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ARTISAN'S & PERFORMERS

Safety Standards

A Compilation of Safety Guidelines By:

THE OFFICE OF THE STATE FIRE MARSHAL

410 West 9800 South, Suite 372

Sandy, Utah 84070

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Chapter 1 – ADMINISTRATION

Accident prevention and efficient operations go hand in hand. Incorporating safe work practices in the fire arts industry is essential to minimize accidents, injuries, and job interruptions. This standard provides safe guidelines and sets the standard for those who perform and practice their art in flame effects before a proximal audience. By addressing potential risks associated with fire performance, these standards shall provide requirements for the protection of audience, support personnel, performers and artisans, assistants, safeties and apprentices, and the property where artisan and performer flame effects are used.

The purpose of this standard shall be to provide minimum requirements for the design, practice, set-up and safe operation during rehearsal and performance, and safe practices in security and storage of hazardous materials as well as take down operations.

NOTE: *This Fire Artisan and Performer Safety Standard is a compilation of fire safety information taken from various internet resources, existing standards, and best practices found throughout the performing arts industry.*

It is intended to apply to flame effects for entertainment, exhibition, demonstration, or simulation before an audience, including their design, fabrication, installation, testing, control, operation and maintenance of flame effects and artisan tools. It also intends to provide safety information to associates, contractors, promoters, owners and independent contractors affiliated with fire artisans and performers associated with the performing arts industry. The information provided herein, is the best available and most current for the performing fire arts.

This Standard disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the use of, or reliance on these best practices and standards.

This Standard covers many, but by no means all, of the circumstances and situations encountered in the operation of fine fire arts associated with the performing arts industry. Should situations arise which are not adequately covered in this standard, please bring it to the attention of the Utah State Fire Marshal's Performing Fire Arts Technical Committee.

Chapter 2 – DEFINITIONS

2.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. Merriam-Webster’s Collegiate Dictionary shall be the source for the ordinarily accepted meanings.

2.2 Approved. Acceptable to the authority having jurisdiction.

2.3 Area.

2.3.1 Accessible Hazard Area. That area made hazardous by the flame effects artist that is normally accessible to a person without the use of an additional means of access that is not normally in place.

2.3.2 Hazard Area. The hazardous area where the flame effects artist or performer operates and or performs their act.

2.3.3 Holding Area. An area where flame effects material or loaded flame effects devices are held prior to use.

2.3.4 Storage Area. An area where flame effects material or flame effects devices are stored prior to use or movement to a holding area.

2.4 Authority Having Jurisdiction (AHJ). Such county and municipal officers who are charged with the enforcement of state and municipal laws, consisting of all fire enforcement officials including designated staff from the Utah State Department of Public Safety, and those who are responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure as presented.

2.5 Cast Members. Performers involved in a production involving the use of flame effects that may or may not be independent contractors, amusement employees or hireling employees.

2.6 Direct Ignition. Automatic or manual means of igniting fuel.

2.7 Fire. The sequence, function or method that results in the deliberate application of spark, flame or heat to a fuel.

2.8 Flame Effect. The combustion of solids, liquids, or gases that may produce heat, physical, visual, or an audible experience before an audience.

2.8.1 Flame Effect Devices. Manually operated devices without the use of automatic control systems often referred to as flame effect tools or flame effect toys by the industry.

2.8.2 Manual Flame Effect. A flame effect that is operated manually.

2.8.3 Portable Flame Effects. Flame effects that are designed and installed, either in a permanent or temporary installation, and that are designed to move or be moved in the course of operation or installation, of a production, or act.

2.9 Flame Effect Appliance. An assembly of components and devices that allow fire to be manipulated in a visual display.

2.10 Flame Effect Artist. A person who designs or develops an artistic program or presentation using a person or tools to control, manipulate or maneuver fire before a proximal audience.

2.11 Flame Effect Assistant. A person or group who works under the supervision of the flame effects artist or performer.

2.12 Flame Effect Materials. A flammable or combustible material that is used as fuel to create a specific flame effect.

2.13 Flame Effect System. Several persons or tool-driven flame effects placed in series and controlled, manipulated or maneuvered by an artisan(s) or performer(s) to produce specific flame effects within a performance.

2.14 Flame Effect Systems, Classifications. As identified in NFPA 160.

2.15 Performer. Any person active in a performance during which flame effects are used and who is not part of the audience or support personnel.

2.16 Permit. A document issued by the AHJ for the purpose of authorizing performance of a specified activity. Unless otherwise specified, the work permit, when used in this document refers to a use permit.

2.16.1 Use permit. A document issued by the AHJ for the purpose of authorizing a fire artisan or performer the use of specified flame effects in a specific venue on a specified date and time or within a specified period.

2.17 Plan.

2.17.1 Design Plan. The plan for a flame effects appliances, tools or toys or a design that presents elements and layout of the performance or act.

2.17.2 Flame Effects Plan. A written report or paper used to convey information needed to evaluate the flame effects, artist or performer, safety considerations and venue specifics for the purpose of applying for a permit and a safety evaluation.

2.18 Rated. A description of performance tools or equipment derived from testing or evaluation that guides appropriate selection, installation, and use of equipment that is not listed.

2.19 Safeties (Artist assistant, Spotters). An individual assistant or group who are designated to protect the performer from hazards related to the performance. Safeties are also to maintain the safety area, protect support personnel, other performers and the audience from hazards relating to the performance.

2.19.1 Guards. Guards provide audience containment from performance area, fuel stations and spinout zones and are not considered as Safeties.

2.20 Spin Off. Fuel or exigent materials that may spin-off, be released or spray from a flame effects tool (toy) during operation of the tool by the artisan or performer.

2.21 Support Personnel. Any individual who is not a performer or member of the audience.

2.22 Tool (Toy). A hand-held flame effect device used to manipulate and/or spin with a wick or other flame effect materials attached and flamed for specific audience proximal flame effects.

2.23 Venue. The property, facility, building, or room within a building where flame effects are used, intended to be used, or are prohibited.

2.24 Wick. An absorbent or combustible bundle, twist, braid, or woven strip of cord, fabric, fiber, or other porous material attached and secured to a flame effect tool or toy that draws up fuel and mayhold the fuel until lighted fuel is then delivered to the base of the flame for conversion to gases and burning.

Chapter 3 – PERFORMANCE REQUIREMENTS

3.1 Professional liability insurance. Professional Indemnity Insurance protects professionals, artisans, performers, and others against potential negligence claims made by those who may feel they were harmed in some way by a performance or act which may have impacted their person or property.

3.1.1 State licensing requirements. Artisans and performers are not required by Utah State statutes to hold or submit proof of public liability insurance to receive or maintain a license for flame effects operator or flame effects artisan or performer.

3.1.2 Professional liability insurance may be required by the local the AHJ, show promoters and/or venue or building management, before the fire artisan or performer will be allowed to set-up, practice or perform within jurisdictional boundaries or venues.

3.1.3 Independent contractor artisans and performers an armature who competes with the professional for performance venue time must identify the local liability insurance requirement. Generally, fire artisans and performers maintain:

1. A minimum of \$3 million in liability insurance specific to fire performance.
2. Professional liability insurance must be renewed annually.
3. Proof of Insurance must be submitted upon request to the jurisdictional requesting office or agency.

3.2 Independent contractor agreements and contracts. As independent contractors, it will be important for the Fire Artisan and Performer to:

1. Read and understand the content of agreements and contracts that are placed before you.
2. Do not sign any document, agreement or contract until you fully understand what has been written and how it impacts you and your art and performance.
3. If you do not understand what has been written in an agreement or contract, consider contacting an attorney for clarification.

3.3 Permit and Approvals

3.3.1 General. Except where otherwise required by the Authority Having Jurisdiction, a use permit shall be required for the use of flame effects before an audience.

1. It may be important for the Artisan or Performer to investigate the local requirements regarding fire performances inside or outside of a building or structure.
2. Generally, all information including application forms can be found on the AHJ's website. Additionally, a quick call to the Office of the AHJ may answer any questions you may have regarding permits, fees, fuel storage locations, venue fire protection concerns and inspection requirements.

3.3.2 Use permits.

1. The use permit shall authorize the use of the number and types of flame effects in the venue as specified in the flame effects plan.
2. Use permits for temporary use are time sensitive, having specified dates, times and the expiration date of the permit.
3. Use permits for permanently installed flame effects shall specify duration and expiration date of the permit.
4. Any activity authorized by the use permit shall be conducted by the permittee or the permittee's agents or employees in compliance with all requirements and standards in accordance with the approved plans and conditions.

3.3.3 Prior Approval Required. The use of all flame effects shall be first approved by the Authority Having Jurisdiction.

1. After the Flame Effects plan has been approved, an inspection of a safety procedure, equipment and storage practices must be conducted.
2. Skill demonstrations are required to meet the requirements of the use permit.

3.4 Flame Effect plans.

3.4.1 Approval of Flame Effect Plan. A plan for the use of flame effects shall be submitted to the authority having jurisdiction for approval.

3.4.2 After the Flame Effect plan has been approved, the plan shall be maintained to be readily accessible at the venue and shall be subject to inspection as specified by the AHJ.

3.4.3 If any addition or modification of flame effects originally described in the approved plan is made, that addition or modification must be approved by the AHJ, prior to use of the modified flame effects.

3.4.4 Flame effects plan requirements. The plan for the use of flame effects shall be submitted in writing or other form acceptable to the AHJ.

3.4.5 When required, a walk-through and a representative demonstration of the flame effects shall be provided to the AHJ before flame effects are approved.

3.5 State License and Testing Requirements.

3.5.1 Flame Effect Performing Artist Licenses. (R-710-2)

1. **Application in writing.** Application for a flame effects performing artist license shall be made in writing on forms provided by the State Fire Marshal.
2. **Application signature.** Application for a flame effects performing artist license shall be signed by the applicant.
3. **Duration.** All licenses shall be valid from the date of issuance through December 31st of the year in which issued.
4. **License transfer.** No licensee shall conduct his business under a name other than the name which appears on his license.
5. **Age of applicant.** Every person who wishes to secure a flame effects performing artist license shall be at least 21 years of age.
6. **Competency verification.** Every person who wishes to secure a flame effect performing artist license shall demonstrate proof of competence by:
 - a. Successfully passing an open book written examination and obtain a minimum grade of seventy percent (70%) or better.
 - b. Submit written verification with the application of having successfully completed a flame effects performing artist safety class or demonstrate previous experience acceptable to the SFM.
 - c. Submit written verification with the application that the applicant has worked with a licensed flame effects performing Artist for at least five (5) training meetings or practice sessions or demonstrate previous experience acceptable to the SFM.
7. **New employee evaluation.** Applicants seeking an original license may perform the various acts while under the direct supervision of a person holding a valid license for a period not to exceed 45 days. By the end of the 45 days the applicant shall have taken and passed the required examinations and completed all other documentation and licensing requirements.
8. **After-Action Reporting.** Every licensed flame effects performing artist shall complete an After Action Report within ten (10) working days after the conclusion of any show and send it to the State Fire Marshal. If there is more than one licensed Artisan or Performer involved in the show, only one After Action Report needs to be sent to the State Fire Marshal for that show.

Chapter 4 – GENERAL FIRE PERFORMANCE

4.1 Independent Contractors. Performing Fire Artisans and Performers who work as an Independent Contractor must meet the following requirements before committing to a specific program, show or performance:

- 4.1.1 Insurance.** Maintain a minimum of \$3 million in liability insurance specific to the fire performance or act you are performing.
1. Insurance must be renewed annually.
 2. Proof of Insurance must be made available upon request.
 3. Without appropriate insurance the fire artisan and fire performer place themselves, promoters, venues and their audience in serious jeopardy.
 4. Without insurance, the performer may not be allowed to perform or present the performance as intended.
- 4.1.2 Contracts or Agreements.** A signed Independent Contractor Agreement with the show promoter may and should be required.
- 4.1.3 Read all Contracts or Agreements.** Read and understand the contents of any contract or agreement prior to signing the document. (An attorney may be required to meet this requirement.)
- 4.1.4 Licensing and Certifications.** Take and pass licensing or certification requirements as required by State or Local government.
- 4.1.5 Safety Inspections.** Contact the Authority Having Jurisdiction (AHJ) prior to your performance and submit to their required safety inspection.
- 4.1.6 Written or Practical Examinations.** A written or practical test or visual examination of skills may be required by the AHJ to meet the minimum skill required to perform at a professional level of quality in your particular art or use of performance tools (toys).
- 4.1.7 Orderly Storage.** Heat sources, fuels, and combustibles must be stored in an orderly, safe fashion.

Chapter 5 – PERFORMANCE RULES AND PRACTICES

5.1 Fire performance. Fire performance by its very nature is a hazardous proposition. Demonstration of or presenting fire related acts can place danger on the performer as well as those who are closely associated with the performer, his tools or the various elements required to produce fire. You as the artisan or performer need to understand you are ultimately responsible for any and all outcomes.

5.2 Know your art. As a fire artisan or performer, you must know your art and be familiar and skilled with what you are performing. Your act must be second nature, flawless, with an adequate knowledge of fuels, tools and safety procedures. Your tools must be solid, tight and easily manipulated. Your wicks must be completely and competently secured. Your knowledge of the fuels you have chosen to use must be supported by scientific data and explicitly intended for the purpose you have selected. Most importantly you must feel comfortable and secure with the medium of fire.

5.3 Responsibility. Through practice, paying attention to detail, following rules, developing best practices and focusing on safety, you can reduce the risk to yourselves, to the staff, to other performers, the audience and the building owners.

5.4 Basic safety rules. Start with safety practices like these:

5.4.1 Make sure your performance area is safe.

5.4.2 Make sure your tool or props are safe.

5.4.3 Never light up without safeties or spotters in place with their attention on you.

5.4.4 Never light up until you are comfortable with the tool or prop you are using.

5.4.5 Never try a new move while lit. Do not leave your original plan or improvise before, during or after the performance.

5.4.6 Make sure you have safety always in mind.

5.5 Protect nonperforming bystanders.

5.5.1 Live fire clear space. Bystanders, roadies, other performers or onlookers, are to be kept clear of the performance and someone who is performing with live fire. Never allow bystanders to move into a cleared performance area, unless invited by the performer.

5.5.2 Restricted storage areas. Whether they are comfortable with fire or not, all nonperforming bystanders must stay clear of the designated performance area, or storage areas, fuel containers, tools, lighters or any trip hazards that may be found at or near the performance area or areas under your control.

5.6 Performance Area

5.6.1 Designated Performance Area. Give the performer space. It doesn't matter if the performance area is marked or designated. The performer may be counting on the space within his “safe performance area” to perform a planned trick or movement that requires the entire space.

5.6.2 In-Act Interference. While the performer is engaged in the act, audience members should never try to put out a performer who has lit their clothing on fire. Many performers plan such things as part of the show. If the performer is unaware of the seriousness of the flame, get the attention of the safety or spotter who is watching the actor's performance.

5.6.3 Audience participation. The audience may approach a performance only if the performer or one of the safeties tells them it is okay to do so. Some performers like to bring the audience into the show. If they offer, the audience member may decline or follow their instructions.

5.7 Guards. Guards provide audience containment duties, keeping the audience away from the performance area, fuel stations, and spin-out zones. Guards are also a support and backup for Safeties.

5.8 The Safety. (Artist Assistant or Spotter)

5.8.1 Safety (Artist Assistant or Spotter). The safety is required by state law and the industry and is a necessary part of every live fire rehearsal and performance. They are the first line of defense for the artist. Fire artists or performers are to have a safety every time they light up. It is important to understand that not everyone can be assigned or accepted as a safety.

5.8.2 Safeties specialty training. Specialty training in a variety of fields, skills and tasks are a necessary requirement for safeties. They must not only be comfortable with fire, but also, injury management. They will need to understand stage crews, stage etiquette, equipment, materials handling, stage patterns and layouts. For many situations, they may manage crowd control and should be at ease in the area of security. For performances, they should be experienced and trained in fire suppression techniques, hazardous materials handling, first aid, crowd control and proficient in the area of security at and around the performance area.

5.8.3 Locating a Safety. Often the best place to find safeties are members of your own group that know your routines, or they may be associates with in the fire art world who have worked with you and your tools. To begin training safeties, start by having them hold various tools to see how they operate and how the wick is attached and secured.

5.8.4 Performer/Safety Communications. The style and methods of communication between safeties and spinners vary widely. The safety needs to be alert and attentive and no more than 15 feet away from the performer during the act. Usually the times when a safety needs to do something is when the performer has hit themselves in some place not immediately visible like their leg or back. If the sound system and crowd are not to

loud, a verbal warning may be enough: “Leg!” Sometimes verbal warnings aren’t heard or the spinner isn’t tuned into the safeties voice. When that happens, the safety may only have 3 seconds to respond and should move into the spinner’s field of vision and use a hand gesture like smacking the area where the fire would be located. If all this doesn’t work, or if the fire threatens to get out of control, the safety should spring into action, be ready to move into the performer’s area with the tools necessary to extinguish the fire or if needed, even tackle the performer as necessary.

5.8.5 Duties of the safety. Protecting the audience, the venue, the performer and the assistants and crew are the priority chain for the safety.

1. Safety Duty – Wick Recovery. This is where a long-standing relationship pays off best. Any tethered device could become tangled, or tied up on the user. An experienced safety will have seen this happen and have a fair idea of how to untangle the item. Sometimes this means handling a burning wick. The point here is to get the job done quickly, before the performer takes a serious burn. If a wick should go into the audience, retrieving it before the audience gets harmed is essential. Safeties should be ready to do whatever is necessary, when it is necessary.

2. Safety Duty – Wick Extinguishing. If you use damp towels, most wicks are pretty easy to get out. But if you're using longer wicks like swords, fans or countach clubs, it's a bit trickier. Plus, if you've switched over to duvetyn or other dry safety cloth, the skill level increases. Either way, make sure that safeties can handle any emergency including the extinguishing of any wicks you might be using. Safeties should aspire to get every wick out in under 1 second. This can be an important skill even if your troupe prefers to spin out their toys.

3. Safety Duty – Crowd Control. Depending on the venue, it's possible that the performance area could be infringed upon by intoxicated or otherwise impaired individuals. In addition to watching for flying fire hazards, many times safeties will have to control unruly crowds too. If someone is just trying to skirt around the performance area, that's usually okay, but, often safeties will have to pull people back from asking questions or otherwise interrupting the performer.

4. Safety Duty – Area Suppression. If something goes terribly wrong, spotters may have to choose between several options. In order they should protect: the audience, the venue, the performer, themselves. Sometimes this will mean directing people to exits, and sometimes this will mean acting like a firefighter - putting out a large scale uncontrolled fire, where one extinguisher or a damp towel probably won't be enough. But there are ways to get things under control. Your local fire department may have beneficial information that will help you know how to keep the area and everyone involved safe. It is a good idea to have a good relationship with the local fire department so you can all work together to keep things under control and safe.

5. Safety Duty – First aid. Safeties should have first aid training that covers burns and blunt force trauma. The Red Cross doesn't currently offer a specific safeties class. What they do offer is often the very best first aid and injury mitigation classes anywhere.

Chapter 6 – CREATING A FIRE ARTS ACT

6.1 Artistic Capacity. When speaking of Fire Art or Flame Effects, both the Fire Artisan and Performer have a marvelous capacity to delight the audience with wondrous visuals, skills and thrills.

6.2 Act Development. When creating or developing a new fire art show, there are six steps or stages that must be taken to insure the show makes it to the auditorium, theater, stage or platform and of course, and most importantly, to the audience.

6.3 Act Development Happens in Six Stages:

6.3.1 Development: The design phase includes: The script is written and drafted into a workable blueprint for the act. (Develop personal standards.)

6.3.2 Pre-production: The preparation phase includes: Blocking out the act. Tools or toys are found or created, wick material and fuels are identified, clothing or costume is made, tricks are identified and music is set. Safety procedures identified. (Safeties or spotters are identified and arranged.)

6.3.3 Rehearsal: With all the pre-production elements in place and using the tools and tricks of the trade, practice the act. Take each trick or element of the show individually and practice. (Safeties are developed through training.)

6.3.4 Production: When confident and assured that you and your act are ready, obtain directives and permits as required. Demonstrate the act in front of people. Sell the act.

6.3.5 Post-Production: Time to adjust and rewrite, the show is edited, music is adjusted, act is renewed, rehearsal again and again.

6.3.6 Marketing & Sales: The act is filmed and digitally mastered. Sent to potential buyers or promoters. Act is picked-up by a promoter. An Agent may be arranged and contracted.

6.3.7 Trick Development: As an Artisan or Performer, it is you or your team who develops the Act design, the tricks and tools you use and the standard by which you perform, do business and drive the act.

6.3.8 The Act. Safety practices are best addressed during the design and preparation phase of the act. It is important to understand at inception of the Act that if anything goes wrong with your performance, it is your responsibility.

6.3.9 More than torching a wick. It is your responsibility to:

1. Develop alert and well-trained safeties.
2. Keep equipment well-maintained, reliable and tested.
3. Design and maintain a performance clear area that it is large enough to meet the requirements of the act and is clean and tidy.
4. Protect the audience.
5. Protect other performers.
6. Protect the venue and the environment.

Chapter 7 – FITNESS

7.1 Accident avoidance. One of the best ways to avoid getting burned as you perform is to work to become physically fit in mind and body.

7.2 Strength. Strength of mind and body are developed. Stamina, speed, strength, skill and spirit, are all attributes achieved through physical fitness. As you prepare to practice and rehearse the elements of your act, regular exercise will be one of the first things you need to be a skilled performer.

7.3 Comprehensive exercise. A quality exercise program sharpens faculties, develops hand-eye coordination, and tones muscle groups.

7.4 Pre-show warm-up. On the day of the show be sure you warm up by exercising muscles and circulating blood. A minimum 20 minute warm-up is reasonable. Just before you go on, loosen-up with a short exercise routine. Consistency will pay dividends in accuracy, performance and wellbeing by calming the nerves and setting focus.

Chapter 8 – SUBSTANCE ABUSE

8.1 Substance abuse and fire cannot be tolerated. Alcohol and drugs are not acceptable in the Fire Arts and Performance scene. You are the ultimate responsible party when it comes to your performance. The people who serve with you should not only be sober, awake and sharp when you are performing but also be alert for people or crew members who are under the influence of mind altering substances. Your safeties are working as security for you and should always be on the look-out for someone who may be out of control.

8.2 Over the counter drugs. Remember, over-the-counter drugs may also be mind-altering to a certain extent and may cause drowsiness. Drowsiness and spinning fire do go well together. Both states of mind are not acceptable before, during or immediately after a performance. Never loosen up before a show with a drink, medication or pharmaceutical. Anything that alters your sharpest state of mind will endanger you and your audience.

8.3 The Impaired audience. It is important for you and your crew to guard against those who may be intoxicated and/or under the influence of drugs. They can disrupt your concentration and divert your focus while performing. They can also draw the attention of your safeties away from the act.

8.4 More than the Safety. To protect you and the act, it will be important for you and your safety to get to know venue security, stage guards and police officers before the act goes on. During the performance, as your safety responds to the impaired person, it would be good to quickly get the attention of a familiar stage guard or police officer. With this kind of help, the situation can be defused with little or no diverted audience attention from you and your act.

Chapter 9 - FABRICS & COSTUMES

9.1 Fabric For the fire Artisan or Performer the most important element of costuming is clearly the fabric. Specifications for fabric are determined by material, weight, weave, combustibility, treatment, and cut.

1. Avoid highly flammable fabrics.
2. Avoid lightweight fabrics, lace or loose weave fabrics.
3. Avoid flammable stretch or fuzzy type fabrics.
4. Avoid pleather, nylon, polyester or other poly type fabrics.
5. Avoid loose clothing, elaborate sleeves, loose neck or sleeve lines, large floppy collars or accessories that may tangle or catch in the flame effect.

9.2 Reliable Fabrics

1. Heavy denim.
2. Leather.
3. Tight weave natural materials such as cotton, wool, etc.
4. Fire or heat resistant or treated fabrics.

9.3 Performance Clothing Clothing is to be tight and close to the body. No fluff or looseness or dangling accessories. If for some reason loose, floppy or fuzzy clothing must be worn by the performer for effect, be sure to rehearse and practice with that clothing before presenting before an audience.

9.4 Shoes or boots Shoes or boots should be tied tight to the leg or covered by pant legs or taped to protect against tripping on loose shoe laces or fire brands dropping into the shoe's openings.

9.5 The Performer's hair Hair is a serious concern as well. Wetting your hair prior to the performance is a common practice to reduce any apprehension. However, if the hair is loose, long or sprayed with hair spray the head must be covered. Head coverings are appropriate if again they are not loose weave or designed with tassels or long tie strings. Use a material or something that can be slipped off quickly if needed. Fabrics used for hair covering should be of the same type as those used in costuming.

9.6 Costuming and performer safety Safety is of utmost concern for local Fire Marshals or Inspectors. The authority having jurisdiction has the responsibility to ask for and expect documentation regarding the testing of flame-retardant clothing.

9.7 Fire retardants Fire retardant products are generally safe to use and comply with ASTM, NFPA and UL testing standards. Companies that develop and market fire retardant products strive to reduce the dangers of fire to the lowest level possible. Fire retardants are generally effective, non-hazardous, non-toxic, and environmentally friendly. All fire retardants, however, deplete and reduce their effectiveness in time. Continuous reapplications may be necessary to promote the highest level of protection these products can provide.

98 Flammability test for cloth Test your fire-retardant materials and fire resistive fabrics with a lighter and a three second vertical test. If any part continues to burn or lights on fire and does not go out, replace it with something better or reapply with fire retardant or get a quality flame resistant fabric.

99 Costumes in Summary

1. Regular performance costumes should be made of flame retardant or high heat retardant materials.
2. Each portion of the costume should be checked for flammability, and flame retarded if possible.
3. Before a performance, the performer should rehearse in costuming several times before the show to insure personal safety.
4. Cover and/or wet hair, secure sleeves and pant legs and seal shoes to protect from fire brands.
5. Never use materials known to be flammable like feathers or fur.

Chapter 10 – THE PERFORMANCE AREA

10.1 Set performance area to act necessity. The Artisan and Performer know the area and space required to complete the act or routine safely. With this knowledge and understanding, it is imperative that before every show or demonstration you identify the area that will be provided for your show. If your space is limited, plan your routine accordingly. Make sure you have space or room to perform the routine you have planned out.

10.2 Clearly mark performance area. Be prepared to mark your performance area. This will help you stay on routine and your safeties to know the boundaries they will be required to protect, and the position of the audience.

10.3 Set –Safety numbers to audience’s nature. If you're performing around people who are intoxicated have extra safeties for crowd control. Just know that intoxicated people are notorious for walking into a performance and disrupting your show.

10.4 Performance Area guidelines. The performance area should be cleared of all flammable materials. Combustible materials should be treated with approved fire retarding chemicals and tested for combustibility in a safe manner before the performance.

10.4.1 Hazard Area Platform. Props, equipment, wiring and other terrain features should be taken into account when designing a performance. Performers should not be in danger of trip-hazards or contact with unforeseen foreign objects.

10.4.2 Proximity plan and fire protection. Careful note of fire protection systems (i.e., sprinkler systems, alarm systems) should be made prior to the event to determine proximity of performance to possible triggers and other effects.

10.4.3 Props and Theatrical pieces. Often, fire performers are not the only act on the stage. Props from theatrical pieces, wiring for bands and DJs, or just theatrical riggings can present a myriad of hazards to the fire artist. Similarly, spinout zones, lamp oil residue from breathing or spinning, and fuel station locations can become a problem for other performers. Generally, the fire arts do not mix well with other acts.

10.4.4 Fire Protection Systems. Passive fire alarms and suppression systems are triggered by a variety of foreign substances. Burning fuels produce most all of them: Smoke, carbon monoxide (CO), particulate matter, heat, etc. Before you go on, check detector sensitivity by talking with venue security. Inform the fire department before the show that they might get a false alarm because of your show.

10.4.5 Vegetation. In the case of plant life, handle all vegetation or flora, live plants or silk flowers, as though untreated, volatile and extremely flammable.

1046 Vegetation Outdoors. In many states plant life gets natural water regularly. With humidity and rain plant life flourishes and is generally naturally protected from fire. In many states found in the south, mid-west and the western states, dry spell are a way of life. Surrounding foliage can be a serious threat when it comes to fire. Landscaping, natural growth, and wild-lands, overhead leaves, nearby bushes, and scrub grasses can all be or become particularly dry and a naturally combustible fuel. Long exposure to heat can dry out, and make leaves and grasses more susceptible to live fire.

1047 Vegetation Indoors. The fire performer must not only be alert and attentive to outside vegetation, but also indoor plants and green vegetation which can start fire with a small insignificant fire brand.

Chapter 11 – PERFORMANCE SAFETY

11.1 Surroundings. One of the trickiest parts of the performance is the area around you. No matter how much you prepare for a show, the performance area is the one thing you sometimes cannot control. Two elements of the performance area are, audience and terrain. The indoor venue's stage and contiguous floor or outdoor existing surroundings can present new elements that may affect your act.

11.2 Audience. Your audience may be uninformed about fire and not appreciate your trickier moves. They may not appreciate your need for a defined performance area. And they may not have full knowledge of fire safety. If you're at a party or a venue with an open bar, chances are you'll have intoxicated people around. Enlist extra safeties to keep the crowd back. And watch out if there are small children. If you're at an event where people are dressed in highly flammable clothing (costume balls, etc.), get some extra towels and soak up residue with water, just to have it ready. Performance distances or proximity to the audience is dependent on the judgment of the performer. In confusing circumstances like these, the best choice is to err on the side of safety.

11.3 Indoors. Some indoor venues will have a stage that will keep the audience at bay, fire resistant materials all around, and a room where you can keep your fuel. Some venues will not have these. Any time you're indoors, ask the promoter about the performance area. Make sure you know any trouble zones that might be near you (draperies, art, etc.). Try to form a safe place away from the performance area that you can use to store fuel and spin out. A back door is usually best, but a separate room will do. Remember to mop up after spinning out with Kero. You can also use orange cones and caution tape to set up a performance perimeter.

11.4 Outdoors. If you're on a beach you usually only need to worry about crowd control. Anywhere else, and the plant life may become a fire problem. Unless it has recently rained, it's a good idea to consider all plants as highly flammable. You should keep an extinguisher near any large plants, particularly if they extend overhead.

11.5 Protecting Fuel. Indoors or out, keep a safety or assistant between you and your fuel station. Unless you can lock your fuel in a fireproof box, there's always the slim chance that a wick could end up near it. Fuel is to be separated from the audience no less than 30 feet. However, when required, no more than 8 ounces of open fuel may be placed on the performance platform or stage during the act. The Safety's protecting fuel should have the biggest moist towels or cloths available and should be ready to smother an errant fuel fire or catch a lit wick flying towards the fuel protection area.

Chapter 12 – FIRE PERFORMANCE SAFETY CHECKLIST

12.1 Venue. The venue inspection is the evaluation of the proposed property, facility, building or room where a flame effect show is to occur. The review is to be accomplished by the performer or their responsible agent and the fire service professional. Venue inspections are important to ensure the venue is appropriate for the proposed flame effects and the safety of the audience.

12.1.1 Are the following items sufficient to support the Fire Performance?

1. Ceiling Height
2. Building construction materials
3. Décor
4. Ventilation
5. Fire Prevention Systems (Alarm and/or Suppression Systems)
6. Exits
7. Flooring Material

12.1.2 Has the Fire Performer provided a written description of the floor plan?

12.2 Holding Area. A holding area is the staging area where flame effect materials, tools or fuels are held and fueled prior to use before an audience.

1. Is the holding area well-lit with sufficient ventilation?
2. Is the holding area isolated from any audience traffic?
3. Are there a sufficient number of “No Smoking” signs posted?
4. Are all flame effect materials and devices that are not in use, stored in accordance with applicable codes, standards and any state and local regulations?
5. Are all flammable flame effect materials and fueled devices in holding areas secured and/or supervised?
6. Is the spin-out area the appropriate size with sufficient ventilation?

12.3 Hazard Area. The hazard area is the anticipated area within the venue where a flame effect is ignited, including an appropriate safety perimeter.

12.3.1 Are the following items sufficient to support the fire performance?

1. Stage
2. Safety perimeter
3. Stage Entrance/Exit
4. Tool Extinguishment location
5. Is there an on-stage fuel requirement?
6. Is the fuel container appropriate for the performance?

12.3.2 Is the hazard area in a neat and orderly condition?

12.4 Equipment.

1. Are all flame effect devices in good working condition? (Visible signs of wear, wick decomposition, loose fasteners or frayed grips, etc.)
2. Have all flame effect devices been tested to verify that they operate in accordance with their design and plan specifications?
3. Has a walk-through or representative demonstration of the flame effect devices been provided?
4. Are there a sufficient number of fire extinguishers of the proper classification and size readily accessible for the performance?
5. Are suitable methods for extinguishing flame effect devices readily accessible for the performance? (Cool water, damp towels, etc.)

12.5 Performers.

1. Are the fire performers and flame effect assistants protected by clothing or other means suitable for their exposure to flame effects?
2. Has the fire performer demonstrated competency by training, experience, or demonstration?
3. Are the fire performers under the influence of intoxicating beverages, narcotics, prescription drugs and/or non-prescription drugs that can impair judgment?

12.6 Verbal Plans. Every Fire Performer should be able to provide a verbal narrative of their role within Pre and Post Performance and Emergency Operations.

12.6.1 Pre-show

1. Has the fire performer advised all performers and flame effect assistants that they are exposed to a potentially hazardous situation during the execution of the flame effect performance?
2. Have the flame effects been evaluated to verify that the fire performer and the audience are not exposed to an unreasonably dangerous situation when the flame effects are activated as designed or anticipated?
3. Is security of the Holding Area and Hazard Areas sufficient and in place?
4. Are there an appropriate number of trained flame effect assistants (safeties, guards or fire watch) for the performance?
5. Do the flame effect assistants have a means of communicating with the performer?
6. Do the flame effect assistants have a means of communicating an alarm?

12.6.2 Show

1. Has the fire performer provided a detailed verbal description of the show?
2. If any changes to the previously provided written performance plan were made on the day of the performance, (exact location, different safety perimeter, number of performers, etc.) have these changes been provided to the AHJ and accounted for?
3. If there is an on-stage fuel requirement, is the fuel stored in an appropriate container?

12.6.3 Post-Show

1. Has the fire performer adequately cleaned-up the Hazard and/or Holding Areas and performed a final walk-through?
2. Has the fire performer notified appropriate personnel that any interrupted life safety systems must now be immediately restored?

12.7 Emergency Operations (Safety Plan). Has the fire performer provided an overview of their safety plan?

Safety Plan

1. First Aid
2. Emergency Exit Plan/Retreat path.
3. Fire suppression plan.
4. Description and location of safety & suppression equipment.
5. Emergency response & emergency communications plan.
6. Identification of Fire Safety Personnel (flame effect assistants, safeties, and **guards**)

Chapter 13 – PERFORMANCE DEVICES AND TOOLS

13.1 Wick security and control. The general rule for insuring the safety of any fire tool is to make sure that the wick(s) can't unexpectedly leave your control and enter the audience area or soar into hazardous areas. The fastest way to check is to hold the tool where you normally would, grab the wick and give it a good yank. If it comes off, the wick is probably too loose and not safe. The yank should be appropriate to the amount of force the wick would normally take while in use. Poi should be yanked much harder than fans, for example. Check for loose screws, nuts, and bolts for any unstable part and tighten as appropriate.

13.2 Pre-burn or live fire safety checks:

13.2.1 Poi

1. Check the grips for wear: if leather, tug firmly, if Kevlar, check for fraying.
2. Verify that chains are solid and undamaged.
3. Check links: replace key rings, tighten quick links, and check quick snaps for discoloration.
4. Check wicks: insure the wick is securely on its binding and that any fasteners will not come off.

13.2.2 Torches/Clubs

1. Insure that ball is attached firmly.
2. Check wood parts for cracks.
3. Insure wick is firmly attached.

13.2.3 Hoops

1. Check hoop integrity look for cracks or bends in material.
2. Verify the security of wicks.
3. Verify the security of all hardware.

13.2.4 Staves

1. Check staff integrity; look for cracks or bends in material.
2. Verify the security of wicks.

13.2.5 Fans

1. Check structural integrity of the fan in general; twist, bend, etc.
2. Check wicks make sure they're on tight and not frayed.

13.2.6 Fingers

1. Check that each finger fits properly well before show time. Tighten or loosen as appropriate.
2. Make sure wicks are properly attached and secure.
3. Test fingers before lighting with vigorous swinging to insure secure attachment.

13.3 Device and tool protections.

1. Tools shall be made of fire resistive or fire proof materials.
2. Protective covering shall extend at least 4 inches on either side and beyond flame contact zones.
3. Handles shall be attached securely and using the same methods as with wick attachments.
4. Connectors and attaching devices shall be made of materials that reduce wear, deteriorate or fracture under stress.
5. The more connecting points designed into a tool, the greater chance for failure if the tool is not be maintained properly.
6. Devices and tools shall be designed to meet the highest standards required to endure the stresses, torsion, twisting and stretching forces required for tool performance.
7. Flame effect devices shall be maintained and in good working order.

Chapter 14 – Spinning Fire

14.1 Proficiency. Am I ready to spin fire? This is a question that may be difficult to answer. The amount of time you have spent spinning and the number of moves you know can have an effect on whether or not you're ready to spin fire. The confidence and skill you have developed during your many hours of practice will help you to perform your moves and tricks with accuracy.

14.2 Confidence and Skill. All fire spinners need to make sure they're ready and prepared to spin fire with various types of tools and toys before performing in front of an audience. Confidence and skill to do the job safely, artistically, and with the utmost proficiency before the audience really is the goal.

14.3 Safety While Practicing. For the spinner a staff is safer to spin while lit than Poi. Poi can and do tangle around a spinner's body and are hard to get off once attached, although a staff can easily be dropped. A staff poses more danger to bystanders as a carelessly released staff can fly off and cause major damage.

14.4 Get Help & Advice. Ideally you should have an experienced fire spinner to help you spin fire for the first time. Nothing is as good as real life help and guidance. It is good to have someone with experience help you and watch out for your safety.

14.5 Don't rush. Don't be in too much of a hurry to start spinning. You should not practice with lighted tools at the beginning. You will however, want to start spinning as soon as possible. Spin when you're ready and not when your friends say you are. There isn't any reason to rush to start spinning fire that is worth the potential danger to yourself and those around you.

14.6 Your first live fire Spin. Don't try moves you're not confident with. Know which moves you can perform well with little chance of tangling around yourself and spin slowly. More accidents happen when you spin too fast. Consistency and calm nerves are key to starting with live fire. You should be able to consistently spin a fire staff/poi without hitting yourself. This doesn't mean you'll never hit yourself when lit, but it greatly reduces the chances of injury. Practice with your fire poi unlit and if possible add a bit of weight to them. You could try covering them with an old pair of socks.

14.7 Safety. It's crucial that you take appropriate steps to ensure the safety of yourself and those nearby. When spinning always have a safety nearby with a fire blanket, fire extinguisher, or wet towel in case the worst does happen. Keep a safe distance away from other people but not so far that your safety can't easily reach you. Get your safety to keep an eye out for anyone that might walk too close to you while you're spinning.

14.8 Fuel. Read the section on fuels and the MSDS for the fuels you are using. Make sure you never spin with something dangerous such as methylated spirits, diesel fuel or gasoline. The safest fuel for spinning is kerosene, or paraffin in some countries, which is usually the main ingredient in lampoil. Kerosene doesn't transfer onto other materials easily and doesn't light as easily as other fuels do. Kerosene is also the least explosive of the fuels. However, no fuel is completely safe and you need to make sure your fuel is safely contained at least 30 feet from an audience and kept well away from flames.

14.9 Spinning off. Don't forget to remove excess fuel from your wicks before lighting up. There are many ways of doing this and the best way to collect the excess fuel is by placing the wick securely in a container before spinning the excess out. Just spinning unlit should never be done indoors and even outdoors it pollutes the environment and places slippery fuel on the floor you're spinning on. Always use a spin-off bucket to avoid contaminating the area and the environment.

14.10 You will get burned. Eventually, every fire spinner will get burned and most fire performers have a distinct lack of body hair on their arms. So know what to do if you do get burned by reading the First Aid section.

14.11 Maintenance. Housekeeping is the last thing you would have expected as a professional fire artisan and performer when discussing spinning fire, best practices, stage etiquette or professionalism. The fact is that respecting the venue, thinking of others and stepping to a higher standard, before, during and after the show, is the very definition of a true professional. You and your assistants must keep in mind and make it a practice to clean-up after yourselves after each performance. Spin-off fuel, bits of wick, trash and residue on the floor, walls or equipment is not an image you want your promoter, venue owner or your fans to see after you have taken your bow. Leaving the place; building, stage or field, better than you found it will earn you respect and trust, set your act and crew apart from others, and develop relationships that will be friendly and profitable. Make sure cleaning aids are packed and available in your bag of tricks.

14.12 Have fun! Your first spin is going to be the most memorable—so have fun!

Chapter 15 - STAGE PRESENTS AND SOCIAL ETIQUETTE

15.1 You're a Member of a Larger Community of Show people, presenters, actors and musicians. All are artisans in their own right! Every Fire Artisan and/or Fire Performer must have the confidence to do the job in excellent fashion. But sometimes this confidence can lead to danger. An experienced performer often develops certain habits that may not coincide with more accepted community ideals and particular safety standards and rules. As a performer, a member of the Community of Fire Artisan's & Performers and the Show Community, it is your responsibility to try to help and accept others and their ways.

15.2 Confidence vs. Cockiness. One bad incident from even a very experienced performer could make this happen. It doesn't matter what your experience level is, you should watch out for the community whenever you see someone spinning. They may be new and inexperienced without a general clue, they may be cocky experienced spinners taking a couple of shortcuts, or they may be a professional troupe that simply forgot a couple of things. Whatever the case, if safety isn't first on their mind, help out.

15.3 Equipment. Ask other performers you don't know if you can see their tools. Check them for cracks, loose bolts, etc. Even well used tools can develop problems. If you notice a problem, point it out. If they haven't noticed it, usually it's because they're too busy to deal with it. If so, offer to fix it for them. You may allow them to keep that tool in their routine safely. If you spot a possible problem with their equipment, try to point out specific incidents where the problem has arisen: "My friend lost a wick because he used key rings like these, and they broke during a leg wrap." If not, keep any criticism internally focused: "I don't feel safe about that staff" or "I get a little nervous when you spin those torches."

15.4 General safety. If you notice someone about to light up without an apparent safety.

15.4.1 Offer Assistance. Ask the inexperienced or unsafe performer if you could help with equipment or offer to spot. I've never heard anyone refuse such an offer. Sometimes, you'll notice safety problems as they arise. If so, feel free to yell them out quickly: "There's a bush right behind you!"

15.4.2 Willing to share. Most performers are willing and glad to share their reasoning behind a practice, procedure or safety. If you ask them with kindness, it could be a very comfortable way to point out a particular problem you have seen or that they have overlooked.

15.4.3 Serious problems. If you see someone spinning with a clear path to their fuel, a child moving into the performance area, or anything else that could become a big problem; FIX IT! If you feel less experienced than the person with the problem, ask them about it. Offer your concern with reasoning.

15.4.4 Unsafe practices. If the performer continues to follow unsafe practices, keep asking them to fix them. Ask performers to back you up. If that doesn't work, and the problem is serious enough, perhaps the fire marshal or police could help you make your point.

15.5 Uncertain safe practices. If you're not sure about a particular safety point or industry standards, ask someone. When a question comes up and you're not sure, never think your personal experience over rides accepted standards and rules. Find a professional to answer the question for you. Most performers are glad to share their reasoning regarding safe practices and general safety.

15.5.1 Fire Marshal. You can ask the authority having jurisdiction or you can always speak with a state or local fire marshal.

15.6 The Fire Arts. The serious handling of fire and fire performance is an art for many, a profession for some, and even spiritual for a few of its practitioners. Fire Artisans & Performers may expand their capability and understanding of the fire arts along with the associated prerequisite of safe operations by contacting a variety of professional organizations.

15.6.1 The North American Fire Arts Association is a non-profit safety organization dedicated to raising the level of safety awareness in the fire performance community. NAFAA has gathered and disseminated good sound information about the art of fire handling and fire performance. Myths and well-intentioned false information have been displaced by accurate information, quality education and sound training practices.
Contact information: <http://www.nafaa.org/>

15.6.2 United Fire Artists is a non-profit, professional partnership comprised of members of the fire performance community whose goal is to promote fire safety through education and training.
Contact information: united fire artists or <https://www.safefirefx.org/documents/>

15.6.3 Home of Poi is a professional group designed to enhance dance, rhythm and safety in all facets of the fire arts arena.
Contact information: <http://www.homeofpoi.com/lessons>

15.6.4 Office of the Utah State Fire Marshal. This office is the Authority Having Jurisdiction for State licensing and certifications for Firework Display Operators, Special Effects Operators, Flame Effect Operators and Flame Effect Artisans and Performers. The following website contains vital information on laws and rules, forms, contact information, and license testing information. <http://firemarshal.utah.gov>.

Chapter 16 – FUELS AND CHEMICAL SAFETY

16.1 Material Safety Data Sheet—MSDS

16.2 What is a MSDS?

A Material Safety Data Sheet contains information for handling or working with a particular substance. MSDS's include information like the flash point, toxicity, health issues and handling procedures of a substance, as well as what to do when something goes wrong in an accident.

16.3 Who should read a MSDS?

Anyone who uses a fuel or toxic material should review the MSDS, more so than the average consumer. This means anyone who performs/interacts with a fuel in any way. This includes someone who is a safety for a fire performer.

16.4 Why should I read the MSDS on the fuel that I use?

To use and interact with your fuel in a safe manner you need to know things like how flammable it is, what happens if you get it on your skin, what you should do if you swallow some, what do you do if you get it in your or anyone's eye, what you should do if you spill it or swallow it, how should it be stored, how it can be safely extinguished if on fire, will/can it explode, will it give you cancer, what effects can result from long term use.

16.5 Where do I get a MSDS?

Every company that manufactures or distributes hazardous chemicals must have/provide a MSDS. The purchaser has the right to know everything about the material that they are purchasing and as such the seller must assist you in obtaining a copy of the MSDS. If they cannot provide a MSDS do not purchase the fuel.

16.6 The index of the Fire Artisans & Performers –

Safety Standards have MSDS information on most of the fuels and chemicals used in fire performance. If you don't find it there, some universities and libraries may also have copies of MSDS's. You can also try looking it up on the internet.

16.7 Where can I search for a particular MSDS on the Internet?

NOTE: The only way to truly know what is in your fuel is to get the MSDS from the manufacturer or supplier.

1. [Hazard.com searchable database \(http://hazard.com/msds/index.php\)](http://hazard.com/msds/index.php) A large database. Unlimited searches.
2. [Cornell University MSDS Search \(http://msds.pdc.cornell.edu/msdssrch.asp\)](http://msds.pdc.cornell.edu/msdssrch.asp) A huge database, simple search function.

3. [MSDS solutions \(http://www.msdsolutions.com/en/\)](http://www.msdsolutions.com/en/) A huge worldwide database. 50 free searches.
4. [ExxonMobil MSDS \(http://emmsds.ihpspl.com/msds/search.html\)](http://emmsds.ihpspl.com/msds/search.html) Australasian manufacturer of Pegasol 3440 Special.
5. [Coleman Products MSDS \(http://www.coleman.com/coleman/msds/lantern.pdf\)](http://www.coleman.com/coleman/msds/lantern.pdf) White gas/Lamp fuel/Lantern Fuel

16.8 Do we have some direct links to the MSDS of the fuel you are using?

No, because there are hundreds of manufacturers of the fuels that are used throughout the world and the chemical makeup/composition varies considerably even across the country along with the toxicity. MSDS's are specific to the manufacturer and can change over time. Two bottles could both be labeled as the same fuel by different manufacturers, however their properties may still vary, especially the toxicity.

16.9 Who can I trust?

Be very careful. Say for example if the Manufacturers Safety Data Sheet (MSDS) for a particular brand of aviation-type kerosene says that it is one of the few that are 100% pure kerosene, then you might trust it if you also see the barrel it comes out of and read the labels on that barrel. Treat anything that is repackaged for retail sales (smaller than 55 gallon drums) as highly toxic. Do not take someone's word at face value. Always check the MSDS yourself.

Chapter 17 - Information on Fuels

17.1 Fuel containers. Keep your fuels in their original containers for transport and storage. In the fuel storage area for your performance, all fuels should be kept no less than 30 feet from an audience, in sealed metal containers that are clearly marked. Test your fuel containers with a baseball. If they can't withstand the impact of a strong throw, they may fail if a fire toy hits them. If you're using any non-metal fuel containers, test them empty with a 6-10 second close proximity burn of white gas. Basically, try to imagine a lit wick hitting your fuel dump at the same time you have to put out someone in the audience.

17.2 Separation of heat and fuel. On top of these measures, make sure that you at least have a safety person between fire and fuel. This includes your spin out area. "No Smoking" signs are to be placed at and near fuel stations and storage areas. The best method for protection is to ensure that there is a hard wall between fuel and performance platform. Don't allow audience members near your fuel. Be sure to post adjacent path and traffic corridors as non-smoking areas.

17.3 Wick fuel load. Whenever you'll be spinning near other people, you should always get excess fuel off your wicks before lighting. Do this by spinning them quickly until droplets stop coming off. You should probably do this every time, though it makes for nice effects when controlled and handled properly. For safety, do this away from the performance area and away from traffic zones if you're using kerosene or lamp oil (as these fuels are toxic to the environment and don't evaporate).

17.4 Breakdown of fuel types and uses.

17.4.1 Naphtha (aka. White Gas [US], Coleman Fuel, Zippo fuel)

Naphtha is the hottest burning fuel used by most performers. It has a very low evaporation point, well below room temperature, so it will quickly evaporate from the floor, your wicks, or your containers. Mixing with Vaseline will slow evaporation but make it harder to soak. This also makes it the fastest lighting fuel. Brushing a naphtha soaked wick with a flame or spark will usually ignite it immediately. Because it burns with hot-body radiation, it is the hardest fuel to color, and uses the most oxygen while burning. This gives it the advantage of being the easiest to smother of the petrol fuels. Naphtha is the preferred fuel for contact fire, hybrid wicks and large flames and relatively smoke free burning. It burns with toxic residue however, and should not be used excessively at indoor venues. It gives the biggest flame for fire breathing, but the most hazardous one as well, and it is very hard on the liver when absorbed or accidentally ingested.

17.4.2 Kerosene (aka. K-1, Charcoal lighter fluid, high grade diesel fuel)

Kero is almost as hot as naphtha once it gets burning. It has an evaporation point above room temperature so it will stay on your wicks for weeks, and leave an oily residue on any surface it touches. This makes it one of the slowest lighting fuels, taking several seconds to ignite from a lighter in cold temperatures. Kero can also burn in very low oxygen environments, so it is preferred over naphtha in elevated areas. Unfortunately, this also means that if it ignites on any porous surface, chances are, both sides will ignite. Like gasoline, the fumes have an explosive

potential, so don't leave kero in direct sunlight in any container and avoid storing it in cars during summer. Kero is the preferred fuel for long outdoor performance on pure Kevlar wicks. It cannot be used for contact fire, is hazardous for fire breathing, should be avoided for hybrid wicks, is very smokey and toxic for indoor venues and can be extremely difficult to fully extinguish.

17.4.3 Paraffin (aka. lamp oil [US], mineral oil)

Lamp oil is very similar to Kero in its properties. The biggest difference is that it has a slightly smaller and cooler flame that requires a little more oxygen. It's easier to fully smother, and has a little less explosive potential. It's also easier on the body which makes it the preferred fuel for fire breathing, though extreme cautions should be used. Although it burns almost as smokey as Kero, it generally has fewer toxins which make it the preferred fuel for long burning indoor performances. It should be noted, however, that recent testing has uncovered that paraffin can be auto-ignited (i.e.: without spark or flame source) at temperatures produced by fire performance. In other words, spin or hold a club through a couple of burns and the metal parts could become hot enough to ignite paraffin on contact with vapors or fuel.

17.4.4 Alcohol (aka, liquor, rubbing alcohol, ethanol, isopropyl, white lightning)

Any short chain alcohol (methyl, ethyl, and propyl) in mixtures above 50% (100 proof) is sufficient for many fire practices, though methanol should never be used as even its fumes are a neurotoxin. The higher the proof, the better the flame. Alcohol reacts like naphtha in most cases: high oxygen use, low evaporation point, quick lighting. It burns much cooler than the other fuels however, and has a tendency to go out unexpectedly on pure Kevlar wicks. It's cool flame and liver compatibility makes it the safest fuel for experimentation with new tricks, particularly fire breathing, contact fire, and close proximity wick play. However, ethyl alcohol will make you drunk if used for fire breathing, denatured alcohol (which contains methanol) can cause blindness if taken in quantity, and isopropyl has a foul taste. Alcohol has another advantage over the other fuels in that it can dissolve a variety of substances that will cause the flame to turn colors. Because of its wimpy flames, terry or hybrid wicks should be used when spinning to prevent unexpected extinguishing. Alcohol is the best fuel for small or short fire and burns the cleanest of all fuels for close indoor venues (except when colored).

17.4.5 KEROSENE (called *paraffin* in many places outside the U.S.) is the safest fuel for all fire props.

1. **Kerosene reasonably safe.** That doesn't mean that it **is** safe, but it's safer than any other kind of liquid fuel. It is the least explosive of fuels.
2. **Pure kerosene.** Pure kerosene is not particularly toxic. If splashed on the skin it should be wiped off promptly, but if it isn't it will only give you contact dermatitis (skin rash). If it is splashed in the eyes it should be thoroughly rinsed out. If you should drink some, drink a glass or two of water to reduce the possibility of indigestion, gas, or diarrhea, but do not induce vomiting (because of the possibility of inhalation).

3. **Aviation kerosene.** Very few brands of kerosene are 100% pure, with no additives. These are sold as aviation kerosene and are not available to the general public. As of December 1998, the only sources found were Exxon Aviation Turbo Fuel, Mobil Jet Fuel-Kerosene turbine fuel, and Pennzoil Kerosene Turbine Fuel (Aviation).
4. **Kerosene additives.** All of the several hundred other brands and types of kerosene (aviation fuel, coal oil, heating oil, lamp oil, and fuel oil) contain a variety of extremely toxic ingredients, principally benzene and naphtha. These additives or impurities are absorbed through the skin and mucous membrane, and accumulate in the liver and kidneys. Some directly attack the corneas, so if such kerosene is splashed into the eyes, the eyelids should be held open and flushed for fifteen minutes, and you should seek medical attention immediately. Again, if swallowed, do not induce vomiting, but seek medical attention immediately.
5. **Consider kerosene as highly toxic.** All kerosene should be treated as if it is highly toxic. If the Manufactures Safety Data Sheet (MSDS) for a particular brand of aviation type kerosene says that it is one of the few that are 100% pure kerosene, then you might trust it if you also see the barrel it comes out of and read the labels on that barrel. Treat anything that is repackaged for retail sales (smaller than 55 gallon drums) as highly toxic. There have been reports of people repackaging various grades of kerosene as nontoxic or good for jugglers and fire-eaters – some was, some wasn't.
6. **Scented and unscented lamp.** Scented and unscented lamp oil is kerosene without the bad smell. But contrary to popular belief, the additives that make it more aesthetically acceptable also make it more poisonous. Roman Oil was originally a naturally occurring fuel and lamp oil without the usual odor or smokiness. Again, the assumption was that if it didn't smell bad it wasn't bad for you. And again, the assumption was wrong: it is often among the more toxic of kerosene's.

17.4.6 COLEMAN FUEL and LIGHTER FLUID (Ronsonal and Zippo) consist of naphtha with various additives to control smell and appearance. They are preferred by many jugglers because they are not as smoky or as smelly as kerosene, and they light quickly. But naphtha is much more volatile than kerosene -- that is, it is more likely to explode or get out of control than kerosene. You cannot dip blown-out but still smoldering torches into naphtha because that will instantly set the contents of your fuel jar on fire. Just approaching a fuel storage area while holding smoldering torches can cause the fuel to ignite. You must completely extinguish all smoldering and wait at least thirty seconds before recharging your torches when using naphtha. Naphtha is as toxic as the worst kerosene.

17.4.7 CHARCOAL STARTER (Kingsford and Wizard) is a mix of kerosene and naphtha. Some jugglers prefer a mixture of 4 parts Coleman to 1 part charcoal starter, because they think it makes a brighter but safer flame, with less smoke and stink. Others mix Coleman and kerosene to produce the same effect. All of these fuels are highly toxic if inhaled or ingested.

17.4.8 GASOLINE, PAINT THINNER, AIRPLANE FUEL, and other highly volatile fuels are extremely explosive and extremely toxic. The fumes remaining in a one-gallon can that has been emptied of gasoline can explode with the force of a stick of dynamite. When it is very hot and humid, gasoline fumes will not readily disperse and may be ignited as much as a half hour after all the original products are capped and stored. The fumes from Coleman, lighter fluid, and barbecue starter will explode almost as readily, but not with quite the same force -- say, a half-stick of dynamite. Kerosene and lamp oil are fairly hard to blow up, which is why they are used in lamps and home heaters.

17.4.9 HIGH PROOF ALCOHOL OR LIQUOR. Some Fire-eaters and fire-breathers sometimes use high-proof liquor, such as Ron Rico Purple Label Rum. This avoids the problems of poisoning, but blowbacks are just as likely. EVERCLEAR, which is pure (100%, 200 proof) grain alcohol, is also sometimes used. It approaches the volatility of gasoline, making blowbacks almost inevitable. It is not available in some states. The only medical problem with liquor or Everclear is that what you absorb from doing a few blasts of fire will get you quite drunk. That's not a reasonable condition to be in if you are doing fire.

17.4.10 GRAIN ALCOHOL is produced by fermentation. It is the basic ingredient in beer, wine, and liquors, and is not immediately poisonous. Beverages with an alcohol content of 60% (120 proof) or higher are volatile enough to be used with fire props, but are seldom used because they produce a wimpy flame.

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17.4.11 Fire arts performance fuels. Common fuels and their uses in fire arts performance.

1. Coleman/White Gas. Coleman fuel and white gas are somewhat smokey, almost a soap like taste, lingering smell to the air. Wonderful ignition with a moderate burn length. An orange- yellow flame, great for night.

a. Experience has shown that white gas has the quickest light and shortest burn time, with the cleanest burning. It has a very low flash point. This fuel is **not** to be used for blowing fire.

2. Kerosene. Tastes like Moonshine but aspirates well without fear of blowback. Quick ignite, short burn. Recommended for breathing, not for poi, staff or other toys. Smokey and residue. Slows down in cold weather (Shorter burn, harder to create a strong blow). More of a deep orange flame.

a. Kerosene has the longest burn time and somewhere between lamp oil and white gas as far as ease of lighting. It is definitely the most smelly, smokey and leaves residue on the tools (stinky, sooty is not optimal for some acts.)

b. Blowing is not a quality option with this fuel.

3. Lamp/Candle Oil. Lamp oil or candle oil has little taste, good aspiration, slight risk of blowback. Long burns, though a touch stinky/smokey. Slow to ignite, has a "creeping" flame. Great for inclement weather. Has a reddish flame.

a. Lamp oil and Coleman fuel are used for toys and are well established. They can be used in and out of doors. Kero, may be used for blows. There are many arguments for and against each fuel and it really comes down to personal preference.

b. Lamp oil has a longer burn time, but a slower light up. It is somewhere between white gas and kerosene on the clean burning spectrum. Higher flash point, is good for blowing.

4. Mixing fuels. A mix can make a good happy medium when searching for an optimal fuel. Soaking tools in lamp oil first and dipping them quickly in white gas at the end is one option. Depending on need, mixing can utilize lamp oil's longer spin time and the easy lighting quality of white gas.

a. Lamp oil and white gas will separate, but if you dip sequentially the white gas will be on the outside for the easy light.

b. Mixing lamp oil or kerosene with Coleman, in a 50/50 or 3/4 Coleman to 1/4 lamp oil, will produce more smoke, but not nearly as bad as without the Coleman. Using Smokeless or ultra pure lamp oil does not smoke much, but the spin off is really slick and hard to clean.

c. For indoor performance, white gas alone will produce the cleanest burn. To add time for a longer burn on white gas, adding more wick is generally helpful.

5. Climate, altitude and temperature. Climate, altitude and temperature can affect fuel and the burn quality in a significant way.

a. Temperature. To support the point; in a colder climate kerosene may be more difficult to light and produce a shorter burn time. Other fuels with higher flash points may react differently or may not be affected at all.

b. Altitude. The higher the altitude, generally the shorter the burn. Fuels and flame size will react differently at sea level than at five thousand feet.

c. Climate or atmosphere. High humidity may cause the flame to reduce in size to an extent. Whereas, in a dry climate or lighter atmosphere the flame may become larger and more fluid.

d. Frozen Fuel. Fuel will still burn when it is frozen. More importantly, when fuel is thawed, there is no apparent difference in the way the fuel reacts or burns. It is basically the same.

6. Fuels differ from state to state. Not all fuels are created equally. Manufacturer location determines fuel content and mix. For example, Coleman in the southern states reacts and tastes differently than it tastes and reacts in the western states.

17.4.12 Eye Care. When working with fuels, always wear chemical protective clothing with gloves and eye protection. Avoid direct bodily contact with the fuel where possible. If fuel splashes into the eye, quickly and gently blot the fuel or chemical away with a clean cloth or paper towel. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 20 minutes or until the fuel or chemical is removed, moving the head side to side under the flowing stream while holding the eyelid(s) open. Obtain medical advice immediately call 9.1.1 as needed. Do not rub the eye(s) as this may cause further damage. Don't put anything other than clean flowing water or contact lens saline in the eye (do not use eye drops unless directed to by medical authority). Reference: <http://www.mayoclinic.com/health/first-aid-eye-emergency/FA00041>

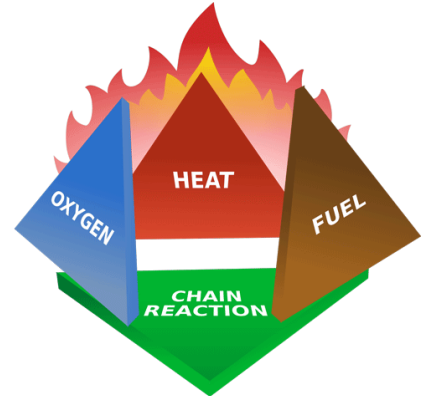
Hazardous Fuels Information Safety
Additional information from HOME OF POI... (www.homeofpoi.com)

Chapter 18 – Fire Science

18.1 What is fire?

Fire is a chemical, exothermic reaction. Exothermic means the chemical reaction will produce heat. For fire to exist it requires oxygen, a source of ignition (heat), fuel of some type or classification and a chemical reaction. When these elements are brought together in a specific combination, fire is produced. Historically, these elements have been called the fire triangle, however since science has become more focused on these elements and the chemical reaction that takes place, the four elements are called the fire tetrahedron.

To control fire, each of the elements may be controlled together or individually. If you want to extinguish the fire, just remove one or more of the elements and the fire will go out. If you want to make it hotter, add oxygen or fuel or if you want to lean the fire, reduce oxygen.



18.2 Fire Extinguishers. The fire extinguisher is designed to remove one or more of the elements found in the fire tetrahedron. The portable fire extinguisher is also designed to extinguish small fires only – by persons who have had hands-on training, are skilled and knowledgeable about fire, fire tactics and safety procedures.

Untrained persons may have a false sense of security with a fire extinguisher in hand and unknowingly place themselves and others in harm’s way.

18.3 Location & Placement. Fire extinguishers are to be located or placed in a position that is easy to access. They should not be obstructed or placed where they may be hidden from view.

Important note: The venue fire extinguishers are generally placed 75 feet apart and are specifically designated and required by law to protect the patrons and the facility and cannot be removed from their location. You are considered the professional you are to maintain your own extinguishers as part of your fire protection tool base. You should maintain no less than 4 fire extinguishers specifically for the use of you and your safety staff. Locate them at the fuel station and storage area(s) and around the performance area during the performance.

18.4 What classification of fire extinguisher should I use?

Classification of fire extinguishers depends wholly on the type of fuel that is burning. Fire extinguishers will display on their casing the Class of fire they can be safely used on:



Class A - Trash, Wood, Paper



Class B -Liquids, Grease



Class C - Electrical equipment

18.5 Water extinguishers. A water filled extinguisher can be used on a **Class A fire only**. That includes, trash, wood and paper. Never use this kind of extinguisher on a flammable or combustible liquids fire or near spilt or open containers of flammable liquid. Water will spread the flammable liquid and make the fire larger. Also, never use them on electrical equipment that is still connected to the power. If the item and surround areas can be safely disconnected from the power supply then and only then can water can be used on the remaining normal combustible fire.

18.6 Carbon Dioxide Extinguishers. These extinguishers are filled with highly pressurized carbon dioxide (CO₂). Commercially, CO₂ can be used as a refrigerant, made to put bubbles in soft drinks and produce "Dry Ice" which is solid CO₂. Its a non-flammable gas and does not conduct electricity. As the CO₂ is released by the extinguisher the pressure that it was under dramatically drops causing the temperature of the liquid/gas to dramatically drop to almost -80 ° C. Because of this process, ice may form at and fly from the horn. The agent in this extinguisher displaces oxygen and cools the fuel which extinguishes the fire.

The CO₂ extinguisher is suitable for Class B and C fires only and may be ineffective at extinguishing Class A fires because it may not be able to displace enough oxygen to successfully put the fire out. Class A materials may also smolder deep in the fuel bed and may re-ignite. Generally, this type of extinguisher is not recommended for use on a person who is on fire. **This agent can cause frost bite, chemical burns and death if inhaled.**



18.7 Dry Chemical Extinguishers. The one we recommend is rated for class A, B, C. (be aware that some are only rated for class B and C fires). The extinguisher shown to the right is a dry chemical type suitable for class A, B and C as you can see shown by the universal blue and white labels. The extinguisher sends out a fine dust/powder to coat the fuel creating a barrier to the oxygen. The powder also works to interrupt the chemical reaction of the fire. Hence, the reason why you should aim at the base of the fire where the fuel is. Failing to do so will mean it will be totally ineffective. There is also an optimal distance from the nozzle to the fuel for best coverage. Stand too close to the fire and you could waste the powder and run out before covering all the burning fuel. Stand too far away and the powder film will be too thin to be effective. Some of these extinguishers can be used on a person on fire (see extinguisher to right Filled with foray®) without too much added inhalation risk. To be certain always check the MSDS for your fire extinguisher to find if there is an inhalation hazard.

18.8 At what stage should I use a fire extinguisher? Only fight a fire if it will not endanger yourself or others. Fire extinguishers are only suitable for small fires no bigger than an office trash can.

18.9 🚨 DO NOT FIGHT THE FIRE: Always, your safety first!

1. If the fire is quickly spreading beyond where it started.
2. If you are alone. Always have a partner with you.
3. If you cannot fight the fire with your back to an escape route.
4. If the fire can block your only escape.
5. If you do not know what is burning.
6. If there are possible toxic fumes, excessive smoke (when large synthetic materials such as the nylon in carpeting or foam padding in a sofa burn), they can produce highly toxic gases that can be fatal in very small amounts.
7. If there is a possibility of a flash fire or fire eruption.
8. If you do not feel comfortable with fighting the fire.

18.10 What should I do if a person is on fire? In the fire arts arena, the best way to deal with a person whose clothing has caught on fire is to first alert them of the fact. If extinguishment is necessary, there are four tools that may be used for this purpose (not all may be readily available at the venue).

1. Have the person; stop what they are doing, drop to the floor/ground, roll around and back and forth until the fire is out.
2. An A listed Fire Blanket.
3. An ABC Fire Extinguisher
4. A Moist (wet) cooling blanket or cloth.

18.10.1 Deployment time; depends on the capacity of the safety in locating or getting a hold of or locating the safety device for deployment and the time it takes to deploy the device, blanket, extinguisher or tool for use.

18.10.2 Stop, Drop and Roll. SDR is a quick, efficient way to put a fire out that is on a person. Remembering to cover ones face and then "stop, drop, and roll" may not be enough however, having the right equipment on hand can finish the job and can protect you and others from accidents and injuries. (Deployment time: Immediate)

18.10.3 A listed Fire Blanket. An A listed fire blanket is a safety device designed to extinguish small incipient (beginning) fires. It consists of a sheet of fire retardant material which is placed over a fire in order to smother it. Using a fire blanket will smother a fire, but be aware it will also contain and hold heat inside and close to the body. Once the fire is out, open the blanket to remove trapped heat. (Deployment time: 10 to 50 seconds.)

18.10.4 ABC Fire Extinguisher. The ABC fire extinguisher is a stored pressure extinguisher and the most common fire extinguisher available today. It may be found in practically every theater, on every stage and in every business office known. The agent within the cylinder is a non-toxic, mono- ammonium phosphate fine powder. When used, it will make a substantial powder cloud and spread virtually everywhere. Before using an ABC dry chemical fire extinguisher on a person, ask the person to cover their face (eyes, mouth and nose) with their own hands if they have not already done so. During a performance, it is not recommended except under extreme circumstances.
(Deployment time: Immediate.)

18.10.5 A Moist (wet) Cooling Blanket or Cloth. This make-shift Fire Extinguishing tool is not considered a "fire blanket". However, it is very effective in extinguishing a fire on a person and cooling any residual burning. It requires a large cloth, cotton sheet, cotton tarp, wool blanket, etc. and 1 or 2 liters of cool water.
(Deployment time: 10 to 50 seconds.)

18.11 The Fire Extinguisher and MSDS. You may wish to check the MSDS for your fire extinguisher to find if there are any inhalation hazards. Is the multipurpose dry chemical material toxic or banned? What happens when the agent contacts soft tissue, what kind of reaction does it cause? We do know, that if multipurpose dry chemical comes in contact with the tissue, the tissue exhibits a remarkable ability to resist infection and a normal capacity to heal following many types of injury. This negligible toxicity of the multipurpose dry chemicals makes them relatively safe for extinguishing the flaming clothes of human burn victims.
Reference: PMID: 459189 [PubMed]

18.11.1 Dry Chemical Agent. For some dry chemical extinguishers, when inhalation occurs, they can be treated as if a mineral dust was inhaled. Resulting with irritation to the respiratory tract, a transient cough or short term shortness of breath may occur. To be certain, please check the MSDS of your extinguisher.
reference: <https://www.ansul.com>

18.12 If a fire performer catches on fire. (It is appropriate to interrupt the show for this kind of an emergency or event.)

1. Alert and inform the individual that they are in fact on fire. Especially if they do not appear to know about the fire.
2. If they cannot quickly brush the flame out themselves then,
 - a. Instruct them to stop, drop to the ground, and roll around over and over.
 - b. Tell them to stop rolling once a fire-blanket is ready to deploy or an extinguisher is available to smother remaining flames.
 - c. Wet a cloth, blanket or fire blanket with water to cool residual burning.

3. Once the fire is out, carefully open the fire blanket to release residual heat.
4. Cover the person with cooling blanket and treat for burns.

18.13 Vegetation Fire. *What should I do if the ground or surrounding area starts on fire?*

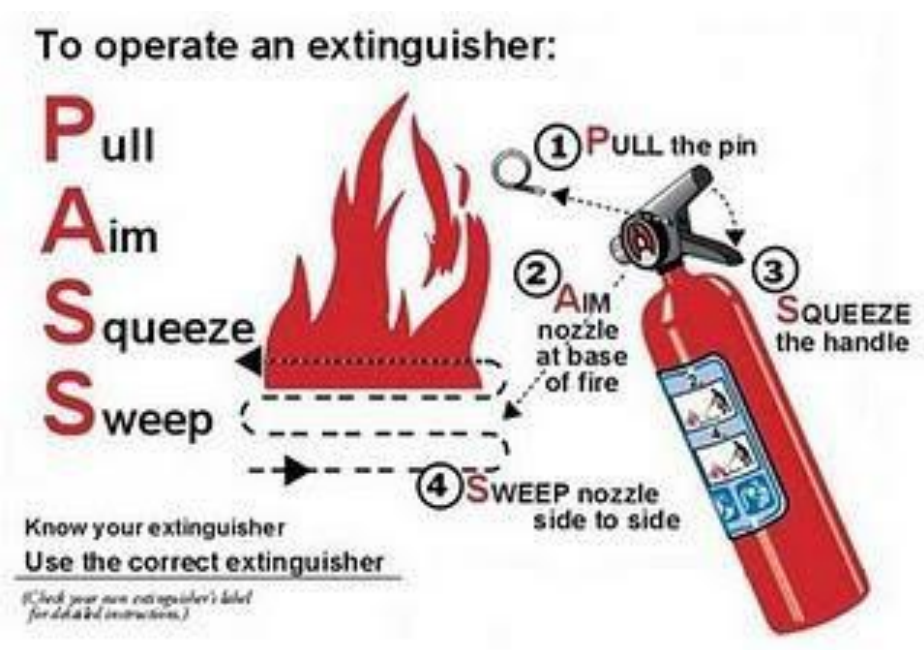
18.13.1 If the ground or surrounding area is on fire follow the instruction found on the label printed on the side of your fire extinguisher.

1. Safety First! Call 9.1.1
2. Evacuate the Audience and Crew to a safe location.
3. Take a team with more than one extinguisher and head or slow the progress of the fire.
4. When Fire Department arrives, back-off and let them do their work.

18.13.2 Do not fight the fire:

5. If the fire is quickly spreading beyond where it started.
6. If you cannot fight the fire with your back to an escape route.
7. If the fire can block your only escape.
8. If you do not know what is burning.
9. If there are possible toxic fumes, excessive smoke (when large synthetic materials such as the nylon in carpeting or foam padding in a sofa burn), they can produce highly toxic gases that can be fatal in very small amounts.
10. If there is a possibility of a violent ignition or explosion.
11. If you do not feel comfortable with fighting the fire.

18.13.3 How to Use a Fire Extinguisher. All fire extinguishers will have simple instructions clearly printed on the side of the canister. Know your extinguisher before you may need it. Practice using one.



18.13.4 How do I check my fire extinguisher for serviceability?

Your pre-light-up safety check will include checking all your safety and first aid equipment and all performance fire extinguishers.

1. Y N] Are they ready to work?
2. Y N] Is it free from any debris with pin intact?
3. Y N] Check pressure gauge arrow is in the green and expiration date is good.
4. Y N] Check that it has no dents or corrosion
5. Y N] Are they readily accessible?
6. A B C D] What class fires can they be used on?
7. Y N] Are their classifications suitable for your situation?
8. Y N] Has your safety crew read their instructions and know how to operate if required?
9. Y N] In what order are the methods that you use to put out a fire?
10. Y N] At what point does the extinguisher get used?
11. [] Who is in charge of their use?
12. [] At what stage is a fire extinguisher not enough?
13. Y N] Do you still have a safe escape route from the fire?
14. [] Where is your fuel storage container?
15. Y N] Is there any material in the local area that once on fire could produce dangerous toxic gases?
16. Y N] Is there any material in the local area that once on fire could explode?
17. [] Phone location and what number to dial for emergency services?
18. Y N] Do you have clear instructions to direct emergency fire services (Fire department) to your location?

Chapter 19 – FIRST AID

19.1 First Aid for Burns.

19.2 Cool Running Water. Hold the burned area of the body under cool, gently running water for about ten (10) minutes, by which time the burned area should have returned to normal body temperature. Remove jewelry and clothing from the affected area, but leave any that is stuck to the skin. Cover the burn with a sterile (clean cloth), non-stick dressing. If the casualty is conscious and thirsty, give frequent small amounts of water. **DO NOT GIVE ALCOHOL.** Alleviate pain by gently pouring cool water over the dressing.

19.2.1 Unless the burn is minor in nature, seek medical aid as soon as possible.

19.2.2 DO NOT apply any lotions or moisturizer, prick or break blisters, overcool the casualty, put towels or adhesive bandages directly onto the burn.



19.3 Burns most common. Of all the injuries that fire performers accumulate, burns are probably the most common. This article aims to teach performers how to identify the three main classes of heat burns and the appropriate first aid for each class.

19.4 Contact thermal burns. This rendering is not intended to cover general fire safety nor does it cover chemical, electrical, or cold burns. Please do remember your basic fire safety rules, and also remember that if you catch on fire, **STOP, DROP, and ROLL.**

19.5 Classes of burns.

19.5.1 First Degree Burns

A first degree burn is caused by brief exposure to heat. In a first degree burn, the skin is intact, but red and the burned area is painful. A sunburn is a type of first degree burn.

19.5.2 Second Degree Burns

A second degree burn is caused by prolonged exposure to heat or very high temperatures. In a second degree burn, the skin may be intact or it may appear to be partially peeling. It may also appear moist or have a mottled appearance. Any burn with blisters is second degree. The burned area is very painful in a second-degree burn.

19.5.3 Third Degree Burns

A third degree burn is the most serious type of burn and is caused by prolonged exposure to very high temperatures. In a third-degree burn, the skin is burned through its full thickness. The tissues underneath the skin may show through. The edges of the burn are frequently charred. The center of the burned area may not be painful because the pain receptors in the skin have been destroyed along with the skin.

19.6 How to care for a burn?

19.6.1 First thing. Regardless of the class of burn, the first thing to do is to **STOP THE BURNING!** Get the heat source away from the skin and extinguish any residual flames. Use a wet towel to put out any burning tools (toys) that may be tangled or near the skin and work to remove any hot metal from the skin as quickly as possible. Once the heat source is removed, examine (but do not touch!) the burned area to assess the class of burn.

19.7 Treating a 1st Degree Burn. If you have identified the burn as first degree, immediately immerse or run the burned area under cool water. A garden hose works nicely. This forcibly lowers the temperature of the burned skin and stops the burn from getting any worse. Most first aid books say that this should last about 15 minutes, however, 10 minutes may be sufficient to lower the temperature of the skin to the point where the burn will not get any worse. Holding the affected area under water for too long may cause frost-bite or at the least be extremely uncomfortable. Important note: Never, never use ice to cool the affected area, ice will burn the skin.

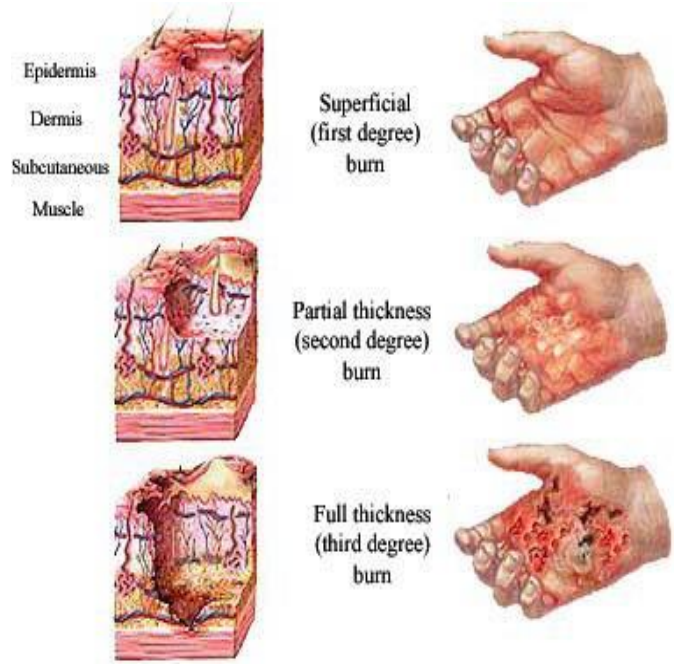
19.7.1 Wives-tales. After the skin has been cooled, **do not** put lotions or salves, butters or oils on the burn. Leave the skin uncovered and dry. Most first degree burns resolve after 1-2 days. For pain while the burn is healing, put cool, wet clothes on the burned area.

19.8 Treatment for Second Degree Burns. If the skin is intact (not peeling) then either immerse the burn or run the burn under cool water for at least ten (10) minutes to stop the burning. After the skin has been thoroughly cooled, you may apply an antibiotic ointment or cream such as bacitracin or a neomycin/polymixin blend (Neosporin). Do not try to burst the blisters.



- 1. Healing time.** The 2nd degree burn will usually resolve with minimal to no scarring within 7 to 14 days, although it may take as long as three weeks. Once the blister burst on its own, try to trim off the dead skin with fine scissors. This is painless and helps to prevent infection. To reduce pain while the burn is healing, put a cold, wet cloth on the burned area.
- 2. Unprotected blister.** If the skin is broken do not immerse in water as this can lead to infection. Cover the burn in a clean, dry dressing (gauze works nicely) and go to the nearest emergency room.

19.9 Third Degree Burns. After removing the heat source, cover the area with a clean, dry dressing. If there is clothing stuck to the burn, do not try to remove it. Because victims of even relatively small third-degree burns can go into shock suddenly, call 9.1.1 for emergency services. Third degree burns frequently get infected and prompt medical treatment is required for such a deep infection. Failure to receive prompt medical attention can result in gangrene, loss of a limb, or sepsis (infection of the blood, which is often fatal). In particular, these kinds of infections are very difficult to treat with antibiotics.



19.10 When to seek immediate medical attention for a burn.

If a blister is greater in diameter than 2 inches (4-5 cm), if a total burn is larger in surface area than about the size of a deck of playing cards, for any burn involving a break in the skin (including all third- degree burns), if the burn involves the face or genitals, and if the burn is an electrical or chemical burn.

19.11 Infection.

if a burn starts to look red, painful, swollen or warm it could be infected. However, if an area of redness appears around a burn and spreads over a period of several hours, go to an emergency room as this may signify a serious and life-threatening infection. Also, call your doctor if the burn does not seem to be improving after 10 days or you feel the burn is getting worse.

19.12 If in doubt. When in doubt, seek medical attention for a burn. Burns are complicated medical injuries and may require very advanced care for severe cases.

APPENDIX – A

NORTH AMERICAN FIRE ARTS ASSOCIATION

This is a home for fire artisan's and fire performers. This is a place to share best practices through knowledge, safety practices, fire codes and rules and building a community of fire artisans and performers.

An ongoing mission of the NAFAA is engaged in collecting all of the North American fire codes, regarding all aspects of fire performance.

The North American Fire Arts Association, in collaboration with its daughter associations, presents this mission statement and guidelines

The North American Fire Arts Association was established in 2002 to provide resources to fire artists, to aggressively create and maintain a set of nationally recognized self-governed safety standards regarding fire art and to establish fire art as a recognized genre of the art world through education and communication. The North American Fire Arts Association is an organizational shell set up to gather, unite and organize the regional Fire Arts Associations.

Our mission is to:

- To gather and distribute rules, regulations, laws and other information of specific interest to fire performers and to provide education, training and support services to fire artists.
- To work with fire artists from around the country to assemble a set of self-governed national safety standards that will sensibly address the concerns of fire professionals and exceed federally regulated standards based in part on scientific research and study.
- To work with already established fire associations (such as the National Fire Protection Association) to establish self-governed national safety guidelines and standards for such things as performance and travel.
- To accredit persons involved in the fire arts who maintain national safety guidelines, including but not limited to, performers, tool builders, safety technicians, costume and set designers.
- To encourage fire departments to reduce undo restrictions on fire performers through education, cooperation, and explanation of internal regulations.

NAFAA Performer Safety Guidelines. (Revision 2.1)

The purpose of this document is to provide a minimum set of voluntary fire performer safety guidelines that attends to the concerns of public health and safety as applied to the performing fire arts. This document is meant to supplement and clarify the NFPA 160 standards involving 'Group I' devices. It is not intended to replace local fire codes; all diligence should be used to discover the local codes for open flame performance.

I) Performer

NAFAA artists should act in a professional manner. They should be capable, well rehearsed, and safe each time they light up.

A) Capable

- Performers should not attempt performance under the influence of any judgment or reaction impairing substance.
- Performers should be in good physical health, with no temporary or permanent debilitating health issue that could interfere with the planned routine.

B) Practice

- Every practice should be performed where the artist can be reasonably assured of minimal traffic.
- Unlit practice tools should have some visible marking on them to insure others do not accidentally run into the tools during use.
- Before lighting up, the performer should be ready to spin the tool for its full duration. At least three successive practices without operational problems should be performed before a lit routine is attempted.
- When lit, no new moves should be attempted. If the flame lasts longer than anticipated, a spotter should assist with dousing the wicks.
- Each performance should be practiced lit several times to verify duration and capability before a performance is attempted.

C) Costume

- Regular performance costumes should be made of Flame Retardant or High Heat material.
- If not, each part of the costume should be checked for flammability, and flame retarded if possible.
- Before the performance, the performer should practice lit in the expected costumes several times to insure safety.

II) Safety Personnel

Each performance and lit practice should have at least one spotter ready to meet fire emergency needs, with additional spotters and guards as needed.

A) Guards

- Guards provide audience containment duties, keeping audience away from performance area, fuel station, and spinout zones.
- Fire safety training is beneficial with guards, but not required.

B) Spotters

- Spotters are in charge of onstage and back stage fire safety including emergent and intentional wick extinguishing.
- Spotters should be well aware of the various aspects of fire performance and familiar with the routine to be performed.
- Spotters should be trained in flame extinguishing, response times, untangling equipment and audience control.
- When needed, the spotter responds to the audience needs, the venue's needs, then the performer's needs, in that order.

C) First aid training

- All spotters should have at least rudimentary first aid training, particularly burn care.
- At least one spotter should have strong first aid or medical training.
- For particularly large performances, the venue should provide an on-call ambulance or medical team for the event who should be aware of the duration of the performance.

D) Equipment

- Intentional extinguishing can be managed with a safety towel of damp cloth, flame treated cloth, or high heat material.
- Spotters should be dressed with the same care as a performer and should have a safety towel at all times.
- Safety personnel should be equipped with all fire safety devices they have been trained to manage. Ideally, all spotters and guards should have an extinguisher available to them.

III) Tools

NAFAA performers should use well-maintained tools. Not only should they be constructed to prevent uncontrolled wicks, they should be regularly tested to insure capability.

A) Wick Attachment

- Wicks should be attached to the fire tool via some hard limiting method. Wire, screws or bolts should be run through the wick and device. Glues and friction should not be the primary method of wick attachment for any swinging device.
- Wicks should be made in such a way as to prevent loss of any part during use, either by using fireproof materials in construction, or some other method to prevent partial loss.

B) Handle Attachment

- Shafted tools (clubs, staff) should either be made of fireproof materials (metal, carbon fiber, etc.) or have a protective covering that extends at least 4 inches beyond typical flame contact zones (for a spinning staff, this is 4 inches in either direction of a wick).

- Handles should be attached with much the same care as wicks. Balls or tethers should not depend on glue or friction to remain on the shaft; some hard device should be employed to maintain attachment.
- Chain grips should be made of durable materials, or augmented with metal grommets when soft goods (e.g. leather, nylon) are used, and should be vigorously checked before each use. Any sign of wear should be considered cause for replacement.

C) Connectors

- If the device has multiple connected parts or chains, the connectors attaching all parts together should be of a sealed ring type rated above the maximum possible stress that can be applied to the device.
- Any connectors that could be exposed to heat should be made of tempered metal; not plastics, drop forged or spring metal.
- Drop forged connectors (snap connects, et al) should not be positioned where they could be struck by another metal piece [to prevent shattering].

D) Checking

- Before each use, the performer should quickly glance over each device to ensure that all parts are in good condition and stable. A quick test is to grasp each wick and tug it away from the normal point of contact.
- Before each lit performance, special care should be used to insure all nuts, screws, and wires are tight and secure. Grips and handles should be thoroughly checked for security and the wicks should be tested thoroughly. Any sign of wear should be treated as a failure.

E) Fueling

- Tools should be soaked, splashed or basted so that excess fuel can be completely recovered and sealed or returned to proper containers
- Always spin off excess fuel, in an area free from expected foot traffic and far from ignition sources, before performing.
- If available, make use of wick attachments to catch fuel before hitting the ground, avoiding the spin out zone entirely.
- Always mop up oily fuels before leaving. Remove oily residue from performance area between performers. Treat mops, rags, or other cleaning devices as soaked wicks.

IV) Fuels

The basics behind fuel safety are to ensure that an uncontrolled burn does not occur, and that the audience and passive safety devices are not affected. Performers should have MSDS for all fuels used and be familiar with any special needs for them.

A) Storage and transport

- A fuel's original retail container is usually the best choice for storage and transport.

- If the original container is too bulky or unavailable, then a sealed metal container is the best overall choice. Canadian performers should use governmentally issued containers of the appropriate type.
- Fuels should be kept out of direct sunlight, away from sparks or flame, and in vapor sealed containers.

B) Back stage fuel

- All primary fueling should take place in a back stage fueling area.
- Back stage fuel stations should be manned by a performer, guard or spotter until completely secured.
- Always seal fuel containers and dip buckets when not in use.
- When at all possible, place the fuel area outside, behind a hard wall; and have a clear corridor from the fuel area to the stage. Never move wet wicks through the audience without guard escort.
- If you can't have a hard wall between fuel and fire, place a spotter with a towel between and insure that fuel containers are sealed before any ignition.
- Audience and smoking should be restricted within 30 feet of fuel station.

C) Open Onstage Fuel

- If an onstage fuel reserve is needed, all effort should be made to restrict quantity and capability of accidental spills.
- Highly stable metal containers with self-closing lids are preferred.
- Fuel quantities should be less than 8 oz (240ml).
- Unneeded fuel (i.e. after use) should be removed immediately.
- Fuel placed on stage for dipping should be for as short of time as possible and never on stage beyond the time of the act.

V) Performance

Each performance should be arranged so that the audience is never in danger of sustaining damage from the performer and that the venue is safe as well.

A) Separation

- Depending on the nature of the audience (seated, intoxicated, familiar, passing by, etc), an adequate separation from the performer should be maintained. Barricades may be required for large audiences or certain venues.
- If the performer will be spinning tools, breathing fire, or otherwise producing effects that are not entirely within their field of vision at all times, the audience should be sufficiently separated to allow guards or spotters to intercept audience members attempting to enter the performance area. Usually 15 feet is adequate.
- If the performer will be using a tool that is predominantly within their field of vision, implicitly under their control (ex. fire fingers), or the audience does not require excess management (i.e. seated or fenced), then the performer may come within a few feet keeping in mind audience flammability differences.

B) Flame toxicity

- Petrol fuels burned on open wicks always produce toxic fumes, smoke, or other health hazards that are augmented in an enclosed space.
- Petrol fuel burning should be very limited indoors, even in well-ventilated venues. When possible, use high-proof alcohols in place of petrol fuels.
- For outdoor spinning, semi-enclosed areas with low wind can be as hazardous as indoor locations.
- Whenever petrol fuels are used, the most purified fuel is preferred: white gas or lampoil over kerosene.

C) Performance area

- The performance area should be cleared of all flammable materials, or flammable materials should be treated with approved fire retarding chemicals and tested for combustibility in a safe manner before performance.
- Props and other terrain features should be considered when designing a performance. Performers should not be in danger of contact with foreign objects.
- Careful note of sprinkler systems should be made to determine proximity to performance, possible triggers and other specifics.
- In the case of plant life, handle all flora as though untreated and flammable.

VI) Clean Up

Immediately after each performance, fuel buckets should be closed and sealed, fuel returned to approved transport containers, fuel stations locked or removed from premises and any residual fuels mopped up and removed. Hot tools should be wrapped in safety cloth until they cool down. Any exotic materials (i.e. flame retardant) should be removed, locked or guarded.

Source: http://www.nafaa.org/nafaa_safety.html [Revision 2.1] Updated 5 Jul 2005

APPENDIX - B

CLOTHING

Can my Clothing burn? Clothing can burn if it comes in contact with excessive heat (hot metal parts on a fire poi set) or the actual flame.

Can flame resistant clothing save me?

No, it will not. As an electrician I have seen flame resistant barriers and flame-resistant cables catch on fire and burn quite happily. This can also happen with flame retardant and flame-resistant clothing. Flame resistant means it will be difficult to set on fire but it is possible, it also means it is likely to self-extinguish when the heat source is removed. Flame retardant is easier to set on fire compared to flame resistant. It should also self-extinguish without the heat source.

Why use flame resistant clothing?

Flame resistant clothing can give the wearer extra time to remove the clothing or smother the flame. E.g. Dropping to ground and rolling over. Flammable clothing can, however, be given a flame-resistant finish to minimize the risk of catching on fire and slowing the burning process.

What does the fire service use?

The fire service or other dangerous occupations wear expensive industrial flame-resistant clothing. These are made from materials like glass, aramid, novoloid, sulfur, and saran. These materials are used in special weaves and combinations to reflect heat and be highly flame resistant. We use a particular weave of Kevlar® (aramid) on fire poi as a medium to soak our fuel onto. The fuel will burn and the Kevlar® or Kevlar®/glass weave will not as long as fuel remains, although it will degrade over time. Kevlar® on its own will not protect you from the heat.

What makes clothing burn faster?

Fabrics with loose weaves or worn loosely tend to catch fire more easily. This is because there is more oxygen around the fabric to aid the burning process. Fluffy or fuzzy clothes or clothes with dangly bits of stuff hanging off them, also tend to catch on fire easily unlike smooth, not fluffy, clothes with no dangly bits. Denim with its heavy closely woven weave tends to burn slower.

What is safe?

Unless labeled as flame resistant or flame retardant all fabrics should be treated as highly flammable. Natural materials in tight weaves without fluff, the thicker the better, will give you more time to put out the flames and will provide you with better protection. Wear tighter clothing which is less likely to catch against your fire poi or staff as it passes your body and will have less oxygen between them and your body.

The phrase, "better protection" means a few seconds like 3 to 4 sec at best. Your clothes could catch on fire behind you and you could be unaware until it is too late. You must have a spotter or safety person watching over you at all times holding a fire blanket*. Safer clothing will give them that extra time to put you out. When smothering the flame be sure to cover the performer so as to push the flame away from and not into their face or airways.

Once a flame gets hold it will grow extremely quickly even if you are wearing "safe clothing".

*Fire Authorities confirm that "fire blankets" are the best way to deal with human torch fires (i.e. when a person’s clothing catches alight).

How can I protect myself further?

Spraying the material with water will remove air from between the weave and hence provide some additional protection.

What about my hair?

You should consider wetting your hair before performing or use a cotton scarf to cover hair.

Examples of different materials held against a flame:

NOTES from the U.S. Consumer Product Safety Commission, Flammable Fabrics Act)		
Material		
Rayon	3.0 sec	
Cotton	4.8 sec	Cotton and other cellulosic fibers (linen, rayon, lyocell, ramie) ignite easily, burn with a bright flame, smell like burning paper, and leave a white feathery ash. Weave density has a big impact on burning time.
Denim	5.0 sec	Denim is made from cotton in a twill weave. Because it is closely woven it will burn more slowly, but because of the quantity of material, they burn longer.
Silk	7.6 sec	Wool and silk (protein fibers) shrink from the flame, are hard to ignite, smell like burning meat or flesh, sputter as they burn and leave a crisp, foamy crushable residue. Although these fibers have natural flame retardance because they are difficult to ignite and burn slowly, fabrics of these fibers often burn easily because of an open fabric weave or knit and dyes or finishes present.
50/50 Cotton/polyester	9.2 sec	Blended fabrics -- cotton and polyester fibers together in one fabric, for example, combine to make a fabric that doesn't burn like either fiber. Blends sometimes are more dangerous than either individual fiber *can cause severe skin injury because they shrink as they burn and tend to stick to skin.

Polyester*	10.0 sec	Polyester and nylon fibers may be slower to ignite, shrink and pull away from the flame source initially, but eventually will burn with a flame. As they burn, the melting residue holds heat and cools slowly to form a hard bead-like plastic. Melting residue holds heat and cools slowly to form a hard bead-like plastic residue. A chemical odor is given off. The melting residue is a very high temperature and can cause deep and severe skin burns. Acrylic fibers burn with a flaming, melting drip of molten material. All manufactured fibers burn at a high temperature.
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Additional tests performed by Pele:

Here is what was found when the fabrics were held directly over the flame, the equivalent to a move gone wrong....

- **Lightweight Cotton/Gauze:** Up in flames in three seconds.
- **Middle Weight Cotton** (like a cheap t-shirt, not really tightly woven): Up in flames in 3 seconds.
- **Tight Woven Cotton** (a nice t-shirt): Up in flames in 6 seconds, BUT once it was up in flames it was hard to put out. It just kept going. At first it smoldered to a little brown mark so we thought it wasn't going to go, then it burst into flames, literally! We did this a few times just to make certain.
- **Tight Woven Heavy Cotton** (Like Khaki pants): I left it there 10 seconds and it didn't go up in flames but after 10 it would have. That was the point at which the brown scorch mark was working through the material.
- **Denim** (without frays): held it there for 10 seconds (if you're safety hasn't put you out by then you have big problems anyway). It left little black soot marks that wiped off.
- **Cotton Corduroy:** Held it there 10 seconds. It scorched a-bit because of the loose fibers being raised up but once it made it past those it didn't go.
- **Wool** (Light grade, loose weave): 10 seconds until scorch, much like the tight weave cotton.
- **Wool** (heavy grade, like a blanket): Worked better than denim.
- **Flax** (it tends to be light and airy, like a cotton): 3 seconds and it was history.
- **Silk** (the shiny, light refined stuff): It lasted about 5 seconds before it frizzled into a tiny flame.
- **Raw Silk** (the coarse, heavier one): This held up to a count of 8 seconds before it smoldered fiber by fiber. . but it never really went poof.
- **Leather:** It doesn't actually burn, it more curls up into this little black roll, and that was the edge of the light weight leather after about 20 seconds (I was really curious with this one). The center never went up.

Moral of the story is that not *all* natural fibers are acceptable to spin in. The lighter the fabric and the looser the weave, the faster it goes up. Keep in mind that you have about a two to three second grace period before you would catch fire, and then you have about one second while the fuel residue burns off. After that it's all the fabric. This means that the safeties should give no more than 3 seconds warning before they step in.

Source: http://www.homeofpoi.com/lessons_all/teach/Library-Fire-Training-Fire-training-and-safety-Clothing-and-Costume-Fire-safety-1_2_140

APPENDIX - C

GUIDE TO METALS USED IN MANUFACTURING FIRE TWIRLING EQUIPMENT

Did you know? Some metals heat up very quickly under a flame and can become a greater burn hazard. Others are brittle and cannot take impacts and some can give off toxic fumes. These are things you should know for your own safety!

The facts about metal components

We have provided this useful information so you can select safer, impact resistant, and longer life fire twirling equipment. Please feel free to print for your own records.

- **Zinc:** Zinc coatings on mild steel extend the corrosion life by 20 times. However, the coating melting point is low between 400-450 deg. *C and when burned can generate Zinc Oxide fume which is **toxic** and an irritant, which may lead to zinc or metal fume fever. However, "Metal fume fever" is a short lasting, self-limiting condition with symptoms similar to influenza, and unlikely with normal use. The fuel will be giving off toxic fumes anyway. Zinc has a higher thermal conductivity than plain steel, so watch out for burns from smaller zinc coated items. These items are generally very cheap. NB: not used in our products.
- **Cast iron or iron ore:** Some swivel clips and connectors. This is very cheap, heavy, hard and **very brittle** so it can break on impact. Do not use.
- **Copper:** Copper has a very high thermal conductivity and will heat up very fast under a flame. Watch out for **burns!**
- **Aluminium (aka Aluminum):** Common used Alloy 6063. Melting point is 660 deg. *C. When melting it will create a respiratory irritant. This is a softer metal . Aluminum has a higher thermal conductivity (4 x) than plain steel. Never use an aluminum ball chain as it heats up quickly because of its small mass and breaks very easily. However, it is suitable for tube core poi heads and as tube for a twirling staff if the wall thickness is sufficient.
- **Brass:** Safer than Zinc with a higher melting point of 940 deg. *C (twice that of Zinc) but with similar thermal conductivity to Zinc. When burned under extreme flame it can generate Zinc Oxide fume which is toxic and an irritant, which may lead to zinc or metal fume fever. However, "Metal fume fever" is a short lasting, self-limiting condition with symptoms similar to influenza, and unlikely with normal use. The fuel will be giving off toxic fumes anyway.
- **Mild steel:** The melting point of mild steel is 1515 °C. This will **rust** with time unless plated or coated. Coatings will wear off with time. Hardened carbon steel is much harder than mild steel, but still brittle and with internal stresses. Case hardened carbon steel provides a tough interior

while providing a hard, but more brittle exterior. With many months of heating and cooling we have seen high impact components snap so be careful where this metal is used.

⚠️ **Dangerous use of Mild steel key/split rings:** Continuous heating and reheating of these rings with any centrifugal forces causes the ring to open up. Standard cheap low carbon key rings will **weaken** at 260 Deg. *C. within 2 minutes!

Even small stainless steel split-rings will open. Remove risk, and product life by using stainless steel quick-links. See [links and parts](#)



increase product safety
[Stainless steel quick-](#)

- **Nickel Plated Steel:** Nickel is tougher than iron and is harder and more **durable**. Nickel provides greater **abrasion and corrosion resistance**. Overheating will cause nickel plating to come off mild steel. However, it will not melt under 1450 deg. *C, when it would then become an irritant of the eyes, nose and throat.
- **Type 304 Stainless steel:** Type 304 stainless steel contains iron, nickel and chromium. It is this addition of chromium and nickel that gives the steel its unique stainless, **abrasion and corrosion resisting** properties. Although not as hard as high carbon steel it provides **high strength without brittleness**. It has a melting point of 1420 deg. *C, after which it will then irritate the eyes nose and throat. Stainless steel has a much **lower (1/3) thermal conductivity** than plain steel and will heat up under a flame much more slowly so the effect of any burns will be less. Benefits of stainless steel include: Corrosion resistance, **Fire and heat resistance** (retains strength), attractive appearance, strength to weight advantage, high impact resistance, and **very long life**.

With so many benefits stainless steel is the preferred alloy for use on fire twirling equipment.

Your guide to ball chain poi cords and components



What is Ball chain? **Ball chain** is a type of chain made with small hollow balls connected by small rods. Each ball is made from rolling a flat piece of metal over the interconnecting rods. The above picture portrays two interconnecting balls on the left opened, showing how the rods are secured.

Advantages of Ball Chain:

- Smooth, chain that will not catch on clothing/skin
- Kinkless
- Easy to untangle
- Each ball acts as a swivel

Disadvantages of Ball Chain

- Not as strong as our 7x7 stainless steel wire or welded oval link chain
- Will wear out sooner than our welded oval link chain when overly stressed.
- Caution: Only soak the wick in the fuel container as the hollow balls will soak up the fuel and can cause the chain to catch on fire while spinning.

Can I use ball chain on my fire poi set?

This depends on the type and size of your ball chain, the weight of your fire head, and your swinging style.

Types of Ball Chain:

- **Aluminum ball chain.** Not suitable as it has a high thermal conductivity and breaks very easily. Be aware that colored and decorative ball chains are quite often aluminum underneath.
- **Mild Steel ball chain.** Good with correct sizing, shorter life compared to stainless steel. Quite strong. Normally coated with nickel for greater abrasion and corrosion resistance, however as coating does not effectively get inside the ball and the ends or insides of connecting rods, rust and abrasion wear will occur within the chain. Overheating will also cause nickel plating to come off mild steel.
- **Stainless Steel ball chain.** Very good with correct sizing. Excellent longer life abrasion and corrosion resisting properties. Stainless steel has a much lower (1/3) thermal conductivity than regular steel and will heat up slower under a flame. Benefits of stainless steel include: corrosion resistance, fire and heat resistance (retains strength), attractive appearance, strength to weight advantage, high impact resistance, and longer life.

Sizes of ball chain as supplied in our shop

- Size #13 (Ball diameter 1/4inch or 6.3mm has an average tensile strength of 90lbs or 41Kg)
- Size #15 (Ball diameter 5/16inch or 8mm has an average tensile strength of 120lbs or 54Kg)

Poi spinning styles

- If you spin an 80cm poi set with 140gm cathedral fire heads at 2 rev/sec the force on the chain will be approximately 14 times greater at the bottom of the swing. Which is like having an unmoving, 2Kg poi head pulling down on the chain.
- If you spin the same set faster at 3rev/sec the force on the chain will be approximately 30 times greater at the bottom of the swing. Which is like having an unmoving 4.2Kg poi head pulling down on the chain.
- If you wrap the poi around a limb you could effectively have half the spinning radius and hence double the force again.

Fire Artisan & Performers – Safety Standard

- Kicks and quick changes of directions will also put greater stress on the chain, possibly over 100 times the resting weight of the poi head
- Always allow extra margins for any additional stresses (forces and heat) you may put onto the chains.
- If you like big fire heads, faster spinning with kicks and wraps you should consider welded oval link chains for your poi cords.

*"the force on your hand is equal to the mass times the velocity squared all divided by the radius."
How do I attach ends to my ball chain?



In order to attach quick links and fire heads or handles to ball chain it is recommended that you use a type "A" coupling.

The coupling has an eye for attaching quick links and an attached bowl which cradles the ball chain. Drop the ball chain into the cradle by passing the connecting rod through the slot in the side wall. Once the ball chain is in place crimp the slot together to prevent the ball chain coming out again. Never attach wick heads or handles directly to the "A" coupling as this will cause undue side pressure on the first connecting rod resulting in shorter life of the product.

Use quick links shown below or other suitable connectors.

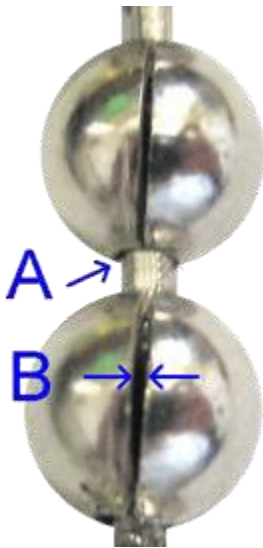


⚠ Dangerous use of Mild steel **key/split rings**: Continuous heating and reheating of these rings with any centrifugal force causes the ring to open up. Standard cheap low carbon key rings will weaken at 260 Deg C. within 2 minutes!

Even small stainless steel split-rings will open. Remove risk, increase product safety and product life by using stainless steel quick-links. See [Stainless steel quick-links and parts](#)

Use a quick link at the fire end and tighten the quick link with pliers to prevent it from coming undone once the head is attached.

How do I check my ball chain for wear and tear?



Referring to the diagram above.

If you have a nickel plated steel ball chain look for signs of rust and wear marks at point A and signs of the ball opening too much at point B.

If you are using a stainless steel ball chain look for signs of the hole at point A getting larger and again the ball opening at point B.

Depending on your style of spinning you could see signs of wear at any point along the chain length.

⚠ No matter what you decide to use, always check your equipment before using it.

Caution: Only soak the wick in the fuel container as the hollow balls will soak up the fuel and can cause the chain to catch on fire while spinning.

Source: http://www.fromnewzealand.com/articles/metal_fire_twirling_parts.php

APPENDIX - D

What is KEVLAR® ?



KEVLAR® is made by [Dupont](#)

KEVLAR® is one of the most important manmade organic fibers ever developed. Because of its unique combination of properties, KEVLAR® is used today in a wide variety of industrial applications. KEVLAR® para-aramid fiber possesses a remarkable combination of properties that has led to its adoption in a variety of end-uses since its commercial introduction in the early 1970's.

Fibers of KEVLAR® consist of long molecular chains produced from poly-paraphenylene terephthalamide. The chains are highly oriented with strong inter-chain bonding which result in a unique combination of properties

General Features of KEVLAR®

- High Tensile Strength at Low Weight
- Low Elongation to Break High Modulus (Structural Rigidity)
- Low Electrical Conductivity
- High Chemical Resistance
- Low Thermal Shrinkage
- High Toughness (Work-To-Break)
- Excellent Dimensional Stability
- High Cut Resistance
- Flame Resistant, Self-Extinguishing

Because of some of these features a KEVLAR® weave is ideal for using as a wick for holding fuel.

Other uses of KEVLAR®:

- Ropes that secure the airbags in the crucial landing apparatus of the Mars Pathfinder
- Small-diameter, lightweight ropes that hold 22,000 pounds and help moor the largest U.S. Navy vessels
- Shrapnel-resistant shielding in jet aircraft engines that will protect passengers if an explosion occurs.

- Run-flat tires that allow for greater safety because they won't ruin the rim when driving to the nearest assistance
- Gloves that protect hands and fingers against cuts, slashes and other injuries that often occur in glass and sheet metal factories
- Kayaks that provide better impact resistance with no extra weight
- Strong, lightweight skis, helmets and racquets that help lessen fatigue and boost exhilaration

KEVLAR® when used as part of the wick material.

There are a number of variants of weaves for belts or "wicks" containing KEVLAR®.

- KEVLAR®/Steel/Cotton, KEVLAR®/Cotton and KEVLAR® coated glass fiber threads are used in a number of different weave configurations to produce different characteristics depending on what the end product will be used for.
- These configurations affect the wear, absorption (when used for wick) and strength of the end product.

As you have seen above there are many uses for KEVLAR® and you will notice that there are many different KEVLAR® products being offered to fire performers by a number of well known and not so well known suppliers. You can choose the product that best fits your requirements.

Using the word KEVLAR®

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The word KEVLAR® must always accompany the "®" symbol to show its registration status every time the word appears. If the "®" is not available on a keyboard then "(R)" or 'R' are allowed.

How to get permission to use the KEVLAR® brand name.

To use the KEVLAR® brand you must gain a license from the Trademark Administrator in your region.

Contact details are available from the www.kevlar.com website

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