to a larger one.

❖ **Dimmers**

➢ Dimmer racks must have 36" clearance in front.
➢ Do not overload dimmers. A dimmer's rating should be listed on the device, itself.
➢ Always remove power from dimmers before performing checks or maintenance.
➢ Always work with a partner when performing dimmer rack/module maintenance.
➢ Never place body parts near empty dimmer rack slots. Live electrical contacts will be exposed when dimmer modules are removed.
➢ Inspect and clean dimmer packs and racks regularly; change filters if necessary.
➢ Ensure good contact/installation of dimmer packs in the rack.
➢ Only licensed professional electricians may perform electrical work on dimming systems.

Electrical Safety

❖ Additional Resources & Works Cited:

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Electrical Safety

- Extension cord types and ampacity ratings, including voltage drop over length.

Cord Length, feet	Current flowing through cord			
	10A	15A	20A	30A
Cord Size = #16 gauge wire				
10	1.0 V (0.8%)			
20	2.0 V (1.7%)			
30	2.9 V (2.4%)			
40	3.9 V (3.3%)			
50	4.9 V (4.1%)			
100	9.8 V (8.2%)			
Cord Size = #14 gauge wire				
10	0.6 V (0.5%)	0.9 V (0.8%)		
20	1.2 V (1.0%)	1.8 V (1.5%)		
30	1.8 V (1.5%)	2.7 V (2.3%)		
40	2.4 V (2.0%)	3.6 V (3.0%)		
50	3.0 V (2.5%)	4.6 V (3.8%)		
100	6.1 V (5.1%)	9.1 V (7.6%)		
Cord Size = #12 gauge wire				
10	0.4 V (0.3%)	0.6 V (0.5%)	0.8 V (1.7%)	
20	0.8 V (0.7%)	1.1 V (0.9%)	1.5 V (1.3%)	
30	1.1 V (0.9%)	1.7 V (1.4%)	2.3 V (1.9%)	
40	1.5 V (1.3%)	2.3 V (1.9%)	3.1 V (2.6%)	
50	1.9 V (1.6%)	2.9 V (2.4%)	3.8 V (3.2%)	
100	3.8 V (3.2%)	5.7 V (4.8%)	7.7 V (6.4%)	
Cord Size = #10 gauge wire				
10	0.2 V (0.2%)	0.4 V (0.3%)	0.5 V (0.4%)	0.7 V (0.6%)
20	0.5 V (0.4%)	0.7 V (0.6%)	1.0 V (0.8%)	1.4 V (1.2%)
30	0.7 V (0.6%)	1.1 V (0.9%)	1.4 V (1.2%)	2.2 V (1.8%)
40	1.0 V (0.8%)	1.4 V (1.2%)	1.9 V (1.6%)	2.9 V (2.4%)
50	1.2 V (1.0%)	1.8 V (1.5%)	2.4 V (2.0%)	3.6 V (3.0%)
100	2.4 V (2.0%)	3.6 V (3.0%)	4.8 V (4.0%)	7.2 V (6.0%)

8. Costumes, Wigs, and Makeup Safety

Though many safety considerations from other areas of theater overlap and apply to work in and around the wardrobe and makeup departments, the use of specialty equipment, materials and techniques in these areas warrants special consideration. Costumes and related crafts are often created in some of the smallest workshop areas using some of the most dangerous chemicals used by theatrical artists, so it is critical to make the safety and health of the workers a primary concern. In addition, many items discussed in the following section will be not only near technicians and performers but in intentional, intimate contact with their bodies. As such, the potential risks and hazards of their use must be well understood.

❖ General Guidelines

- ➢ Safety protocols specific to these areas should be agreed upon, documented, and posted, as necessary.
  - ■ Emergency procedures and contacts should be clearly posted in all work spaces.
  - ■ Workers in these areas must be appropriately trained on safety policies and procedures. Documentation of trainings should be kept accessible.
  - ■ Incident reports should be filled out, just as in other areas.
- ➢ The costume shop should be outfitted with a first aid kit containing all normally stocked supplies, as well as extra:
  - ■ Burn spray/gel for accidents with pressing and steaming equipment
  - ■ Band-aids for minor accidents involving needles, scissors, etc.
  - ■ Antiseptic wipes for the same
- ➢ Workshops and fitting/dressing rooms often have limited space. Be aware of your surroundings at all times and how other workers and projects present potential hazards.
- ➢ Beware of fatigue and exhaustion.
  - ■ Take breaks when working on projects for long periods of time.
  - ■ Be extra diligent and stay focused when doing repetitive tasks.

- Do not continue work if you are insufficiently rested or nourished. Arrange a break with a supervisor.

❖ Design & Construction Considerations

➢ Designers must be intimately familiar with the script, director's vision, and other designs (scenic & lighting primarily), to prevent potentially hazardous conflicts. Costumes and accessories should not:
- Restrict a performer's breathing
- Restrict a performer's ability to move safely as required by blocking, physical action (including choreography), scenery, and backstage configuration
- Pose a trip hazard (including the type of shoes worn)
- Have components which might prick, jab, pinch, scrape or otherwise injure the performer
- Be susceptible to ignition or combustion if accidentally exposed to a flame or high heat source, such as an incandescent footlight

❖ Other Performer Considerations

➢ Allergies
- Have a section on fitting sheets asking about allergies to fragrances, dyes, wool, latex, animal hair and other materials used in costumes, crafts, wigs, and makeup.

➢ When fitting actors, take extra care pinning and cutting while they are wearing the costume.

➢ Never iron or steam a garment when it is being worn.

❖ Specialty Equipment

➢ *Manual Devices*
- Scissors, needles, presses, grommeting tools and other manually operated equipment must be used with care. Though they typically pose only a minor threat to workers, their frequent use makes them ideal candidates for complacency, which often results in accidents.
- Use thimbles for millinery and other projects requiring the use of thick/dense materials.
- Needles that have been exposed to blood or other bodily fluids should be disposed of in a hard container so that they cannot poke someone else.

Technically, they should be placed in a medical biohazard container for sharp, contaminated objects. Follow bloodborne pathogen procedures.

- ➢ *Sewing Machines*
  - Always use the correct size/type of needle.
  - Keep body parts clear of moving parts, especially the needle.
  - Wear eye protection for wire work and when machine sewing objects with hard components that could break the needle and send it flying.
- ➢ *Irons & Steamers*
  - Both have the potential to cause severe burns when used improperly or carelessly.
  - Never leave an unattended iron or steamer near combustible materials.
  - Always disconnect from electricity when not in use.
  - Domestic vs. Industrial irons
    - Domestic irons sit upright and have a reservoir for water that may be left filled between uses.
    - Industrial irons sit face down on ironing hot plates and should have their steam tubes drained daily to prevent rust.
    - Never sit an industrial iron face down without a hot plate. It will quickly overheat other materials and potentially cause a fire.
  - Steamers
    - Steam may not always be visible.
    - Never place body parts in front of a steamer.
    - Always hold steamers by designated handles.
    - Never steam garments while they are being worn.
    - Sometimes steam is invisible. Treat the steamer as if it is on unless you know otherwise.
    - Always hold steamers by designated handle(s).

❖ Care and Maintenance

- ➢ Performers should be trained to care for their own costumes and accessories. They should know:
  - How and where to store them post-performance
  - When and where to send garments to launder
  - How to report damage or malfunction
  - Any special care procedures that will not be taken care of by technicians

Costumes, Wigs, and Makeup Safety

❖ Make-up

- ➢ Do not share makeup - one kit per performer
  - ■ Used makeup can carry bacteria, viruses, fungus, etc.
- ➢ Replace old makeup.
- ➢ Only use products approved for cosmetic use.
- ➢ Use products only as directed!
- ➢ Ingredients should be listed on kits and FDA approved.
- ➢ Allergies
  - ■ Types and severity of reaction are unique to each individual.
  - ■ Watch for warning signs:
    - Rash
    - Itching
    - Swelling
    - Redness
  - ■ Notify costume/make-up designers and artists as early as possible about potential allergic interactions.
- ➢ Harsh chemicals
  - ■ Solvents like peroxides, hydroxides, alcohol and acetone, which are used for bleaching, softening, and removal of certain make-up products can be very irritating to the skin, eyes, and mucous membranes. Use sparingly and briefly. Moisturize afterward.
- ➢ Beware of effects of long-term exposure through:
  - ■ Inhalation of powders, mists, sprays containing chemicals. Ensure adequate ventilation in areas where exposure to these types of hazards are common.
  - ■ Penetration of chemicals through the skin into the bloodstream.
  - ■ Ingestion of chemicals in lipsticks or when other makeup products come into contact with the mouth.

❖ Dyes, Paints, Adhesives, and Other Chemicals

- ➢ Supplies which create dangerous tactile (caustic liquids) or airborne hazards (particles, fumes, vapors) must be used only by adequately trained workers using all appropriate safety protocols.
- ➢ Any combustible supplies should be secured in a rated flammables cabinet. This could include liquid dyes, spray paints, cleaners, solvents, etc.
- ➢ *Whenever possible, use chemicals that are less toxic*. Research alternative solutions, especially when working with chemicals that require industrial-grade personal

protection and ventilation systems.

- *Always* read manufacturer instructions, including safety data sheets, before using *any* product.
- *Never* use unlabeled products or those with unknown chemical composition.
- Adequate ventilation must be present in workspaces at all times
  - Opening a window or relying on a standard building ventilation system to remove toxic substances in the air is not an adequate measure of protection.
  - If adequate interior ventilation is unavailable, you may be able to complete the task outside. Be cautious and use common sense.
  - Clothes dryers must be adequately vented, as the "lint" fibers themselves can prove toxic and cause respiratory problems.
  - See Hazardous Materials section for more info. on ventilation.
- Always use appropriate PPE with hazardous materials (see PPE section for more info.).
  - Respirators (particulate or chemical cartridge-based) appropriate for the materials used. Always follow guidelines set by the material manufacturer.
  - Gloves should be worn any time caustic chemicals or industrial strength adhesives are in use. Latex, nitrile, neoprene, or vinyl gloves may be appropriate, depending on the situation, but you should check with glove manufacturers to be certain when using toxic chemicals.
  - Don't forget eye protection (preferably goggles) around liquids or airborne particles/fumes which could cause irritation.
- Watch for symptoms of short- and long-term exposure to toxic chemicals and seek medical attention if any occur. These could be warning signs or indications of potentially larger health problems caused by exposure:
  - Headaches
  - Dizziness
  - Breathing problems
  - Skin irritation
  - Abnormal fatigue
  - Digestive problems
  - Depression
  - Memory issues

❖ Additional Resources

➢ *Websites*

- OSHA 29 CFR 1910.1030 - Bloodborne Pathogens. (n.d.). Retrieved from https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9806&p_table=STANDARDS

➢ *Books*

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- Dryden, D. M. (1993). *Fabric painting and dyeing for the theatre*. Portsmouth, NH: Heinemann.
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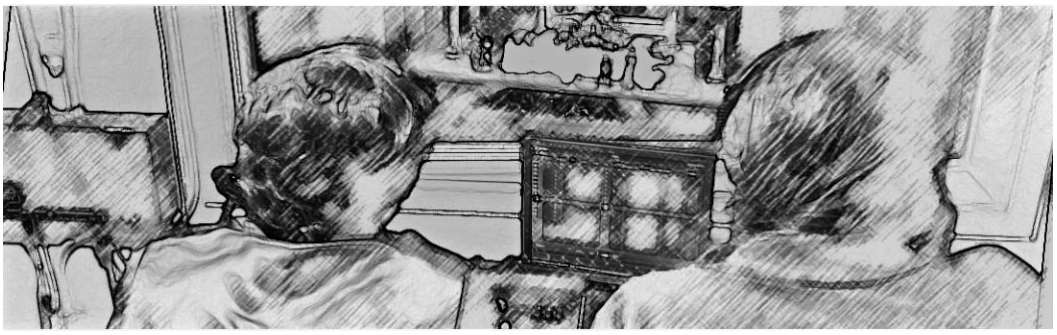


9. Crew & Performer Safety

After weeks or months of preparation, there comes a time when every aspect of a production is brought into the performance space and coordinated through load-in, technical, and dress rehearsals. Though many of the same practices and procedures for safety are relevant, this period brings with it a new set of goals and, usually, a new group of people who must collaborate safely and effectively to achieve them. Though the cast and crew will have very different roles during the show itself, it is critical that they work together and be on the same page as they navigate the challenges of moving scenery, moments of sudden and complete darkness, and the unknowable stumbling blocks which are part of the thrill of live theater.

❖ Working Backstage

- ➢ Personal Preparedness
  - ■ Apparel & Accessories
    - Similar to work in a production shop, backstage apparel should be comfortable and practical, the major caveat being that it must also be black (usually).
    - Avoid loose or dangling clothing or accessories.
    - Wear sturdy, closed-toe shoes.
    - Ensure that you have adequate pockets or belt-mounted pouches.
    - Utilize a sturdy belt for headset beltpacks and accessory pouches.
    - Carry a small flashlight (possibly gelled blue) and a good multitool (unless prohibited) for quick fixes.
    - Keep a checklist of responsibilities and timing of duties on your person at all times.
    - Always carry a pen/pencil and a watch or phone clock.
  - ■ Flexibility
    - Backstage crew must be ready to problem-solve quickly and in a clear-headed way at all times, keeping their own safety and the safety of those around them as top priority.

- Official backup plans should be in place for all situations which are ***likely*** to arise during live performance, but crew members should be ready to deal with unforeseen circumstances and adjust accordingly at all times.

■ Mindfulness
- A great crew member solves problems before or as they happen, not after they have caused collateral damage.
- Crew members should strive to be respectful and as considerate as possible of the needs of others working in the space, including performers and other crew members. Always remember that theater is a collaborative art and works best when each person involved supports all others.
- Know what is going on around you at all times and anticipate problems before they occur. Take the least invasive and most effective steps to resolve them.
- Remember your limits and those of the rest of the crew. Do not attempt any tasks for which you are not adequately prepared or equipped.
- Know that other people may ***not*** know what is going on at all times. Be ready to inform them and keep them safe. This might be as simple as being ready to pull out a flashlight quickly so a performer doesn't trip on a cord running to a temporary scenic unit.

➢ Verbal Communication

■ Establish a protocol so that effective lines of communication remain open during technical rehearsals and performances.
- Means of communication: Headsets, walkie talkies, intercoms, etc.
- Chain of command for situation management: Usually the stage manager has final say during performances, unless the stage manager is a student under teacher supervision.
- Train users on effective backstage communication methods.
  - ◆ Identify yourself and the intended recipient.
  - ◆ State the message as clearly and concisely as possible.
  - ◆ Respond in kind, including acknowledging receipt of message.
  - ◆ Example:
    - ➢ *Rail*: Rail to SM
    - ➢ *SM*: This is SM
    - ➢ *Rail*: Downstage scenic unit is obstructing Rail cue 6.
    - ➢ *ASM*: This is Deck ASM. Deck crew is working to clear unit.
    - ➢ *SM*: Thank you Deck. Holding. Please advise when clear.
    - ➢ *ASM*: Obstruction is clear.
    - ➢ *Rail*: Rail confirms. Thank you.

- ➢ *SM*: Thank you. Standby Rail 6
- ➢ *Rail*: Rail 6
- ➢ *SM*: Rail 6 GO.

- ◆ Train crews to not chatter idly on headset or other communication system. Lines should remain open as much as possible in case of emergencies. Crew members should remember that anyone may be listening in on the intercom system at any time, so keeping comments respectful and professional is critical.
- ◆ Train crews to remain silent when in standby to prevent accidental cue actions.

- ● ***Look out for each other and the performers.*** Respectfully inform and educate whenever there is an issue. Often this will come in the form of a performer or crew member watching the show or chatting with other company members in backstage areas which should remain clear and/or quiet. If the issue persists, involve the stage manager or a supervisor.

➢ Written Communication

- ■ Stage managers or other supervisors should create and/or post documents which help convey relevant information between crew and performers. Examples could include:
  - ● Emergency contact numbers
  - ● Maps of egress plan
  - ● Signs noting locations of first aid, fire extinguishers and alarm stations
  - ● "Backstage access: Authorized personnel only"
  - ● Cast and Crew Sign in sheets
  - ● Pre-show and Shutdown checklists
  - ● "Caution: Trip hazard/Open Pit/Trap, etc."

➢ Pathways

- ■ All backstage pathways to be used by crew and performers should remain clear and free of impact/trip/slip hazards.
  - ● Scenic or lighting elements should be removed from potential impact zones (especially where people could hit their heads) or clearly marked and adequately lighted.
  - ● Electrical cables should be securely taped, carpeted, etc. in the least intrusive manner possible. Mark and light these if they are in a common pathway and there is any risk of tripping. Consolidate cable runs as much as possible to limit the number, and keep them as out of the way as possible.
  - ● Holes, traps, open floor pockets, etc. should be closed or cordoned off if they pose a potential risk.

        - Be aware of leaking fog/haze machines, spilled prop. liquids, etc. which could become slip hazards.
    - Mark out pathway boundaries if possible/necessary with paint or tape on the floor.
    - Ensure that all pathways are wide enough for costumed actors to pass freely without risk of entanglement.
    - If a pathway is temporarily blocked by moving scenery during the show, have a crew member with flashlight on hand to redirect anyone who needs to navigate the area.
    - ***Never*** block doors or exit pathways backstage.
    - A crew member should be assigned by stage management to check pathways pre-show.
- Visibility
    - Darkness is typically a necessity in the theater, but that doesn't mean it should be allowed to be hazardous. Steps must be taken to ensure that crew and performers can see what they are doing to avoid hazards and perform their duties.
        - During work sessions or technical rehearsals, if the lights will be turned out suddenly, call out "Going Dark!" and wait for "Thank you" from all in the space before turning lights out. Crew members may be backstage on ladders or in other positions which would render them unsafe in the dark.
        - Stage management stations and the fly rail should be illuminated adequately for reading, as both jobs require it during a performance.
        - All backstage crew members should carry flashlights for as-needed situations.
        - Clip lights of varying types are useful in lighting small areas backstage in a semi-focused way. These are often called "running lights" and may need to use a lower wattage bulb and/or be gelled (usually blue) to limit light bleed that may be seen by the audience. When using incandescent bulbs in clip lights, be aware that they will get hot and should not be placed near combustibles.
        - Brightly colored spike tape and/or glow tape may be used to mark hazards and reference points, including pathways, platform and step edges, the ends of railings, and other protruding scenic elements.
        - ***A note on glow tape***: Glow tape is great for marking platform and step edges onstage, so that actors have reference points to quickly exit after a blackout, but it is almost useless in the perpetual darkness backstage. Glow tape requires bright light to "charge" and will only emit light for a short period of time once in darkness. When glow tape is inadequate or impractical backstage, use running lights.

Crew & Performer Safety

- ➢ Cleanliness & Order
  - ■ It is critical to keep backstage areas clean and free of clutter, even more so than in production areas, because of the added element of darkness.
    - All items required backstage (props, set pieces, lighting and sound equipment, etc.) should have designated and demarcated positions. This way, the crew and performers can become accustomed to their locations and will know how to safely access certain areas and avoid others.
    - Keep all items outside of designated pathways. When scenic pieces must be moved into pathways to access or exit the stage, provide alternate safe routes for those moving through the area.
    - All backstage and onstage areas, including scenic units, should be thoroughly swept and sometimes wet-mopped before rehearsals and performances. This is especially critical in dance concerts and other performances in which performers may not have sturdy footwear, if any at all. Generally, stage management works with crew members to assign and perform these pre-show cleanings, to ensure that no areas are skipped.
  - ■ Keep flammables away from heat sources.
    - Costumes, props, etc. should be constantly monitored, as their position backstage may change numerous times during the performance.
    - Be especially careful of lighting instruments in the backstage area which may be off at one moment and on the next.
- ➢ Walkthroughs and Training
  - ■ Safety Walkthrough for crew & performers
    - The TD or stage manager will lead the walkthrough, usually before first rehearsal in the performance space. This constitutes a training session for all involved.
    - Performers should pay close attention during this time and take note of anything that will directly affect them during technical rehearsals and performances.
    - The safety walkthrough should identify proper backstage pathways, exits, first aid, and whom to see in case of emergency.
    - Any potential hazards in the performance space which will remain in place should be pointed out during the walkthrough:
      - ◆ Steep steps
      - ◆ Ramps
      - ◆ Cable paths on floor
      - ◆ Lighting booms or other equipment
      - ◆ Traps, open pits, or other holes

        - Raised platforms without guardrails
        - Speakers (potential for hearing loss)
        - Lights (potential for vision loss or temporary blinding)
    - The safety walkthrough is an excellent time to let performers know who their crew liaison will be, should they have a question or concern backstage during rehearsals or performances.
    - In addition to rehearsal and performance information, the safety walkthrough should include instructions for cast and crew about what to do in an emergency situation, such as a fire or shelter-in-place event. For crew, this may or may not include assisting the audience in a timely and safe exit.
- Backstage training for performance
    - Stage management must ensure that every crew member is clearly assigned duties both before, during and after the performance. Crew members are then responsible for completing assigned tasks in a safe and professional manner.
    - A thorough inspection and, if necessary, repair of all elements used in performance should be completed by designated crew members prior to each rehearsal or performance. The stage manager should ensure that these checks have been completed.
        - Check props and scenic units for damage or excessive wear.
        - Check moving units for proper functionality.
        - Test all flying scenery which will move during the show.
        - Test all special effect equipment for proper working order.
        - Ensure that all backstage lighting, including exit signs, is working properly.
    - Each crew member and performer must be aware of when and where they should and should not be during the show. They should remain clear of scenery pathways and only use pathways when necessary. Designated crew break areas and meeting places may need to be set by stage management.
    - Crew members should know the backstage chain of command and whom to see for each type of situation.
    - Crew members should know the locations of first aid kits, fire extinguishers, and fire alarms, as well as fire curtain operation and procedures, if applicable.
    - Crew members should be trained in how to politely and professionally deal with unauthorized personnel in the backstage area, and whom to see if special situations or difficulties arise with such persons.

Crew & Performer Safety

- Shutdown Procedures
  - A stage manager or other designee must ensure that all end-of-day procedures are followed to keep the theater in a safe state between occupancies. These procedures should include:
    - Turning off and/or disconnecting power from stage and running lights, effect devices, sound systems and any other potential heat sources. Only ghost lights, exit lighting, and other safety lighting should be left on when the theater is unoccupied.
    - Props, costumes, and accessories stored/secured appropriately.
    - Dressing rooms, green rooms, and other backstage areas should be inspected for good condition, checked for devices that might have been left on (curling irons, etc.), lights turned off, and doors locked.
    - All areas of the stage, including the orchestra pit and fly rail, should be returned to a safe state and inspected by designated individuals. Any areas requiring temporary railings, stanchions or caution tape should be restored.
    - The fire curtain should be closed while the theater is unoccupied, if it is equipped to do so. See local authorities to confirm.
    - The ghost light should be placed in designated spot and illuminated.
    - All restricted access areas (often including the entire theater) should be secured to prevent access by unauthorized personnel.
    - Any security systems should be activated by the last person leaving the building.

Crew & Performer Safety

❖ Performer Safety

- ➢ Personal preparedness
  - ■ Performers should be informed of the specific physical and environmental demands of each production from the outset so that they can prepare and condition themselves for the role, or turn it down if appropriate.
  - ■ Adequate training by a qualified individual must be provided for all conditions and demands which require special instruction or consideration. These include but are not limited to:
    - Physically demanding dance/choreography sequences
    - Fight scenes which may require special training and conditioning
    - Specialty devices (roller skates, stilts, unicycles, etc.)
    - Raked stages
    - Performer flying, aerial work, stunt falls, or work at heights requiring PPE
    - High levels of noise
    - Bright lights
    - Abnormal temperatures or humidity levels
    - Potential allergens in the environment, including atmospherics, animals, food, natural fibers in costumes and set pieces.
  - ■ Once informed of all potential demands and environmental factors, performers must either take the necessary steps to prepare or step down, if necessary.
  - ■ Adequate warm-up time and practice sessions must be built into the daily schedule for specialty sequences which involve specific physical risks, including injury or strain.
- ➢ Rehearsal Apparel
  - ■ Rehearsal apparel should be practical and comfortable, as much as possible.
    - No bare feet or sandals should be allowed on stage unless approved by the stage manager.
    - Use specialty shoes such as heels only after a safety walkthrough and confirmation from stage management that potential hazards have been minimized.
    - Performers should not wear loose or flowing clothing or jewelry unless approved by stage management for rehearsal use.
- ➢ Costume, Makeup, Wig Hazards
  - ■ Remain alert to the possibility that costumes could pose a hazard backstage and notify wardrobe crew or a stage manager of any potential issues, including:
    - Not enough room for quick changes
    - Entanglement or trip hazards (including shoes or the costume itself as a trip hazard)

- Pathways that are too narrow
- Heat sources too close to costume storage areas or performer pathways

■ If responsible for your own costume, ensure that it is properly put away and not thrown down haphazardly backstage or in a dressing room.

■ Notify wardrobe and/or makeup supervisor early in the rehearsal process of potential allergies which may be relevant.

■ Double check that costumes and wigs have been properly cleaned or sanitized before use.

➢ Hazard Awareness for Performers

■ Safety Walkthrough

- See above section

■ Tech. Rehearsals

- As technical elements are integrated into the production, performers will be made aware of other hazards in the performance space, which they must then integrate with the knowledge gained during the safety walkthrough.
- Stage management or crew members will inform performers during these rehearsals about scenic movements, lighting and sound elements, and other effects newly present at during this time.
- Performers should be prepared to remain still and quiet for long periods of time during tech. rehearsals as technical elements are integrated, troubleshot, and practiced.
- It is the responsibility of the performer to take all new information into account, especially with regard to specific hazard avoidance on and offstage. See the section below on Typical backstage and onstage hazards for examples.

■ Mindfulness

- In addition to the specific hazard awareness training mentioned above, performers should remain alert and focused at all times, keeping in mind that there is always a chance certain hazards were not made clear or are not expected. The next section contains examples.

❖ Typical Backstage and Onstage Hazards

➢ People as Hazards

■ Distracted people

- Unfortunately, this hazard is all too common, especially with younger performers and crews. Generally, stage management is responsible for keeping distractions in check in a courteous and professional manner:

- Socializing backstage instead of staying focused
- Watching the show from the wings, forgetful of what is going on backstage and how they may get in the way
- Cell Phones, etc. - any distracting devices should not be allowed backstage except in special circumstances (an ASM taking notes on a tablet, for instance. or using the phone as a timer)
- Performers "in the zone" and not mindful of their surroundings

- Uninformed people
  - In a perfect world, there would be no uninformed people on stage or in the backstage areas. Unfortunately, it does happen from time to time and those who *are* informed must be ready to deal with the possibility. This may be as simple as an orchestra member who walks through the wing to access a bathroom or a substitute dresser who hasn't had a chance to practice being backstage during major scene shifts.

➢ Fall Hazards

- Many fall hazards exist in performance spaces that do not fall under OSHA regulations for general industry because of the special nature of theater performance spaces. Guardrails meeting general industry OSHA standards (see section on fall protection) should be used backstage at all times, but they may not be aesthetically or practically appropriate on the stage itself. ESTA/ANSI have adopted standards to fill this void which cover special fall hazards present in theaters.
- Fall hazards may need to be dealt with differently depending on what is happening in the theater at a particular time. Different protocols must be implemented for these varying situations:
  - During load-in
  - During technical rehearsals when people may be traveling from the house to the stage frequently
  - During a performance with audience present
  - When the theater is shut down and darkened
- Onstage and backstage fall hazards and potential measures of safety
  - Falls from the stage into the orchestra pit or audience:
    - Performance Conditions
      - ➢ Train performers and crew to stay at safe distance and do not block any action close to the edge.
      - ➢ Provide clear markings or illumination at a safe distance from the edge.
      - ➢ Escort audience members who go on stage.

- ➢ Use physical scenic barriers blocking access to the edge, if appropriate.
- ➢ Install specialty fall netting in the orchestra pit.

◆ All Other Times

- ➢ Keep fire curtain closed, if and when possible.
- ➢ Place physical barriers with stanchions/rope, caution tape, etc. wherever edge hazards are present.
- ➢ Use a ghost light any time the theater is dark.
- ➢ Implement removable railing at the stage edge.
- ➢ Install specialty fall netting in the orchestra pit.
- ➢ Post signs indicating the nature of the hazards in each area.

● Falls into traps or other holes in the stage

◆ Performance Conditions

- ➢ Train performers and crew to stay at a safe distance and do not block any action close to the edge when trap is open.
- ➢ Inform performers and crew about times when the trap(s) will be open and closed.
- ➢ Provide clear markings or illumination at safe distance from edge.

◆ All Other Times

- ➢ Place physical barriers with stanchions/rope, caution tape, etc. wherever edge hazards are present.
- ➢ Use a ghost light any time the theater is dark.
- ➢ Install removable railings around open traps.
- ➢ Post signs indicating the nature of nearby hazards.
- ➢ ***Do not leave an open and unguarded trap accessible and unattended.***

● Falls from raised areas of the stage onto lower areas

◆ Performance conditions

- ➢ Train performers and crew to stay at safe distance and do not block any action close to the edge.
- ➢ Provide clear markings or illumination on edges, visible at all times people may be on platforms or other raised areas.
- ➢ Install railings, where appropriate, but do not let performers believe that a non-regulation railing will protect them from a fall.
- ➢ Never obscure fall hazards onstage with curtains or other barriers unless that barrier, itself, constitutes fall

protection. Fall hazards must be clearly visible to all who may encounter them.

- ➢ Do not place edging boards on the perimeters of raised platforms, as these may cause tripping and be an even greater hazard.

- ◆ All other times
  - ➢ Rope off raised areas which should not be accessed.
  - ➢ Train crew who work on raised platforms about the associated hazards.
  - ➢ Have crew use fall protection PPE when appropriate.
  - ➢ Post signs indicating the nature of nearby hazards.

- ➢ Typical Scenic Hazards
  - ■ Stairs
    - Stairs should not be too steep or shallow unless absolutely necessary. In these cases, special training should occur before use. Generally, the rise and run of a stair should add up to 18", with the rise being no greater than 10". A "proper" staircase has a 7" riser and 11" tread.
    - Stairs should always have a regular rise and run that doesn't vary. Otherwise, they pose a great tripping hazard.
    - Backstage/Escape stairs should be adequately lighted and have handrails of adequate height and sturdiness. See section on fall protection for more information on appropriate guardrail specifications.
    - Onstage/Aesthetic stair rails should either follow OSHA railing specifications (see fall protection) or it must be made clear to all using the staircase that the railing is not to be considered fall protection and should not be leaned on with an expectation of safety.
  - ■ Ramps/Rakes
    - Keep in mind that working or performing on a ramp or raked stage involves more physical exertion, balance and focus. In short, they are a more strenuous environment in which to work, and should only be used if no simpler solution is available. Actors should have special training and additional rehearsal time to prepare and condition themselves for work on a raked stage.
    - Ramps and rakes complicate virtually every other technical element that a performer may deal with. Special consideration must be given to all of the following if a raked stage is being considered.
      - ◆ Floor treatments (slip/trip hazards) and whether specialty anti-slip textures or finishes should be applied

- Costumes (especially footwear with high/spiked heels or slippery soles)
- Props that may roll, tumble, or topple
- Moving or tipping set pieces
- Lighting which may affect vision
- Atmospheric effects that may lower visibility or leave residue on the raked deck, creating a slip hazard
- Any element an actor carries or moves which may throw him/her off balance

- Clearly mark or otherwise make clear the edge of the raked stage or ramp, to prevent tripping or falling.
- When working on rakes or ramps, use counter-rakes if ladder use is necessary. Do not use a ladder on any type of slanted surface.

- Slick surfaces
  - Make every effort to keep surfaces clean and dry.
  - Clean up spills of any nature promptly.
  - If surfaces are inherently slippery or treated with a slick substance and this cannot be changed, all who walk on them must be properly trained and rehearsed to interact with the surface safely.
  - Refer to ESTA/ANSI E1.34 - 2009 (R2014) for more detailed information on slippery surfaces and safety protocol.
- Stage Machinery
  - Similar to the safe movement of scenery by crew during scene changes, any time stage machinery is used (automated or manually driven) extra care must be taken because of the presence of moving parts.
  - Only trained personnel should operate stage machinery.
  - Safe pathways around all moving parts and components must be clearly marked and lighted adequately.
  - Train actors and crew who will be near the machinery. They should know:
    - When it will be used
    - How it works (basically)
    - How to avoid dangerous components and moving parts
    - Whom to see with questions or concerns

➢ Hazards related to special effects and stage combat
- See next section

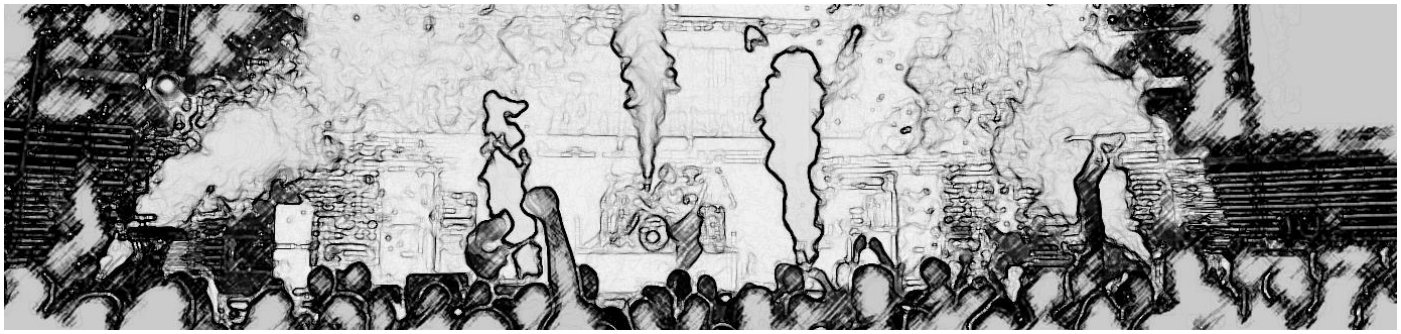
❖ Additional Resources

➢ *Websites*

- ESTA/ANSI Standards for Raked Stages (scroll to standard ANSI E1.60 - 2018). (n.d.). Retrieved from https://tsp.esta.org/tsp/documents/published_docs.php
- ESTA/ANSI Onstage Fall Protection Standards (standard ANSI E1.46 - 2018). (n.d.). Retrieved from https://tsp.esta.org/tsp/documents/published_docs.php
- ESTA/ANSI Floor Slipperiness Standards (standard ANSI E1.34 - 2009 (R2014)). (n.d.). Retrieved from https://tsp.esta.org/tsp/documents/published_docs.php
- Event Safety Alliance Website. (2019, April 2). Retrieved from http://eventsafetyalliance.org

➢ *Books*

- Kincman, L. (2017). *The stage manager's toolkit: Templates and communication techniques to guide your theatre production from first meeting to final performance*. New York, NY: Routledge.
- Gillet, C., & Sheehan, J. (2017). *The production manager's toolkit: Successful production management in theatre and the performing arts*. New York: Routledge.



10. Special Effects & Stage Combat

Many spectacular effects in theater come with their own sets of risks for performers, crew, and even audiences. Consider the risks and safety measures needed before employing any of the following. Inform/train crew and performers on the presence of any of these hazards and any necessary safety protocol. ***Inform audiences both in writing (signs on entrance doors, notes in program) and in pre-show announcements if any effect will be used which poses a potential threat to any audience member.***

❖ Typical Special Effects and Potential Associated Hazards

- ***Strobe lights*** - These may cause headaches, seizures, flicker vertigo, and even atrial fibrillation in those suffering from epilepsy and other similar conditions. Inform performers and crew members prior to usage during rehearsal. Follow emergency protocol if any person exhibits an adverse reaction to the strobe lights.
- ***Lasers*** - Devices emitting laser beams should never be pointed in such a manner that the beams may directly contact the eyes of performers or audience members. Notify performers if this is a possibility and how to ensure they avoid eye contact.
- ***Projectors*** - Projections are often used as scenic elements, creating the possibility of bright light focused directly through an actor's field of vision. Whenever possible, angle projections so that they do not shine directly in anyone's eyes. If this is unavoidable, train actors on the presence of projections and how to avoid looking directly at them. This may involve the director, as blocking may be an issue.
- ***Moving Lights*** - Any lighting instruments which move automatically present a potential impact hazard to performers and crew if placed on the stage deck or in low-hanging positions. The movement of the lights may pose a trip or entanglement hazard. They may also come on at full brightness in any given direction, so performers and crew must be made aware of this possibility and any specific instances of moving light use that could create a temporary blinding hazard.
- ***Water Effects*** - These may spill, causing slip hazards for those on stage. They may pose an electrical shock hazard as well. *Never use water effects near electrical devices or receptacles!*

- ***Aerotechnics*** - The primary hazard associated with these effects is the compressed air which powers them. This pressure can both eject projectiles at a high rate of speed or fail in a catastrophic, explosive way. Always use appropriate, rated hardware and air pathways (pipes, tubes, fittings, etc.) which is made for compressed air use at the appropriate pressure (with room to spare). Do not use handmade, high pressure devices. When using confetti or streamer cannons, treat them as always loaded and pressurized. ***Never aim a confetti or streamer cannon at anyone***.
- ***Gunshot effects*** and other loud, sudden noises - These may startle or frighten certain audience members. Be sure to keep all persons clear of the source of the sound, whether a speaker or a live source (blank firing gun, for instance). See the next section on stage weaponry for more details on the use of theatrical firearms.

❖ Fog and Other Atmospheric Effects

- General Considerations
  - Any airborne particles produced by special effect equipment has the potential to cause health problems for performers, crew and audience members. Effects associated with potential hazards include:
    - Fog Effects
    - Low lying fog effects
    - Haze
    - Smoke effects
    - Dust effects
    - Gases and smoke from pyrotechnics
  - Stages should be ventilated well enough to clear the air within 5-10 minutes.
  - Audience ventilation systems should keep patrons from being exposed to more than incidental amounts of vapor and particulate matter.
  - Be aware that the vapors produced by atmospheric devices are likely to set off fire alarms which detect particulates in the air. Check with local or building authorities if there are questions about the type of smoke detectors in the building and what will trigger them. If atmospherics are to be used, they must be in low enough concentrations to not set off alarms, or you must contact the local authorities to see if arrangements can be made to avoid audible alarms during the performance. Keep in mind that this may not be possible.
  - Inform audiences of the use of atmospheric effects through the use of lobby signs, program notes and pre-show announcements. Make sure house management is provided with details of the type of effects used and their chemical composition, in case of patrons with specific allergies or sensitivities

- Be aware of the air flow patterns in the building created by HVAC systems (air conditioning and heating). Some older buildings and those not specifically designed as performance spaces may actually pull fog-filled air into the audience, causing visibility and, potentially, breathing problems.
- Never expose young performers (children) to atmospheric effects on stage.
- Possible health issues caused by over-exposure to atmospheric chemicals include:
    - Cough, throat irritation, headaches, dizziness, fatigue, colds, respiratory infections, bronchitis, allergies, asthma, skin and eye irritation.
- Follow emergency protocols (see first aid and incident management) if acute effects are experienced by anyone exposed to atmospheric effects. Be ready to inform emergency personnel of the nature of the effect, including all chemical substances present.
- Be aware of the potential toxicity of atmospheric fluids used in fog/haze machines.
    - First and foremost, always read manufacturer instructions for atmospheric devices and Safety Data Sheets on compatible fluids for details and potential hazards.
    - Most modern fluids for atmospheric effects are, technically, non-toxic chemicals (mixtures of water and different types of glycols, glycerin or mineral oils), which might lead some to believe they are "safe" for inhalation. This presumption does not, however, take a few critical factors into account:
        - Some who are exposed may have pre-existing conditions, such as asthma, allergies, or lung disease, which make them overly sensitive to these particulates to begin with. The supervisor in charge of atmospherics for the production should check with those who will be most exposed, inquiring about known sensitivities.
        - Performers (dancers and singers in particular) will be inhaling more of these vapors than the average person breathing normally because they must breathe more deeply to adequately support strenuous activities and vocal needs.
        - Atmospherics are often used to such a great extent that the air becomes so saturated that even the lungs of a healthy adult will be affected by such overexposure. Limit the use of atmospherics to the minimum amount necessary for the desired effect and discontinue use immediately if any ill-effects are observed in those working in the vicinity.

- Most fluids are heated to such a great extent for dispersion that normally non-toxic chemicals may decompose into more toxic compounds, which may then be released into the air.
- Only use fluids approved for use by the machine manufacturer.
- Avoid homemade fog effects using common household oils as fluid, as these are potentially more harmful than specialty fluids made for this specific purpose. Some may even be flammable in large concentrations.

➢ Special considerations for ***atmospheric machines***:
- Most machines use heat to warm fluids to their evaporation points.
- Keep machines clear of combustibles.
- Do not touch machines near the heating element or nozzle/output during operation; severe burns may occur.

➢ Special considerations for ***low lying fog***:
- Most low-lying fog is created by cooling the fog fluid and/or air near the stage floor to such a degree that water in the air condenses to form a low fog which evaporates very quickly unless cold air is continuously supplied.
- Low fog created with dry ice is made up entirely of water vapor ***but*** the dry ice itself is solid carbon dioxide which, when it sublimates, creates an area rich in carbon dioxide gas. This gas ***is*** harmful if breathed in directly and adequate ventilation in the area is necessary to ensure that nearby personnel receive adequate breathable air.
- Low fog created with a fluid-based machine hooked to a cryogenic gas system creates mist that, itself, is as non-toxic as any other fog fluid. ***However***, the cryogenic gases (liquid nitrogen or carbon dioxide) used for rapid cooling of the fog are toxic and will be present in high concentrations near the fog output of the systems. As with dry ice, adequate ventilation must be present and ***performers and crew must not be exposed directly to the output of these systems, as there is not adequate breathable air.***
  - Cryogenic low fog systems also involve large gas tanks under pressure and should only be used under the supervision of a trained professional.

➢ Special considerations for ***smoke and dust effects***:
- Any substance burned to create smoke will release harmful chemicals into the air. Additionally, the combustion of any material on or near a stage is to be avoided at all costs except in the case of pyrotechnics under the supervision of a trained professional.
- Materials dispersed into the air to create dust effects (talc, flour, starch, etc.) always contain substances which are harmful if inhaled. Do not use such effects in indoor spaces where unprotected individuals may inhale the particulates.

- Organic dusts are highly flammable in high concentrations and should not be used near heat sources or open flame.

❖ Pyrotechnics

As awe-inspiring as they are, pyrotechnics are inherently and extremely dangerous. Not only do they pose a fire hazard, but the bright light, loud sound, and smoky bi-products emitted by certain devices pose further hazards. Their safe use requires a great deal of study and practice. Entire books and multi-year training courses exist on the subject of safe pyrotechnic practice.

- ➢ Non-professional theaters, as a general rule, should not use pyrotechnics of any sort. There are almost always other ways to convey the same effect with minimal risk.
- ➢ If pyrotechnics are deemed "necessary", check first with local fire and building authorities about the feasibility of their use. They may not be permitted under any circumstances.
- ➢ ***Pyrotechnics must be supervised and operated by a trained professional, following state and local ordinances. Additionally, proper permits must be applied for and issued in many cases!*** Students and volunteer workers should not handle or trigger any pyrotechnic effects unless thoroughly trained and under the ***direct*** supervision of a trained professional.
- ➢ All who will be working or performing in the vicinity of pyrotechnic effects must be well-informed and trained to stay at a safe distance from pyrotechnics at all times. Performers and crew should be informed of the timing and nature of all pyrotechnic effects.
- ➢ Pyrotechnics release harmful chemicals into the surrounding air. Ensure adequate ventilation wherever indoor pyro. effects are to be employed. Stages should be ventilated well enough to clear the air within 5-10 minutes, and audience ventilation systems should keep patrons from being exposed to more than incidental amounts of vapor and particulate matter.
- ➢ Flammable or combustible materials, including scenic elements and costumed actors must be appropriately flame-proofed or kept at a safe distance from the effect. Manufacturer guidelines will specify safe working distances.
- ➢ Never leave unused pyrotechnic devices unsupervised. Dispose of duds and re-store any unused effects after each rehearsal or performance.
- ➢ Keep fire extinguishers close at hand, with trained operators at the ready.
- ➢ Be aware that the smoke produced by pyrotechnic devices (including smoke effects) is likely to set off fire alarms. If these devices must be used, contact the local authorities to see if arrangements can be made to avoid audible alarms during the performance, keeping in mind that this may not be possible.

- ➢ Pyrotechnic devices and peripherals must be kept safe and secure. Never store combustibles/explosives near igniters or heat sources. Lock all components away and give access only to authorized personnel.
- ➢ For more specific information on national code relevant to the use of pyrotechnics in live performance, see NFPA 1126 - Standard for the Use of Pyrotechnics Before a Proximate Audience

❖ Stage Combat & Weaponry

- ➢ General Guidelines for Stage Combat
  - ■ Any fight sequences, whether or not weapons are involved, must be coordinated, choreographed, and supervised by a trained professional, a fight director/choreographer. ***Amateur fight choreography is unsafe and should never be attempted.*** Contact the Society of American Fight Directors (www.safd.org) if in need of training or professional supervision.
  - ■ Performers who have been thoroughly trained by the fight director must warm up and practice fight sequences before each rehearsal and performance under the direction of a fight captain who has been trained to maintain the safety standards put in place by the fight director. These rehearsals should involve physical warm-ups, reminders of safety protocol, and both slowed-down and real-time rehearsals of all fight sequences until all performers are comfortable.
  - ■ Stage management should ensure that adequate time and space are given during pre-show for this fight call.
  - ■ Combat sequences should not be rehearsed or altered except under the supervision of the fight director or fight captain.
  - ■ "Playing" with weapons must not be tolerated.
  - ■ Emergency procedures should be detailed for all those involved in combat sequences so that everyone knows how to proceed in the event of an accident or injury. Designate someone (usually the stage manager) to be the primary contact in emergency situations.
  - ■ In case of minor injury, have a well-stocked first aid kit readily available as well as extra ice or cold packs for accidental hits or falls. See First Aid section for more info. on First Aid kits.
- ➢ General Guidelines for Stage Weapons
  - ■ ***Treat all stage weapons as if they are real!***
  - ■ In non-professional theaters, especially schools, the use of weaponry on stage should be limited as much as possible due to the many potential issues inherent when they are present.

- In institutions where weapons are prohibited (almost all schools) special permission will need to be granted by the administration before any stage weapons are brought into the facility. Certain procedures must then be followed to bring the weapon into the theater.
    - Provide details on the nature and use of the weapons in question, including the responsible parties and details of how the weapons will be stored securely.
    - Arrange for supervised load-in of the weapon into the theater. An escort may be required to prevent a misunderstanding, as those not involved with the production may mistake stage weapons for real ones. This escort could be a campus safety officer, local law enforcement, etc.
    - Never openly carry a stage weapon outside the theater. The stage weapon should be enclosed, wrapped, or otherwise concealed in an inconspicuous manner.
    - Never sneak a stage weapon into the theater. Inform all interested parties (administration, local authorities, other individuals in the vicinity who may see the weapon) so that no one is caught off guard when they see the stage weapon in or around the theater.
    - Some institutions have a specific inspection policy for stage weapons, which may include inspection by campus safety or local law enforcement. Be sure to know and follow any such policies, and make sure all those involved with production and handling of weapons are aware as well.
    - Stage weapons should not leave the theater and their storage location unless they are in use on stage.
    - For weapons permanently stored in the theater, a check-out procedure should be put in place so that the weapons supervisor (prop master, TD, etc.) always knows who is responsible for the weapon at any given time.
    - Anyone who will handle a weapon must be trained in its safe handling, handing off, transport, and storage.
    - Weapons should only be handled at appropriate times by trained and designated individuals
        - Fight Directors & Captains
        - Performers using the weapons
        - Crew member(s) responsible for safe keeping of the weapons backstage
        - Supervisor responsible for locking the weapons up between rehearsals and performances
    - Never leave weapons unattended

- Stage weapons should be locked in designated locations with access restricted to authorized personnel. *Best practice:* Stage weapons should be under double lock, especially theatrical firearms.
- ***Treat all stage weapons as if they are real.***

➢ Weapon-specific protocol

■ ***Edged weapons*** (knives, swords, axes, bows and arrows, etc.)

- Decide initially whether *decorative* or *functional* weapons are needed and ensure that all who handle the weapons know what type they are and how they are and are not to be used.
  - ◆ Decorative weapons are made for display only and are not built to be used in *any* combat situation, even play/fake/stage combat. They are not manufactured to withstand such use.
  - ◆ Functional weapons may be "functional real" or "functional stage combat". Both types are manufactured to be used, not just displayed. Functional *real* weapons, such as martial arts swords with real, sharpened edges, should not be used for stage combat.
- Functional stage combat weapons with edges should have dulled edges and blunted tips
- Make sure any functional stage combat weapons have been specifically designed for stage combat to ensure they will to stand up to combat use without failing in a dangerous way.
- Inspect weapons prior to each use for damage (cracks, breaks), loose components and hazardous wear (burrs, nicks, etc.). Do not use damaged weapons and turn them over to the designated weapons supervisor for repair. Inspections should be made before each use by the designated weapons supervisor, as well as the actor who will be using the weapon.
- Do not use knives with moving parts in stage combat, as failure of the mechanism could result in serious injury. This includes plastic disappearing knives, switchblades, pen knives, pocket knives, and butterfly knives.
- Wear appropriate PPE at all times, as prescribed by the fight director.
- Keep protective devices (sheaths, edge guards, etc.) in place until ready to use on stage.

■ ***Theatrical Firearms***

- No matter which type of theatrical firearm is selected, a qualified, professional fight director must thoroughly train all who will handle the weapon in its safe use.
- Assess needs to determine the type of theatrical firearm needed:
  - ◆ Dummy guns (solid, single piece with no moving parts)
  - ◆ Functional replicas (working actions but no firing capability)

        - Manufactured blank guns
        - Modified practical firearms (real guns, modified to no longer fit real ammunition, only blanks)
    - As with other stage weapons, a protocol must be established which dictates:
        - Where theatrical firearms are stored: Store in a clean, dry, nondescript location, separate from ammo.
        - How they are secured: Double lock theatrical firearms in secure, tamper-proof containers.
        - Who has access: Only trained, qualified, and authorized personnel should be granted access to theatrical firearms. Each institution should have a designated supervisor who has ultimate authority over the use of theatrical firearms and the ability to restrict access.
        - How local authorities, including law enforcement, and other building occupants will be informed of the time and location of the use of blank firing guns.
        - Who will retrieve, inspect, prepare, and hand off theatrical firearms to actors before rehearsal or performance (a properly trained individual, often called the "gun wrangler")
        - Procedures for loading and, if desired, testing. Those performers who use the weapon and are downrange should be invited to watch loading and testing, if possible.
        - Procedures for passing "hot" (loaded) theatrical firearms from person to person.
        - Where and how the theatrical firearm will be kept secure during the rehearsal or performance and how it will get back to the gun wrangler after use on stage
    - ***Treat all theatrical firearms as if they are real and loaded***
        - Never point a theatrical firearm at anyone or anything you don't wish to destroy, including the audience.
        - Only place a finger on the trigger when ready to fire
        - Be aware of the target ***and*** what's beyond
        - Never leave theatrical firearms unattended
- ***Notes Specific to Blank Firing Guns***
    - Blank firing guns can and have caused serious injury and death due to careless or improper use.
    - All who handle the blank firing gun should know:
        - Does it have a single, double or semi-automatic action?
        - What is the caliber and load (half, full, primer, etc.) of ammo
        - Where does the gun vent? There may be multiple vent locations.

        - What is the backup plan in case of misfire?
    - Inspect blank firing guns for damage and proper working order before each use (and before loading)
    - Clean blank firing guns periodically in storage and after every rehearsal or performance in which live rounds were fired.
    - Never dry fire blank firing guns; this could damage the firing mechanism.
    - For blank firing guns, note the vent direction.
        - Hot gases and powder debris will be vented either out the barrel, the side, or the top of the gun, depending on design.
        - Never point the barrel ***or*** the vent at anyone at any time. The fight director should adjust choreography accordingly so that all shots and staged movements are in appropriate "firing lanes".
    - Use appropriate PPE when training, testing, loading and unloading blank firing guns:
        - Safety glasses/goggles whenever possible
        - Hearing protection at all times for those nearby
    - Make sure audiences are informed of the use of blank firing guns (or non-firing replicas with sound effects) through lobby signage, program notes, and pre-show announcements.

❖ Additional Resources

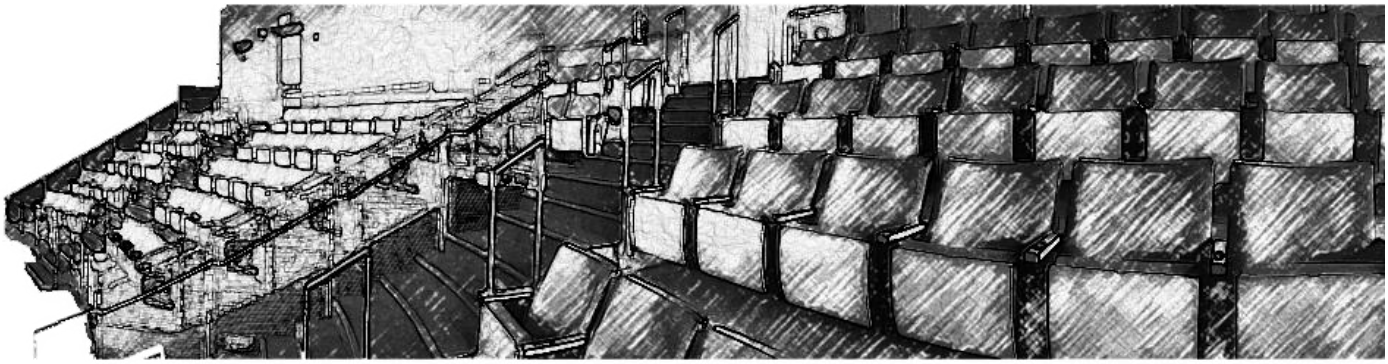
➢ *Websites*

- ESTA/ANSI Fog & Atmospherics Standards (scroll for various standards including: ANSI E1.5 - 2009 (R2018), ANSI E1.23 - 2010 (R2015), ANSI E1.29-2009 (R2018), ANSI E1.40 - 2016). (n.d.). Retrieved from https://tsp.esta.org/tsp/documents/published_docs.php
- Introduction to Modern Atmospheric Effects, 5th Ed. (scroll to bottom of page). (n.d.). Retrieved from https://tsp.esta.org/tsp/documents/published_docs.php
- NFPA 1126 - Standard for the Use of Pyrotechnics Before a Proximate Audience. (n.d.). Retrieved from https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1126
- Society of American Fight Directors. (2009, May 16). Retrieved from https://www.safd.org/
- Dueling Arts International. (2007, Feb 10). Retrieved from https://www.duelingarts.com/

Special Effects & Stage Combat

➢ ***Books***

- Kosanke, K. L., & Kosanke, B. J. (1995). *The illustrated dictionary of pyrotechnics*. Whitewater, CO: Journal of Pyrotechnics.
- *Special effects with fire and smoke: A technical manual for professional use only*. (1985). South Bound Brook, N.J. (P.O. Box 293, Dept. TC): Theatre Effects.
- Girard, D. A. (1997). *Actors on guard: A practical guide for the use of the rapier and dagger for stage and screen*. New York: Routledge.
- Suddeth, J. A. (1996). *Fight directing for the theatre*. Portsmouth, NH: Heinemann.
- Lane, R. J. (2005). *Swashbuckling: A step-by-step guide to the art of stage combat and theatrical swordplay*. New Jersey: Limelight Editions.
- Inouye, K. (2014). *The theatrical firearms handbook*. Burlington, MA: Focal Press.



11. Audience, Facility & Fire Safety

In the final weeks of preparation, before a show opens, we often become so busy getting ready to put the show on stage that we forget about the people who will be coming into the theater to see it. The safety of the audience must be more than afterthought in the overall planning of any production, and care must be taken to ensure that policies and procedures are put in place and adhered to. After all, some of the greatest disasters in the history of theater involve fire in a crowded theater and the deaths of audience members. Many guidelines in the following section are spelled out, officially and in detail, in NFPA 101, the Life Safety Code, while others are ultimately the responsibility of the front-of-house staff, led by the house manager. In non-professional theater settings, the house manager may be a volunteer or even the parent of a student; this does not change the nature of the position or the level of responsibility required.

❖ House Management

- ➢ A program outlining policies and procedures related to audience safety should be created, documented, and adhered to. Once documented, the program should be maintained by the house manager or other designated individual. The following should be included:
  - Characteristics of the space
    - Maximum occupancy (and where signs are posted)
    - Locations of exits
    - Type of fire alarm and fire suppression systems
    - Communication infrastructure (phones, radios, intercoms, etc.)
    - Locations of accessible features, including seating and restrooms
    - Exterior entry considerations (sidewalks, stairs, ramps, etc.)
  - Roles and training for front of house staff
  - Communication protocol for front of house staff
  - Pre-show announcement safety content, including:
    - Locations of exits
    - How to proceed in the event of an emergency (calm and orderly)
    - Backstage access policy

- Notification of potential hazards during performance, including gunshots or other loud noises, strobe lights, and use of atmospheric effects
- Staff/audience interaction policies and procedures
- Emergency/Incident Management
- Evacuation procedures, including accommodations for those with special needs

➢ Training

- House managers and ushers should be trained to deal with all potential scenarios involving the health and safety of audience members. They should know, among other things:
  - Location of First Aid kits and basic First Aid training
  - Location and operation of AEDs, if available
  - Location and operation of fire alarms and extinguishers
  - Location of outdoor facilities for smokers
  - Location of bathrooms, including ADA accessible facilities
  - Procedures for medical emergencies, including where to find a phone, emergency contacts and what address to give emergency responders
  - Procedures for safe, efficient evacuation or shelter-in-place scenarios, including egress pathways, meeting points and roles of the various front-of-house team members - Ensure that evacuation maps are posted as required by local authorities.

➢ Limited Access, Backstage and Onstage

- Audience members should not be granted access to backstage areas without an approved escort at an appropriate time.
- All safety protocols followed by crew and performers must be observed by approved visitors as well.
- Only approved personnel should be allowed access to the stage before, during, and after performances.
- Physical barriers or ushers may need to be employed to prevent audience members from accessing restricted areas, including the front of the stage.

❖ **Pathways**

➢ Clearance and Condition

- All potential audience pathways, as designated by local authorities, should be free of obstruction to a width of at least 3ft. or as specified by local authorities based on egress needs.
- Do not use hallways or stairwells for storage.
- Audience members must not be seated in aisles or other pathways. standing-room-only spaces for sold-out shows may be an option, but local authorities should be consulted before designating standing areas.

- Cords in pathways must be properly secured and, if necessary, signage provided. Keep cords out of audience pathways completely, if at all possible.
- Any carpets or rugs should be secured to prevent accidental movement and potential slipping/tripping.
- Pathways must be kept dry and clean to prevent slipping. Consider whether allowing food and drink in the theater could constitute an unnecessary hazard, especially during performance.
- Exterior doors should have mats so that audience members may wipe their feet and not track water or debris further into pathways.

➢ Visibility
- All potential audience pathways should have adequate illumination at all times. This includes all lobby areas and aisles in the audience, which should be fitted with appropriate aisle lights to remain on during performances.
- Exit pathway lighting must function in the event of a power outage. Test these battery systems regularly.

➢ Stairs and Ramps
- Stairs and ramped pathways must be clean and free of clutter/debris.
- Treat or fit stairs and ramps with anti-slip surfaces.
- Must have appropriate handrails and/or guardrails.

➢ Doors
- All doors that will potentially used by audience members must always be unlocked and unobstructed.
- Fire doors should be kept unlocked and *closed* at all times.

➢ Exits
- There should be at least two clearly marked, easily accessible exits from any point in any part of the theater. For audience areas, the required number will be larger depending on maximum occupancy and local regulations.
- All exit doors must be clearly marked by an illuminated, unobstructed "EXIT" sign.
- Exit doors must always open outward, toward the exterior of the building.
- Temporary, auxiliary exit signs (also illuminated) must be placed in areas where the permanent sign is temporarily obscured by scenery.
- Exit pathways and signs must be properly illuminated at all times, including in the event of a power outage.
- Additional, battery-powered emergency flood lights (often near or attached to exit signs) should be in place and tested regularly for good working order.

Audience, Facility & Fire Safety

❖ Accessibility

- ➢ Theaters must be able to accommodate audience members with disabilities, as specified in ADA guidelines. This includes:
  - ■ Accessible pathways into and around the theater (ramps, etc.)
  - ■ Accessible bathroom facilities
  - ■ Accessible seating locations (wheelchair spaces, etc.)
  - ■ Assistive Listening Systems

❖ Emergency/Evacuation Procedures

- ➢ Front of House staff and backstage crew should be trained and know what role to play in the event of an evacuation, including:
  - ■ Where to be posted, if necessary, to direct audience members to exits
  - ■ How to assist those with special needs
  - ■ How to get oneself out safely
- ➢ Emergency announcements
  - ■ Develop a script with clearly stated instructions, and have it pre-recorded.
  - ■ Distribute audio to all relevant areas with sound system having battery backup in case of power failure.
  - ■ Announcements should be automated or triggered by a trained crew member.
- ➢ Fire Evacuation
  - ■ At the first sign of fire, pull the nearest fire alarm and call 911.
  - ■ Deploy fire extinguishers, if practical. Do not attempt to fight an oversized fire with a fire extinguisher. If the fire cannot be put out within 10-15 seconds, evacuate immediately.
  - ■ If the fire can be slowed by closing doors upon evacuation, do so.
  - ■ Evacuate in a calm and orderly manner.
  - ■ If smoke is present, stay low to the floor.
  - ■ Watch out for falling debris; take cover and protect head.
  - ■ If you become trapped, tap on a wall or pipe to alert rescuers.
  - ■ Account for persons who were in the area of the fire, if possible.
- ➢ Special emergencies
  - ■ Plans should be in place for the following, as well as normal evacuation. Consult local authorities for assistance in planning for these situations.
    - Severe Weather
    - Earthquake
    - Active Shooter
    - Bomb Threat
  - ■ Front of house and backstage crew training should include these scenarios.

Audience, Facility & Fire Safety

❖ Fire Safety

- ➢ The Fire Marshal
  - ■ Make every effort to develop a good, working relationship with the local fire authorities, especially the Fire Marshal's office.
  - ■ Remember that the Fire Marshal's job is to keep everyone safe, so they are on your side, even if it seems they sometimes have unreasonable expectations.
  - ■ Whenever there is a question about the theater's fire safety plan and infrastructure, do not hesitate to contact the Fire Marshal's office for assistance or clarification.
  - ■ Depending on local regulations, the Fire Marshal's office may require a safety official from their office to be on hand for all performances when an audience is present, or in special circumstances such as when pyrotechnics are to be used.
- ➢ Fire extinguishers
  - ■ Generally, multi-purpose ABC fire extinguishers are advisable in theaters. They will handle combustible solids, liquids, and electrical fires.
  - ■ Ensure adequate number and placement of extinguishers. Contact local authorities to confirm, but fire extinguishers should be a maximum of 75ft. apart, and should not require climbing stairs or ladders or going through multiple doors to gain access.
  - ■ Locations of fire extinguishers should be clearly marked with signage.
  - ■ Mount extinguishers 3.5-5ft. above the ground.
  - ■ Extinguishers must be unobstructed on all sides for access.
  - ■ Recess the units, if necessary, so as not to protrude more than 4 inches into a pathway.
  - ■ All front-of-house staff and backstage crew should be trained in proper fire extinguisher use.
  - ■ Fire extinguishers must be fully charged at all times; do not reuse a partially spent extinguisher.
  - ■ Extinguishers should be checked/serviced every 12 months and should be tagged to indicate the date of last inspection.
- ➢ Fire alarm pull stations:
  - ■ Stations must be visible, with unobstructed access.
- ➢ Smoke Detectors
  - ■ Be aware of the type of detectors present in in theater facility. Some detect only smoke while others are triggered by almost any airborne particle, like haze or fog.

- Know whether or not the smoke detectors automatically trigger a building-wide alert, or only a local one, and whether the smoke detection system automatically calls the fire department.
- Have the local fire department's number on hand (on the emergency contact sheets posted in each space) to notify them in case of false alarm or to preemptively check in when atmospherics are being used and there is a chance the alarms will trigger inadvertently.
- Whether smoke detectors are battery-powered or hard-wired, they should be checked regularly for proper operation. A monthly check is ideal, especially for battery-operated detectors.
- Check with local authorities to determine whether there are an adequate number of smoke detectors in the facility.

➢ Sprinkler systems
- Ensure that sprinkler heads remain unobstructed at all times (18" min. clearance).
- Never use sprinkler pipe systems for hanging of items, etc.

➢ Fire doors
- These doors must remain clear and closed unless in use.
- See NFPA 80 for more info.

➢ Fire Curtains
- Where required, an operable fire curtain provides a critical measure of safety in the event of a fire on stage. A properly functioning fire curtain provides both a temporary barrier and a means of fresh airflow, giving the audience both more time and a safer environment in which to exit the theater.
- Fire curtains are not present in all theaters, but must be present and kept in good working order when required by local authorities. Contact the local fire authority if you are unsure whether a fire curtain is required.
- Fire curtains should have both an automatic, emergency closing function, and a manual, non-emergency closing function for day-to-day operation.
- Fire curtains should remain closed when the theater is not being actively used. This closure provides the additional safety measure of a physical barrier preventing falls from the apron.
- Emergency closing of the fire curtain should be tested no less than once every three months.
- Fire curtain inspection and maintenance should be included as part of an annual rigging inspection schedule.
- See NFPA 80 and ESTA/ANSI E1.22 for more information on codes related to fire curtains.

➢ Flame retardancy of curtains, scenery, etc.

- Use fire resistant or inherently flame retardant materials whenever possible.
- Flammable/combustible materials must be kept away from heat and ignition sources
- Permanent fixtures, including audience seating, carpeting, wall coverings, and curtains should be treated for flame retardancy or made of an inherently flame retardant material.
- Curtains treated with flame retardant liquid have a more limited lifespan that IFR curtains and will dry rot over time. They should be flame-tested annually by a professional and replaced when they do not meet local standards for flame retardancy.
- IFR curtains should also be tested periodically for flame retardancy.
- Any scenery that has combustible components should be treated with an appropriate flame retardant and tested by a qualified professional before use. See manufacturer details for specific information on flame retardant products and their properties and application. Some flame retardants may alter the physical properties of the material to which it is applied; for example, soft goods may become more stiff when treated.

➢ Use of flame on stage
- Avoid open flame on stage at all times.
- Special "safe" flame effect devices exist, but should be used by professionals only.
- See NFPA 160 for more info.

➢ Pyrotechnics
- See section on Pyrotechnics in Special FX and Stage Combat

Audience, Facility & Fire Safety

❖ Additional Resources

➢ *Websites*

- NFPA 101 - Life Safety Code - Comprehensive guide to all regulations pertaining to evacuation plans, fire protection, egress, etc. (n.d.). Retrieved from https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=101
- ESTA Standards for Fire Curtains (scroll to standard ANSI E1.22 - 2016). (n.d.). Retrieved from https://tsp.esta.org/tsp/documents/published_docs.php
- Article on the Efficacy of Fire Curtains. (2001, March). Retrieved from https://theatreconsultants.org/fc_esta.html
- NFPA 80 - Fire Doors, Including Fire Curtains. (n.d.). Retrieved from https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=80
- Online Fire Extinguisher Training. (2014). Retrieved from http://www.fireextinguishertraining.com/en/introduction.html
- NFPA 160 - Use of Flames on Stage. (n.d.). Retrieved from https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=160
- Crowd Manager Training - $20 online course in fire code and public assembly management. Great for anyone who acts as a house manager or deals with audience safety. (2018, March 23). Retrieved from https://crowdmanagers.com/training/
- Event Safety Alliance. (2019, April 2). Retrieved from https://www.eventsafetyalliance.org/
- OSHA Evacuation Plan e-Tool. (n.d.). Retrieved from https://www.osha.gov/SLTC/etools/evacuation/portable.html
- ADA Fact Sheet for Theaters. (2011, April 2). Retrieved from https://www.arts.gov/sites/default/files/NEA-ADA-TipSheet-v2.pdf

➢ *Books*

- Gerhard, W. P. (1899). *The safety of theater audiences and of the stage personnel against danger from fire and panic*. New York: W.P. Gerhard.
  - An “antique” guide at this point, but an interesting read.
- ALLIANCE, E. S. , Cooper, D. Ed. (2014). *EVENT SAFETY GUIDE: A guide to health, safety and welfare at live entertainment events in the ... united states*. Place of publication not identified: SKYHORSE Publishing.

12. Additional Theater Safety Resources

Websites:

Unless otherwise noted, all URLs were accessed most recently for this guide on April 2, 2019

- ***Regulatory***

  - **OSHA**
    - Main page for OSHA General Industry Standards https://www.osha.gov/SLTC/generalindustry/
    - OSHA site pertaining to young workers (primarily as employees): https://www.osha.gov/youngworkers/parents-educators.html
    - OSHA Quick Cards: https://www.osha.gov/pls/publications/publication.athruz?pType=Types&pID=6
    - OSHA Fact Sheets: https://www.osha.gov/pls/publications/publication.athruz?pType=Types&pID=2
  - **ANSI**
    - ANSI Standards Webstore https://webstore.ansi.org/
  - **ESTA**
    - Technical Standards Program (TSP) for Entertainment Safety https://tsp.esta.org/tsp/index.html
  - **NFPA**
    - NFPA Standards Main Page https://www.nfpa.org/Codes-and-Standards/All-Codes-and-Standards/List-of-Codes-and-Standards
    - NFPA 101 - Life Safety Code https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=101

- ***Training Opportunities***

  - **ETCP**
    - Professional training assessments and certifications for electricians and riggers in the entertainment industry. https://etcp.esta.org/training/training.html

Additional Theater Safety Resources

- **eSET**
  - Training modules sponsored by USITT, including General Safety, Rigging, Electrics, Wardrobe, and Costume Design. https://www.usitt.org/eset
- **OSHA 10**
  - General Entertainment Safety Training. Classes offered by various organizations, including but not limited to USITT, IATSE and SETC. Search online for training times and locations. For general info. about OSHA training and to locate instructors https://www.osha.gov/dte/index.html
- **Event Safety Alliance**
  - Workshops and Seminars offered throughout the year https://www.eventsafetyalliance.org/esaess
- **Innova Safety Courses**
  - Through USITT http://usitt.peachnewmedia.com/store/provider/provider09.php

❖ ***Other Theater Safety Websites:***

- **USITT Safety and Health**
  - USITT Safety Alliance https://www.usitt.org/safety-alliance/
  - USITT Safety and Health Commission https://www.usitt.org/sandh/
  - USITT Student Alliance for Safety and Health https://touch.facebook.com/Theatre.Safety.USITT/photos/a.220384048435327/245854569221608/?type=3&source=44
- **ACTS - Arts, Crafts, and Theater Safety**
  - Website of Monona Rossol, Industrial Hygienist & expert on Safety & Health in the Arts. Lots of resources, as well as training opportunities. https://www.artscraftstheatersafety.org/
- **PRESETT**
  - Website of Elizabeth Rand, who specializes in educational theater safety. http://www.presett.org/
- **Risk International & Associates** -
  - Dr. Randall W. A. Davidson's ("Dr. Doom") website on risk management in educational theater. http://www.globalhealthandsafety.net/go/risk-international/about.html

Additional Theater Safety Resources

- **Entertaining Safety**
  - Guide to Insurance and Risk Management https://www.prosightspecialty.com/differentiator/entertaining-safety/
- **Play it Safe/ACTSAFE**
  - PDF on school theater safety made in Canada https://www.actsafe.ca/wp-content/uploads/2017/10/Play-It-Safe-Safety-Manual-PDF.pdf
- **Yale Theater Safety Page**
  - https://ehs.yale.edu/theater-safety
- **University of California Performing Arts Safety Manual**
  - A very comprehensive and well-organized guide to theater safety created for schools in the University of California system. http://www.ehs.ucsb.edu/files/docs/gs/UCPerformingArtsSafetyManual-VERS1-030314.pdf
- **CSHEMA**
  - Organization focused on and run by campus safety and health professionals https://www.cshema.org/

❖ ***Career & Technical Education Resources***

- **CDC Education**
  - A large .pdf manual for safety in Career and Technical Education (CTE) https://www.cdc.gov/niosh/docs/2004-101/pdfs/safe.pdf

Additional Theater Safety Resources

Books on Theater Safety and General Theatrical Production:

Carter, P. D., & Chiang, G. (2012). *Backstage handbook: An illustrated almanac of technical information*. Louisville, KY: Broadway Press.

Davidson, R. W., Young, H., & Shamel, R. (2005). *Practical health and safety guidelines for school theater operations: Assessing the risks in middle, junior, and senior high school theater buildings and programs*. Littleton, CO: Risk International Pub.

Davidson, R. W. (2009). *Dr. Davidson's Eye on Theater Health and Safety: An Administrative Overview* (Vol. 1). Centennial, CO: Lifevest Publishing, Inc.

Davidson, R. W. (2009). *Dr. Davidson's Eye on Theater Health and Safety: Setting the Stage* (Vol. 2). Centennial, CO: Lifevest Publishing, Inc.

Davidson, R. W. (2009). *Dr. Davidson's Eye on Theater Health and Safety: On Stage* (Vol. 3). Centennial, CO: Lifevest Publishing, Inc.

Gillet, C., & Sheehan, J. (2017). *The production managers toolkit: Successful production management in theatre and the performing arts*. New York: Routledge.

Gillette, J. M., & Dionne, R. (2018). *Theatrical design and production: An introduction to scenic design and construction, lighting, sound, costume, and makeup*. New York, NY: McGraw-Hill.

McCann, M. (2005). *Artist beware: The hazards in working with all art and craft materials and the precautions every artist and craftsperson should take*. Guilford, Conn: Lyons Press.

Rand, E. (2015). *High School Theatre Safety Manual: For Proscenium Theatres*. CreateSpace Independent Publishing Platform.

Rand, E. (2015). *High School Theatre Safety Manual: For Black Box and Flat Roof Theatres*. CreateSpace Independent Publishing Platform.

Rand, E. (2015). *High School Theatre Signs and Documents*. CreateSpace Independent Publishing Platform.

Rossol, M. (2001). *The Artist's Complete Health and Safety Guide, 3rd Ed*. New York: Allworth Press.

Additional Theater Safety Resources

Rossol, M. (2011). *The Health and Safety Guide for Film, TV, and Theater* (2nd ed.). New York: Allworth Press.

Rossol, M. (1991). *Stage fright--health & safety in the theater*. New York: Allworth Press.

Stribling, Z., & Girtain, R. (2016). *The technical directors toolkit: Process, forms, and philosophies for successful technical direction*. New York: Focal Press.

Additional Theater Safety Resources

Sample Document Links:

*The following are examples of some document types referenced in this guide or otherwise relevant in the creation and maintenance of a comprehensive theater safety program. Each institution must create, modify, or adopt documentation that applies specifically to that particular institution. *All URLs were accessed most recently for this guide on April 2, 2019**

- **Management Policy on Safety** (statement by leadership on importance of safety)
  - Example from Sony Corporation
    - https://www.sony.net/SonyInfo/csr_report/employees/support/index2.html

- **Code of Safe Practices** - Human Resources docs. outlining safety practices in general or in each work area. Workers and/or supervisors document each person's review of this information as well as any relevant training.
  - Example from UCSB Performing Arts Safety Manual. See pp. 89-164
    - https://www.ehs.ucsb.edu/files/docs/gs/UCPerformingArtsSafetyManual-VERS1-030314.pdf

- **Training Documentation** - Verification that workers have reviewed the Code of Safe Practices and/or have completed relevant trainings.
  - Example from UCSB Performing Arts Safety Manual. See pp. 84-86
    - https://www.ehs.ucsb.edu/files/docs/gs/UCPerformingArtsSafetyManual-VERS1-030314.pdf

- **Liability Waiver**
  - Example from Texas Tech. Dept. of Theater & Dance
    - https://studylib.net/doc/11373499/waiver-of-liability-and-hold-harmless-agreement

- **Emergency procedures document**
  - Example from University of Virginia Office of Safety and Emergency Preparedness
    - https://uvaemergency.virginia.edu/system/files/emergency_procedures.pdf

- **Evacuation Map**
  - Example and instructions from US Fire Administration
    - https://www.usfa.fema.gov/training/coffee_break/052417.html

Additional Theater Safety Resources

- **Incident Report Form**
  - Example from the Educational Theater Association
    - https://www.schooltheatre.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=ce2c4e20-5744-377a-951a-9f1e63c604ad&forceDialog=0

- **Equipment maintenance & repair records**
  - Downloadable templates in a variety of formats from template.net
    - https://www.template.net/business/log/maintenance-log/

- **Shop Rules**
  - Set of technical theater posters on Amazon.com geared toward educational use. Includes "Shop Rules", "Safety Rules" and "Backstage Rules". A good starting point.
    - https://www.amazon.com/Ludlam-Dramatics-Technical-Theatre-Educational/dp/B010TSTYAO

- **Safety Data Sheet**
  - Example from WD-40 Official Website
    - https://files.wd40.com/pdf/sds/mup/wd-40-multi-use-product-aerosol-low-voc-sds-us-ghs.pdf

- **Pre-show and Post-show Checklist**
  - A page of document resources from the Rocky Mountain section of USITT for stage managers, including run sheets outlining pre-show, intermission, and post-show responsibilities for SMs and ASMs. Other great examples of SM paperwork as well.
    - http://rm.usitt.org/sm.html

- **Shutdown Checklist**
  - Example of an opening and closing plan for a movie theater. This is mainly geared toward house management personnel but the format and content could easily be modified to be relevant to the duties of a stage manager or technical director.
    - https://www.rosendaletheatre.org/wp-content/uploads/2015/02/ShiftManagerCheckList_OpeningClosingProcedures_RosendaleTheatre_2-2015.pdf

- **Strike Plans**
  - Example from UCSB Performing Arts Safety Manual. See pp. 49-53
    - https://www.ehs.ucsb.edu/files/docs/gs/UCPerformingArtsSafetyManual-VERS1-030314.pdf

13. Theater Safety Glossary

Terms found in the text, in alphabetical order:

AED - *Automated External Defibrillator* - A portable device used to deliver an electric shock to the heart in an effort to restore normal rhythm after sudden cardiac arrest or in cases of arrhythmia. The AED can be used by anyone and usually has voice prompts for proper use, but training is recommended. The machine's sensors will detect whether a shock is needed and will instruct the user when to activate it.

Aerial Lift - Any mechanical device used to elevate a worker to a height. Some examples are personnel lifts (i.e. Genie), scissor lifts, and boom lifts.

Aerotechnics - Air powered special effects, typically using regulated, compressed air stored in tanks and delivered through appropriately rated tubing/pipe and valve systems. Confetti cannons are an example.

Anchorage - A rigid attachment point in a fall protection system to which the worker may connect his/her lanyard. The anchorage should be capable of holding 5000 lbs. *or* be designed by a qualified professional as part of a fall protection system with a safety factor of at least two.

ANSI - *American National Standards Institute* - from the ANSI website: "ANSI is a private, non-profit organization that administers and coordinates the U.S. voluntary standards and conformity assessment system." ANSI partners with private and public industry and government in the US to create and administer standards, including those concerning safety in the workplace, in various industries.

Arbor- In a counterweight fly system, an arbor is a metal frame onto which counterweights are loaded to balance the load on the batten. The arbor is typically connected to the batten with lift lines. Its movement is controlled by an attached rope, called the operating or purchase line.

ASM - *Assistant Stage Manager* - Assists the production stage manager with the running of a show. The ASM may have many responsibilities, but often is stationed backstage, acting as a communication conduit from the stage manager in the booth to the personnel backstage.

Assistive Listening System - An amplification system for audience members who have difficulty hearing/understanding the performance. The devices in the system deliver audio directly to the user's ears via headphones. The system processes the sound to provide a better "speech to noise ratio", making voices easier to understand and distinguish from background noise. ALSs use either FM, Infrared, or Inductive Loop technology.

Theater Safety Glossary

Atmospherics - Special effects such as fog, haze and smoke, which add particulates/vapors to the air. These are often used for mood and lighting effects.

Automated/Motorized Fly System - A fly system using motor-driven winches instead of counterweights to raise and lower loads on battens. Some systems are operated with individual winch controls, while others are fully automated and operated via software on a computer.

Balanced/In weight - In fly systems, a lineset is said to be balanced or in weight when the load on the arbor side of the system is equivalent to the load on the batten side. Even balanced systems will be slightly out of weight when run to their extremes, due to the movement of cable (lift lines) from one side of the system to the other.

Batten - In fly systems, a batten is a pipe from which scenery, lights, etc. are suspended. The batten is lifted by connected lift lines, spaced evenly at appropriate intervals along the length of the pipe. Typically, battens are made of 1.5in. Schedule 40 pipe.

Black Box Theater - An adjustable performance space, typically consisting of a large, windowless room, painted black. Black box theaters often have modular audience seating and dead-hung rigging systems overhead so that the space can be configured in multiple ways.

Block - In rigging and fly systems, a block consists of one or more sheaves (or pulleys) mounted between plates. Blocks are used to divert cables and ropes in various rigging applications. Some common block types found in theatrical fly systems include loft blocks, head blocks, floor blocks, and tension blocks.

Boom Lift - A type of aerial lift utilizing an articulating boom arm to lift the platform/basket carrying the worker to height. Boom lifts have an advantage over some other types of lifts because of the versatility of the articulated arm. They are, however, generally larger and heavier than other types of lifts.

Catwalk - A raised walkway, often above the stage, house, or both, used to access lighting and rigging system components. Catwalks should always have appropriate guardrails and/or fall protection systems.

Combustible - Items, typically liquids, are said to be combustible when they have a flash point (will catch fire when exposed to an ignition source) at temperatures over 100° Fahrenheit. At lower temperatures, they will not ignite.

Dead Hung Rigging System - Exposed, overhead structure in a theater, suitable for hanging rigging components, but with no integral moving parts. May contain pipes, beams, catwalks, etc.

Theater Safety Glossary

Deck - The stage floor

Disconnect - An electrical switch, separating the source of incoming power from wiring/connectors on the inside. Theaters often have "company switches" which are specialized disconnects designed to make it safer and easier to connect devices (i.e. automation, sound, and lighting equipment) requiring more power than a typical receptacle can provide.

Double Purchase Counterweight System - A counterweight system utilizing mechanical disadvantage so that the arbor travels one half the distance of the batten, allowing the fly rail to be located above the stage deck, leaving more room in the wings. Weight on the arbor must be double the load on the batten for balance to be achieved.

Dress - In backstage terms, to "dress" something means to neatly organize and secure it so as to minimize the potential hazard. Primarily, the term refers to running cables backstage, but it could also refer to soft goods, etc.

Dress Rehearsal - A technical rehearsal during which costumes, makeup, wigs, etc. are implemented. These are the final rehearsals in preparation for opening a production for an audience, as costumes are typically the last technical component to be added.

Egress - The paths by which people exit a building from various locations within. Building egress paths must be unobstructed at all times.

Electric - In a fly system, an electric is a batten specifically outfitted with an electrical supply and connections for lighting equipment.

Escape Stairs - Temporary stairs, typically backstage and connected to a scenic unit, which allow performers to safely descend from upper levels of the set to the stage deck.

Fight Call - Designated period of time before rehearsals and performances during which the fight captain reviews and practices any stage combat sequences with all involved performers and crew.

Fire Curtain - A barrier which closes to fill the proscenium opening, isolating the audience from the stage, in the event of a fire onstage. Fire curtains are made of a variety of flameproof materials and may be framed or unframed. In some cases a "deluge" curtain may be in place; this is essentially a water distribution system that creates a curtain of water covering the proscenium opening.

Theater Safety Glossary

Fire Doors - Doors specifically designed to slow the spread of fire in a building by compartmentalizing the fire. Fire doors may be self-closing or automatic closing. In either case, they must not be held open or blocked from closing in any manner.

Fire Resistant - A material is fire resistant if its natural qualities keep it from igniting easily. It must not melt or drip when exposed to an ignition source and must self-extinguish if the ignition source is removed.

Firing Lanes - When using any type of stage firearm, the pathway between the muzzle of the gun and any person, performer or audience member, must be kept clear, in case of accidental discharge. Firing lanes must be taken into account during all fight choreography and may also include lanes for the gun's vent system, if not front-venting.

Fitting Sheet - A document filled out by a performer and/or costumer before or during an initial costume fitting. A fitting sheet should include places to note any allergies or sensitivities a performer may have to fibers, chemicals, dyes, makeups, etc.

Flame Retardant - Chemical treatment for materials that aren't inherently fire resistant to help them resist ignition and slow the spread of fire. These chemicals may be mixed into scenic paint, or used as a treatment for curtains and other scenic and costume fabrics.

Flammable - A material that readily ignites below 100° Fahrenheit when exposed to an ignition source.

Fly System - A system of cables, ropes, blocks, weights and pipes used to raise and lower scenery, lights, etc. over the stage. Typical fly systems include single-and double purchase counterweight, hemp/pin rail, and motorized/automated.

Foul - In fly systems and rigging, to become stuck, caught or otherwise entangled so as to not be safely moveable.

Front of House - Any area or personnel in the theater dealing directly with audience members before they enter the theater. This includes the box office, lobby and concessions areas. Front of House may also refer to lighting or rigging positions in front of the stage area, to the sides and above the audience seating area.

Full Body Harness - A fall protection harness which is designed to distribute the force of a fall evenly across a worker's body. It should have at least one primary attachment ring on the back, between the shoulder blades.

Theater Safety Glossary

Gauge (AWG) - *American Wire Gauge* - The size, in diameter, of a current carrying conductor/wire. Lower numbers indicate larger diameter wires with higher current carrying capacities. AWG is logarithmic, not linear, in scale.

GFCI Protected - *Ground Fault Circuit Interrupter* - A GFCI outlet/receptacle or breaker monitors the input (hot) current vs. the output (neutral) current to ensure there is no current drain across the device in use, which would indicate a "leak" of electricity, possibly through a person. It then immediately shuts off power to the circuit. GFCI outlets/breakers must be used in any location with water nearby, or the potential for dampness (i.e. basements).

Ghost Light - Typically an enclosed light bulb on a post/stand which is placed onstage and turned on at the end of each workday when the rest of the lights in the theater are turned off. The ghost light should provide enough light to illuminate any hazards in the stage area for those entering the theater before the lights are turned on.

Grid - Steel structure over a stage from which rigging and fly systems are suspended.

Grommeting - Grommets are metal rings, typically placed in the webbing at the top of a stage curtain to reinforce the curtain's attachment points, preventing tears.

Hazardous Materials - Any chemicals or other items with inherent properties which could pose a health or safety risk to those who come into contact with them in any way. Each hazardous material in the theater should have a safety data sheet (SDS) on file and training must be provided to all who may come into contact with it.

Headset - The part of an intercom system worn on the head, including an earpiece and microphone. Typically used by backstage crew to communicate during technical rehearsals and performances. Headsets are typically connected to a "beltpack" which serves as a wired or wireless transmitter and receiver.

Hemp/Pin Rail System - An older style of fly system using ropes instead of cables and sandbags instead of steel counterweights. Rather than a locking rail, the ropes are tied off to a pin rail to prevent the movement of the battens to which they are connected.

Horizontal Lifeline - Typically a steel cable strung between two stationary anchor points which is rated for use as an anchor in a fall protection system. The worker attaches his/her lanyard to the cable and may move along it, provided the lanyard stays attached.

House - The area of the theater in which the audience sits.

Theater Safety Glossary

House Manager - Leadership position dealing with all aspects of the audience experience when they enter the theater. The house manager coordinates with the box office staff, ushers and concession workers, as well as with stage management and safety officials, to ensure a safe and enjoyable experience for audience members.

Inherently Flame Retardant - A material, usually fabric, whose chemical properties make it naturally resist ignition, as well as being self-extinguishing. Similar to Fire resistant.

Kickplate (see Toe Board)

Knot Efficiency - The remaining percentage of a rope's breaking strength after a particular knot is tied in it. Each type of knot has an efficiency rating.

Lamp - In theater, the lamp is the light source for a lighting instrument. In non-theatrical terms, it would be called a "bulb".

Lanyard - a strap, cable, or piece of webbing used to tether one item to another. A small lanyard might be used to tether a tool to a worker's belt. A rated lanyard with snap hooks might be used as part of a fall protection system to attach the worker's harness to an anchor point. Lanyards used for fall protection must have integral shock absorption systems.

Lift (see Aerial Lift)

Lift Lines - In fly systems, the cables or ropes which connect the batten to the counterweight and allow it to be lifted. Lift lines typically travel from the batten, up and over loft blocks, then across and over the head block before descending to the arbor (or pin rail in the case of a hemp system).

Lineset - In fly systems, one lineset is made up of all components used to make a single batten move up and down over the stage. This includes the pipe itself, lift lines, various blocks, the arbor and counterweights, the rope lock and all connecting hardware.

Load-in - The time period during which scenery, lights, etc. are loaded into a theater in preparation for the next production or performance. Some load-ins may take weeks or months, others only hours. In repertory theaters, multiple load-ins may take place in a single theater in one day.

Loading Bridge - A special heavy duty catwalk or structural platform high above the fly rail where counterweights are stored and from which the weights are loaded onto arbors to balance the loads on individual battens.

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Lock-out, Tag-out - A system by which tools and other devices are noted as being broken, malfunctioning, or otherwise unsafe for use. The system should include a means of labeling the defective equipment with necessary information and preventing it from being used, if at all possible.

Locking Collar - On a counterweight arbor, locking collars slide up and down above the counterweight stack during loading and typically have thumbscrews to secure them at the top of the weight stack once loading is complete. These collars help prevent the weights from bouncing up and out of the arbor in the event of an accidental crash.

Manual Winch System - A way of moving battens up and down without the use of counterweights, but without the benefit of motorization. Manual winch systems are hand driven and typically use gear assemblies to give the user mechanical advantage to lift heavy batten loads by hand.

Married - In fly systems, when two battens/linesets are tied together in some way and must be moved as one unit. In these cases, clear labeling is a necessity.

Midrail - A catwalk or raised platform roughly halfway between the deck and the loading bridge. In theaters with double-purchase fly systems, the midrail houses the fly rail itself. In other theaters, a midrail may house an auxiliary hemp system or an additional counterweight loading area.

Millinery - The practice of designing and building women's hats.

Moused - In rigging, mousing is the practice of securing a moving joint, typically a shackle pin or turnbuckle screw, with a piece of twisted wire, preventing further movement or accidental displacement.

Moving Lights - Lighting instruments which have the capability to move (pan and tilt) automatically via motors and remote control systems. Many moving lights have an array of other features, including color changers, image/pattern templates and rotators, automatic shutters, etc.

NFPA - *National Fire Protection Association* - From the NFPA website: "The National Fire Protection Association (NFPA) is a global self-funded nonprofit organization, established in 1896, devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. NFPA delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering our mission." Codes developed by the NFPA are accepted and enforced widely in many industries, including entertainment, and include safety standards in the areas of fire prevention, life safety, and electrical safety.

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Orchestra Pit - A sunken area at the front of the stage in which the orchestra sits during performances. Some pits are permanently in place, while others are either platformed over when not in use or have a lift system, making the pit adjustable height or a part of the stage apron.

OSHA - *Occupational Safety & Health Administration* - OSHA is part of the US Dept. of Labor and is a regulatory government agency created "to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance." (from the OSHA website). Standards set and enforced by OSHA keep workers in the US safe by requiring employers in all industries to abide by safe practice standards and by penalizing those who do not.

Personal Fall Arrest System - Items that, when used together, provide a means of protecting workers from falls on the worksite. Used in areas where guardrails are either inadequate or must be bypassed. Systems include full body harnesses, lanyards, appropriate anchorage points, and often head protection.

Personnel Lift - Often referred to as a "Genie" because of the popular brand name. Personnel lifts are small platforms/buckets which lift a worker vertically to access higher work areas. Some lifts have outrigger legs for stability while others rely on a weighted base system.

Point Load - In rigging, a point load refers to the lifting of a load from a single point, rather than distributing the load over a number of lift points.

PPE - *Personal Protective Equipment* - Any number of safety devices used to protect any part of a worker's body in any scenario. Examples include eye protection, hearing protection, ventilators, gloves, etc.

Pyrotechnics - Special effects utilizing flammable, combustible, or explosive materials in the interest of spectacle.

Receptacle - Another name for an electrical outlet.

Rigging - The use of specialty hardware and equipment to suspend or fly items above the stage and other parts of the theater.

Rise & Run - Components of a staircase. Rise is the vertical distance between the top of each step, while run is the horizontal travel of each tread.

Theater Safety Glossary

Safety Cable - A small galvanized steel cable with a swaged loop at one end and a safety clip at the other, used as a safety lanyard for lighting instruments and other overhead equipment in the event of an accidental drop/fall.

Design/Safety Factor - In structural terms, the safety factor is a number by which the maximum breaking strength of a component is divided to obtain the safe working load (SWL) or working load limit (WLL) of the particular item. For example, an item with a 1000lb. Breaking strength and a safety factor of 5 would have an SWL of 200lb. Many rigging components are recommended to have a safety factor of 5, while performer flying typically uses a safety factor of 10.

Scissor Lift - A type of aerial lift that raises a working platform vertically using a scissor mechanism. Scissor lifts are often drivable.

Shock Load - In rigging and fall protection, shock load refers to the extreme stress encountered by a system when an object or person is caught in freefall. Shock loads can be many times the weight of the falling object and can cause permanent damage to system components.

Single Purchase Counterweight System - A fly system in which the load on a batten is balanced by an equal load of stacked counterweights on the attached arbor. In single purchase systems, the batten travels the same distance in an opposite direction from the arbor.

SM - Abbreviation for *stage manager*.

Smoke Hatch - Openings in the ceiling of the stage house/fly tower which open manually or automatically in the event of fire, allowing smoke to escape and fresh air to be brought into the audience area during evacuation.

Snaphooks - Safety hooks on either end of a fall protection lanyard which allow the lanyard to be securely attached to an anchor point. These should be double-latching to prevent accidental opening.

Spreader Plates - Thin metal plates which slide up and down on the rods of an arbor in a fly system. Spreader plates are spaced at least every 2ft. in a stack of counterweights to prevent the rods from bending and releasing weights in the event of an accidental crash. A final spreader plate is placed at the top of the weight stack and is held down by locking collars.

Standby - A command given by the stage manager to notify crew members that a certain cue is to be executed momentarily.

Theater Safety Glossary

Strobe Lights - Specialty lighting instruments capable of producing very short, bright bursts of light, reminiscent of camera flashes. Some people with epilepsy or similar conditions may have symptoms triggered by strobe lights.

SWL (see also WLL) - *Safe Working Load* - The maximum breaking strength of a material divided by its safety factor. Components should never be used beyond their SWL or WLL.
Technical Rehearsal

Toe Board/Kickplate - A structural component of a catwalk or other raised platform that provides a small vertical barrier at foot level, preventing items from sliding off the edge.

Tracking - The movement of items, scenic or otherwise, around the stage, during or between scenes, as specified by the script, director, or designer. Object tracking must be documented, practiced and monitored to prevent unintended collisions or entanglements.

Trap - Sometimes referred to as a trap door. These are openings in the stage floor which can be opened or removed depending on the needs of the production.

Webbing - A strongly woven material, often in strap form, used in rigging and fall protection equipment. Webbing should be labeled with an SWL or WLL.

WLL (see also SWL) - *Working Load Limit* - The maximum breaking strength of a material divided by its safety factor. Components should never be used beyond their SWL or WLL.
Technical Rehearsal

Zip Cord - Sometimes called lamp cord. Most zip cord consists of two low-capacity insulated conductors, often 16AWG, which can be easily separated and pulled apart. Zip cord does not have an additional, outer insulating jacket.