

FRC Team 48

E.L.I.T.E.

Encouraging Learning In Technology and Engineering

Safety Course



MISSION STATEMENT

“Our mission is to maintain Gracious Professionalism while being a positive influence to other teams, through the demonstration of good safety practices and procedures.”

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INTRODUCTION

This safety course study guide is a compilation of information learned from various sources including, but not limited to, high school teachers, college professors, industry professionals, UL (Underwriters Laboratories) Safety Advisors and internet research. It is intended to be used as the student workbook for the Warren G. Harding High School **FIRST** robotics team, Team 48, safety Course. Many thanks to the various teachers, mentors, volunteers, alumni and most of all, student safety leaders whose hard work, dedication and sacrifices have contributed to the continued success of our team.

BACKGROUND

The **FRC** safety program initially began as a pilot program, tested at the Greater Toronto Regional in Canada during the 2004 season. The corporate sponsor for this award was Bruce Power, the licensed operating company of eight nuclear reactors at the Bruce Nuclear Generating Station, located in Ontario, Canada on the shores of Lake Huron and is the largest operating nuclear plant in the world, by output.

After a successful test season, **FIRST** released the newly named, “Safety Awareness and Recognition Program” worldwide in 2005, with UL (Underwriters Laboratories) as its domestic sponsor. All teams were required to have a designated Safety Captain to establish and maintain proper safety awareness on their teams. Initially, any team member (teacher, students, mentor/volunteer, etc.) could be the designated Safety

Captain, but this was changed to be a student-held position, several years later.

Just like with any other judged category, all teams have the opportunity to earn the UL Industrial Safety Award given during closing ceremonies at the competitions. As an incentive to encourage all teams to develop a strong safety culture, **FIRST** created several other smaller safety recognition awards, over the years, in order to acknowledge teams, and even individuals, for above average safety conscious performance. Today, safety is the main priority at any FRC event.

UL (Underwriters Laboratories)

Underwriters Laboratories (UL) is the largest and best known independent, not-for-profit testing laboratory in the world. Founded in 1894 by William Henry Merrill and based in Northwood, Illinois, UL conducts safety and quality tests on a broad range of products. The laboratory provides a full spectrum of conformity and quality assessment services to manufacturers and other organizations. It also assists offers educational materials to consumers and works to strengthen safety systems around the world.

UL provides comprehensive diagnostic testing services in the following areas: fire testing; medical device testing; EPH services (food service equipment, drinking water certification, plumbing equipment); audio/video; home electronics; Source Verification and Inspection Services (SVIS); electric vehicle components and systems; EMC testing and certification; information technology equipment (ITE) industry services; and telecom industry services. It conducts tests on products in these areas to see whether they meet standards set by UL engineers in conjunction with input from manufacturers and product users, but it will also test products to see whether they meet standards set by outside entities, such as a city (in the case of building codes, for instance). As of 2005, there are 20 billion products that carry the UL Mark.

In addition to its work in the U.S. market, Underwriters Laboratories maintains services for companies looking to test products for international markets. This division of UL studies international product certification standards, assists clients with the application process, helps with correspondence and translation, and can coordinate the exchange and review of test data. In order to increase its efficiency in these international realms, Underwriters Laboratories has also launched a sustained effort to establish common standards for safety requirements, testing protocols, and certifications around the world.

CHAPTER 1

Section 1:1 RESOURCES

Please use the following online and social media resources as supplemental guides and information pertaining to the **FIRST** Robotics and our Team 48 safety programs. These references are for information, education and entertainment.

Team 48 Website – Safety Page: delphielite.com/safety/

- This page on our team's website highlights the culture and achievements of our team's internal safety program. We also promote and acknowledge the efforts and accomplishments of other FRC teams that demonstrate outstanding safety awareness. Here you can find information on our Safety Leadership Team, inspiring safety related stories and pictures from build and competition season and results from some of the Safety Challenge games that we introduce at competitions.

FIRST Website – Safety Page: www.firstinspires.org/robotics/frc/safety

- This site provides valuable information relating to the **FRC** Safety Awareness and Recognition Program. Here you can find the **FRC** Safety Manual as well as view current and past year's Safety Animation submissions.

Team 48 Safety Instagram: [safetytime](#)

- This is a fun way to communicate and share safety-related experiences from home, traveling or at competitions. We post many safety fails and safety successes to keep our cyber community informed, educated and entertained.

Safety Slack

- Safety section of our team's Slack phone app to keep team members up-to-date on current and important team related safety news, information and projects. Team members can chat in an open forum and share ideas on improvements and statuses of team safety initiatives, schedule and confirm meetings and post time-sensitive information.

WOW Webcast: https://drive.google.com/open?id=1eEgpyGINPjfoJClev0ARz08IVL_qKPOV

- Just before the start of the 2018 **FRC** season, the Directors of the **WOW** (West Virginia, Ohio and Western Pennsylvania) **FRC** organization created a series of webcasts to aid our extended communities with information on how to improve our teams in various aspects of **FIRST**. Teams that were seen as experts in specific areas such as Community Outreach, Chairman's Award presentation, Vision Systems, etc. were asked to conduct these

webcasts. We were honored with the invitation to do the presentation on Safety. The webcasts are geared toward assisting rookie teams – the “Rookie Cookbook”, but is open to anyone interested in enhancing and improving their team’s culture.

Section 1:2 Team Leadership

While **FIRST** requires at least one student to be assigned as Safety Captain for their team, we have several students in leadership positions that we call the Safety Leadership Team. Our Safety Leadership Team is peer-based and structured by what we call the “Safety PEERamid” (Fig 1.1).

The **Safety PEERamid** is derived from the Food (Group) Pyramid design concept but using a striped safety cone to illustrate the different levels of student safety leadership.

SAFETY PEERAMID

THIS PEERAMID IS OUR PHILOSOPHY AND APPROACH TO SHARING OUR SAFETY FUNDAMENTALS WITHIN OUR TEAM AND THROUGHOUT OUR SCHOOL, COMMUNITY AND BEYOND. OUR PEER MENTORING STRUCTURE STARTS WITH OUR SAFETY CAPTAIN(S) AND FLOWS THROUGH OUR LEADERSHIP TEAM DOWN TO OUR FOUNDATION - THE FRIENDS AND FAMILY OF OUR COMMUNITIES.

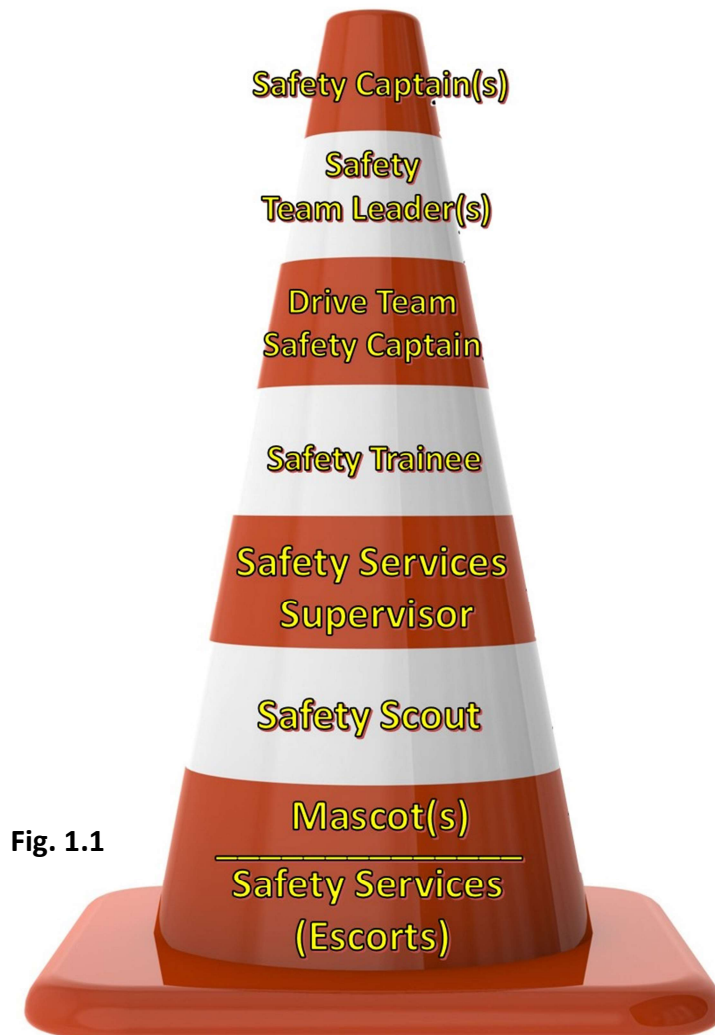


Fig. 1.1

Safety Captain/Co-Captain

The Safety Captain is the student leader of our Safety Leadership Team and our team's overall safety program expert. This student is typically a higher ranked student (Junior or Senior) and has the most experience within our safety program, however, a student of any rank or experience level can earn the Safety Captain position if they display the proper maturity, work ethic, reliability and dedication to the team and team's principles. In addition to the responsibilities outlined by **FIRST** (covered later in this chapter), our Safety Captain works with our Safety Mentor to: Establish behavioral guidelines and rules for our team to follow, develop classes and testing to evaluate team member safety awareness and competency, design processes and procedures for preventing and reporting unsafe working conditions and/or incidents, and manage/mentor the other levels of the Safety PEERamid structure.

Safety Team Leader

The Safety Team Leader is a student that works closely with and supports the Safety Captain. This student can be of any high school rank and displays the same high level of maturity, competency and positive attitude as the Safety Captain. This student: manages the process and procedures established by the Safety Captain, handles most of the administrative duties of the safety team - updating/revising team safety documentation, monitoring student testing/certification, distributing/receiving/recording/posting team materials, etc. This student trains/mentors the Safety Trainee and the subsequent levels of the Safety PEERamid structure and will often fill in as the representative "Safety Captain" for the team if the actual Safety Captain(s) is/are not available.

Safety Scout (Optional)

The Safety Scout is a student that is a member of the Scouting Team that watches and evaluates other FRC teams' robot performance and capabilities during matches. Because they are in the stands at an elevated level, the Safety Scout has an advantage of having an overview of the playing field and, at times, the pit area. The Safety Scout can identify any potential safety related concerns that cannot be seen from ground level and report these issues to a member of our safety team, the competition staff/volunteers or the UL Safety Advisors.

Drive Team Safety Captain

This student is a member of the Drive Team (typically the "Human Player") and is responsible that the drive team is in compliance with all safety rules governing the drive team. This student must: Ensure that the robot cart (War Wagon) is in proper operating condition, all safety supplies are present, accessible and secured on the cart, all drive team members are wearing required PPE (Personal Protective Equipment), anyone handling the robot wears proper gloves and any other necessary protection, safe lifting procedures are being followed, aisle ways are clear for transportation to/from the pit area and provide assistance/guidance to other teams whose actions may pose a risk to themselves or others.

Safety Services (Escort) Supervisor

This student is a member of the Safety Services (formerly known as Safety Escorts) team and may also be a Safety Team Leader, Scout or Trainee. This student possesses excellent communication, organizational and leadership skills and can handle a high level of responsibility. This student manages and assigns duties to the rest of the Safety Services Team during their shift and may even work directly with **FRC** and venue staff to provide assistance and solutions for completion safety or logistics concerns that arise for all teams.

Safety Trainee

This student is typically the youngest and/or the least experienced member of the safety team. This student usually displays high leadership ability and is assigned as a Safety Services Supervisor and/or Safety Scout during events. The trainee works closely with the Team Leader with the functional and administrative aspects of the team, learning the history, details and philosophy of our program. The trainee must also have the proper maturity, work ethic, reliability and dedication as all other levels of the Safety Leadership Team, as they may be asked to fill in as an acting Safety Captain during competition in emergency situations.

SAFETY SIBS

Safety Sibs is a peer mentoring network based on the Big Brothers, Big Sisters concept. Originally created to help struggling team members to pass the safety exam, Safety Sibs is a system where students who are new to **FIRST** and Team 48 are assigned to a veteran student for support and mentoring in all aspects of team safety processes and policies. Big Sibs help their Little Sibs understand and correct behavioral issues, stay up-to-date on general team communication, meetings and events, understand the dynamics of team interaction and prepare for some of the harsh realities and details of the actual competition weekends.

Section 1:3 Roles and Responsibilities

These are the official safety roles and responsibilities of **FRC** team members as defined by **FIRST**. This same information can be found on pages 4 and 5 of the **FIRST** Safety Manual.

All Participants

- Work in a safe and responsible manner.
- Use personal protective equipment (PPE), safeguards, and other safety equipment as required.
- Identify and report any unsafe or hazardous conditions to a student safety captain, mentor, and/or safety advisor. This includes work practices that may cause an accident.
- Encourage safe behaviors in everyone around you.

Mentors

- Lead by example. Practice the same safety behaviors that are expected from the students.
- Provide guidance and encouragement on a safe working environment.
- Provide leadership and guidance on matters of general safety, including the use of personal protective equipment including during the lifting, handling and transportation of robots as detailed in the **FIRST** Safety Manual in team work spaces as well as at events.
- Utilize hazard based safety engineering principles with team members to eliminate or minimize identified hazards to a suitable level.
- Coach the student safety captain(s) to ensure that he/she understands and adequately fulfills the position's responsibilities.
- Collect and store Safety Data Sheets (SDS) for any chemicals, chemical compounds or chemical mixtures (e.g. in paint, and batteries) used by the team. SDS information may include instructions for the safe use and potential hazards associated with a particular material or product. You can obtain SDS sheets from the manufacturer's web site or by calling the manufacturer directly. Become familiar with them and the related emergency procedures. Inform the safety captain of the SDS storage location.

Student Safety Captains

- Develop a team safety program manual that outlines your team's safety culture with consideration to the elements in the **FIRST** Safety Manual.
- Encourage your team to display positive safety behaviors at all times.
- Provide support for any safety questions or concerns that may arise. Seek guidance, as appropriate, from mentors.
- Conduct safety inspections of the general work site, especially the robot construction area. This also applies to the pit station during competition events.
- Know where to find and become familiar with the Safety Data Sheets (SDS) and related emergency procedures.
- Coordinate, deliver, and track safety training for the individual team members as well as team wide safety procedures. It is suggested that teams bring their training log and procedures to events and continue to make comments about infractions and/or areas of continuing improvements.
- At FIRST events:
 - Lead the **FIRST** culture of safety as an event safety ambassador by maintaining safety at **FIRST** events and safety procedures for your team, volunteers and spectators. Advise those around you of safe practices in line with these procedures and escalate to your mentor if support is required. The event safety advisor(s) will also be available for escalation as appropriate.

- Ensure safety practices and compliance with event requirements during load in and tear down.
- Have a safety plan for each event so that in the event of an emergency, all team members know procedures to follow to assure everyone's safety. This would include a meeting spot to gather as well as a list of participants to assure everyone is safe.
- Participate in checkpoint safety meetings with the event safety advisor to collaborate and provide feedback on any event safety needs.
- Be ready to present an executive summary of your team safety program to safety advisors at the event for consideration for the Safety Award, Sponsored by UL. Please register at the event for a presentation time as instructed by your safety advisor at the morning student safety captain meeting on day 1.

Section 1:4 Review Questions

Please answer these questions on a separate sheet of paper and turn it in at the beginning of class.

- 1) Which website promotes and acknowledges the efforts and accomplishments of other FRC teams that demonstrate outstanding safety awareness?
- 2) Which company was the original sponsor of the **FIRST** Safety Program as a pilot program?
- 3) What is our Safety Leadership Team's structure called and explain its unique name.
- 4) Which site provides valuable information relating to the **FRC** Safety Awareness and Recognition Program?
- 5) Which student rank(s) (Freshman, Sophomore, Junior, Senior) is/are eligible to earn our team's Safety Captain position?
- 6) Which member of the Safety Leadership Team handles most of the administrative duties of the safety team - updating/revising team safety documentation, monitoring student testing/certification, distributing/receiving/recording/posting team materials, etc.?
- 7) What is our team's peer mentoring network called?
- 8) According to **FIRST's** safety policy, whose responsibility is it to encourage safe behaviors in everyone around you?
- 9) According to **FIRST's** safety policy, whose responsibility is it to coordinate, deliver, and track safety training for the individual team members as well as team wide safety procedures?
- 10) What is the current official name of **FIRST's** safety program?
- 11) Which member of our Safety Leadership Team works with the functional and administrative aspects of the team, learning the history, details and philosophy of our program?
- 12) On which page(s) of the **FIRST** Safety Manual can information on team roles and responsibilities be found?

CHAPTER 2

Section 2:1 Fire Safety

The potential of a fire is an all too real possibility when working with chemicals, electricity and spark producing manufacturing processes. Motors overheat, wires arc and sparks can ignite flammable vapors from aerosolized liquids. It is important to stay calm, keep a cool head and remember these important and simple steps when discovering a fire.

R.A.C.E.

RESCUE – anyone in immediate danger

ALERT – the proper emergency services by calling 911 and/or pulling the **ALARM**

CONFINE or **CONTAIN** – the fire as much as possible. Close windows and doors, limiting the fire's oxygen supply and helping to keep it from spreading and blocking escape routes.

EXTINGUISH – smaller, controllable fires and **EVACUATE** the area.

In Case of Fire:

Rescue

Alarm

Confine

Extinguish / Evacuate



To use Fire Extinguisher:

Pull Pin

Aim Hose

Squeeze Handle

Sweep From Side to Side



If you find yourself in a position to help extinguish a fire or you are alone in an area with a small controllable fire, follow these steps for proper use of a fire extinguisher:

P.A.S.S.

PULL – the tab or pin on the extinguisher

AIM – the nozzle or hose at the BASE of the fire

SQUEEZE – the trigger or handle/lever (in 3 to 5 second bursts)

SWEEP – from side-to-side, standing 6 – 8 feet away from the fire



Pull the extinguisher's safety pin



Aim the extinguisher at the source of the flames



Squeeze the trigger and hold it



Sweep the source of the flames until the extinguisher runs dry

Before attempting to extinguish any fire, it is important to know the cause and source of the fire. Fighting a fire without knowing the type of fire can make it considerably worse (i.e. throwing water on a grease fire). Fire extinguishers have different ratings to extinguish different types of fires.






Class A - Common Combustibles (wood, paper cloth, etc.)

Class B - Flammable Liquids (gasoline, propane and solvents)

Class C - Live Electrical Equipment (computers)

Class D - Combustible Metals (Magnesium, Lithium, Titanium)

Class K - Cooking Media (cooking oil and fats). These extinguishers are typically stainless steel and found in commercial kitchens.

A		Common Combustibles	Wood, paper, cloth etc.
B		Flammable liquids and gases	Gasoline, propane and solvents
C		Live electrical equipment	Computers, fax machines
D		Combustible metals	Magnesium, lithium, titanium
K		Cooking media	Cooking oils and fats



Class ABC



Class D



Class K

Section 2:2 Shop Safety

The fabrication, construction, assembly and repair of **FRC** robots require the use of a variety of hand and power tools, as well as industrial shop machinery. Machine shops are very busy and can be extremely dangerous if you do not use common sense, proper judgement and follow **ALL** safety rules determined by school and team safety personnel. **Failure to follow and comply with these rules may affect your eligibility to travel to competitions and/or your continued membership on the team.**

General Rules – Safe Work Behavior

- **SAFETY GLASSES, SAFETY GLASSES, SAFETY GLASSES!! SAFETY GLASSES MUST BE WORN AT ALL TIMES IN THE SHOP WHETHER YOU ARE WORKING DIRECTLY WITH HAND TOOL, POWER TOOLS, MACHINES OR EVEN STANDING NEAR/AROUND MACHINES OR TOOLS IN OPERATION.**
- **THERE IS ABSOLUTELY NO HORSEPLAY IN THE SHOP!! THIS INCLUDES MAKING ANY UNNECESSARY LOUD AND DISRUPTIVE NOISES. THIS CAN CAUSE WORKERS TO BECOME DISTRACTED AND LEAD TO DAMAGED PARTS, TOOLS AND PERSONAL INJURY.**
- Return all tools to their proper and original location after use, unless needed for special build activities. These tools must be isolated and neatly kept in our work area with the parts and documents required for the build/repair until the next work session (See 6S Section in Chapter 5).
- No loitering. If you are not working in the shop on a particular task, do not hang around the shop.

- **NEVER RUN THROUGH, OR WITHIN, THE SHOP.** You do not have complete control over your movements (no matter how awesome or perfect you think you are) and you can trip, slip or run into something or someone, causing injury to yourself or others.
- Neat storage is important for personal belongings and equipment. Store personal items in your assigned locker or somewhere safe, away from work areas. Although we'd like to trust our teammates and extended (**FIRST**) family, not everyone shares and displays the same values. Protect your personal items against loss and theft. Also, personal items could get damaged by liquids, debris and/or physical impacts caused by work activities.
- **HOUSEKEEPING IS ONE OF THE MOST IMPORTANT ASPECTS OF SHOP SAFETY.** All food and snacks should be eaten in appropriate areas; never around tools and machinery. Throw out all trash, this includes damaged/scrap robot parts and especially food and beverage containers. Clean up any food (especially liquid) spills **IMMEDIATELY** and make sure no one enters the area of the spill until it is properly cleaned. This is an aspect of what is called, Industrial Hygiene.

Personal/Industrial Hygiene

When most people hear the word “hygiene”, the first thought that comes to mind is personal cleanliness. Even though it is an important part of our daily lives, it isn't just about combed hair, brushed teeth and the appropriate use of deodorant. Industrial hygiene is the practice of minimizing your exposure to hazardous substances. It is important for worker health and safety to practice proper personal and industrial hygiene to prevent the spread of germs and disease, reduce your and others' exposure to chemicals and contaminants which can lead to skin conditions, allergies, or something more severe.

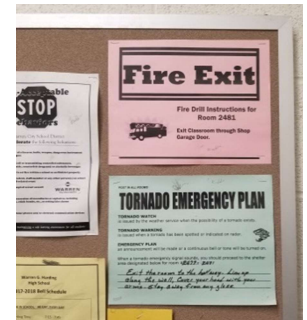
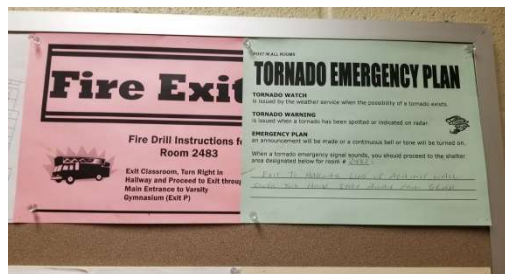
The first principle of good hygiene is to avoid exposure by forming a barrier over the skin with proper PPE (Personal Protective Equipment). Before using a chemical, make sure you read the warning label or SDS sheet to become familiar with the potential risks of using the substance and what you can do to protect yourself. Check your PPE often and clean or replace contaminated items as needed. Never mix contaminated work clothing with regular household laundry. Cross-contamination could occur and spread contaminants to other items.

One of the easiest and most effective hygiene practices is basic hand washing. Good hand washing and scrubbing with soap and water (not just a quick rinse under a faucet) helps to remove germs, contaminants and chemicals. It can also prevent exposure to harmful substances by cross-contamination and ingestion. Always wash your hands before handling food. Small amounts of hazardous material can easily be transferred to food items and be ingested due to cross-contamination. Adverse health effects may not be immediately apparent, but symptoms of health issues may arise after repeated, long-term exposure. Workers should make sure all surfaces of the hands are lathered and scrubbed for a minimum of twenty seconds, then dried with a disposable towel. Proper hand washing, in conjunction with using hand sanitizer, when coughing, sneezing, blowing your nose or whenever around someone who is sick can greatly control and reduce the spread of germs and diseases.

Emergency Equipment and Procedures

SEEK SHELTER – If a situation occurs during after-school or weekend work sessions, requiring us to seek shelter for weather-related or active hostile personnel, please follow normal school guidelines and policies. These procedures are posted on the doorway of each classroom and shops in which we will be working. If team members are located in different parts of the building, make sure someone communicates their names, number of team members and location back to the team's on-site administrative leader.

EVACUATION – If a situation occurs during after-school or weekend work sessions, requiring us to evacuate the building, please follow normal school guidelines and policies and listen to instructions given by school and emergency personnel. These procedures are posted on the doorway of each classroom and shops in which we will be working. Get as far away from the building as necessary due to the event, but stay with the team so that team/school staff and/or faculty can take a head count and account for all team members. If team members are located in different parts of the building, make sure someone communicates their names, number of team members and location back to the team's on-site administrative leader.



EYEWASH STATION – There is one (1) eyewash station located in the wood and metal shops. In the Wood Shop, the eyewash station is located to the left of the door leading into the hallway (Fig. 2.1). In the metal shop, the eyewash station is located to the right of the door leading into the hallway (Fig. 2.2). Usage of the eyewash station will be explained in the next section.

FIRE EXTINGUISHERS – There are two (2) CLASS ABC fire extinguishers located in the wood and metal shops (4 extinguishers total). In each shop, one (1) extinguisher is located by the eyewash stations in the front of the room (Fig. 2.1 and Fig. 2.2), and one is located by the back door leading out into the parking lot (Fig. 2.3 and Fig. 2.4).



Fig. 2.1



Fig. 2.2



Fig. 2.3



Fig. 2.4

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is any type of equipment or apparel (clothing) you wear on your body to keep you safe from hazards in the workshop or at competitions. The most common types of PPE we use in the robotics program are ANSI rated safety glasses, proper footwear (closed toe and closed heel shoes), gloves, dust masks, respirators, earplugs and earmuffs.

Eye Protection

Proper eye protection is the Number 1 mandatory PPE item required for any participant, staff member, volunteer, and even guests to wear in designated areas at all **FIRST** events. It is also mandatory for our team to wear them while working on our shops at the school. Eye protection is required when working with, watching or near a team member working with ANY tool, machine, electrical wiring and chemicals. And **YES**, proper eye protection **IS REQUIRED** even when cleaning.



ANSI (American National Standards Institute) oversees the development of standards for products, services, processes, systems, and personnel in the United States. Although ANSI itself does not develop standards, the Institute oversees the development and use of standards which ensure that the characteristics and performance of products are consistent, that people use the same definitions and terms, and that products are tested the same way. The organization also coordinates U.S. standards with international standards so that American products can be used worldwide.

Acceptable eye protection must have an ANSI rating of Z87, Z87.1 or Z87+ and have a wrap-around protective design. This rating can be found on the bridge of the nose, arm(s) of the glasses or stamped/molded into the corner of the lenses. Standard eyeglasses are **NOT** considered acceptable eye protection **UNLESS** they have the ANSI rated lenses AND protective side-shields (Fig. 2.5) to meet the extended side protection criteria.

The ANSI ratings for safety glasses are determined by using various high velocity and high impact testing methods. For example, Z87+ glasses must pass the “high mass” test, which consists of dropping a 500 gram (1.1 lb.) *pointed* weight onto the glasses, mounted on a head form, from a height of 50 – 60 inches. Pass/Fail criteria is that no pieces can break free from inside the glasses, the lenses cannot fracture and the lens must remain in the frames of traditional style or prescription glasses. The velocity test consists of having a small steel ball (1/4 inch diameter BB's) shot at the glasses at six different impact points at different velocities. Velocity resistance varies per product (Glasses = 102 mph from 150 ft.; Goggles = 170 mph from 250 ft. and 205 mph from 300 ft.) Pass/Fail criteria is the same as that for the high impact test with the addition that no contact of the eye is permitted by deflection of the lens. The glasses and the ratings are assigned as follows:

Z87 No Impact/Lowest impact resistance (only suitable for liquids, fluids, splashes, dust)

Z87.1 Medium impact resistance rating

Z87+ Highest impact resistance rating



Fig. 2.5



Eye contact is critical in industrial environments. In addition to having the appropriate ANSI rating, **FIRST** requires that your eyes must be seen while wearing the glasses. **No shaded, tinted or mirror/reflective lenses are legal at FIRST events.**



NOT ALLOWED

FIRST does allow different colored glasses to be worn as long as the wearer's eyes can be seen. We have come up with an acronym within our team to help remember the **FIRST** recommended safety glasses colors: **CRAB** – C (Clear), R (Rose/Red), A (Amber/Yellow), B (Blue). Other colors may be acceptable as well (Purple, Orange, Green) to allow teams to coordinate their team uniforms.



Proper Footwear

Proper footwear is critical when working in an industrial environment to help with ergonomic support and protection against sharp and falling objects.

Sturdy Closed-Toe and Closed-Heel shoes are the only types of footwear permitted in the shops and in the pits at **FIRST** events. Although industrial, steel-toed shoes are not required, do not allow yourself to become a VOF (Victim Of Fashion). While some shoes offer complete coverage of the foot, the thin, breathable material does not offer adequate protection against heavy, sharp and/or hot items. Additionally, thin-soled shoes will not provide enough protection against stepping on sharp objects such as screws, nails, and scrap metal. All students assigned to the pits during competitions (especially as Safety Services) should plan for hours of standing and walking. Make sure your shoes have substantial heel and arch support; this will aid in reducing foot, leg and back issues.



Teams are responsible for their guests attending **FIRST** events. All spectators and guests should follow the same footwear rules as participants. If substantial close-toed shoes are not available, they may enter the pit area as long as they remain in the pit aisles. Spectators that do not meet the footwear requirement for participants, as described above, are not allowed inside individual team pit stations or in any locations where robots are being worked on. **PLEASE NOTE that loose sandals (like flip-flops) or bare feet are not permitted in the pit area under any circumstances!**



NOT ALLOWED

@Lexi P!

Hand Protection – Gloves

Always wear gloves to protect yourself from hazards present in your workplace environment or while handling material with sharp edges or extreme temperatures. If you do not know what type of glove to use, ask a qualified person for help. Gloves are NOT always necessary or required and, in fact, at times may be a hazard to use. While gloves do protect you from sharp edges, extreme temperatures and chemicals, gloves can also prevent you from holding material securely, dull your sense of touch preventing you from the tactile feeling needed to handle items safely and may also get caught in the moving parts of machines or tools. If you choose to wear gloves while working, be smart and use common sense, use the appropriate type of glove for your work activity. For example do not use the thin medical type rubber gloves for handling heavy and/or sharp metal items or extremely hot or cold objects.



Dust Mask/Respirators

Dust masks and respirators are PPE devices worn on your face to filter the air you breathe, in contaminated environments

Dust masks are disposable, light weight cotton or cloth masks that fit over your nose and mouth and filter out particles in the air such as dust, dirt, liquid/fluid sprays (even saliva) and pollen and other allergens. You typically see these being used by health care workers, construction personnel and landscapers.

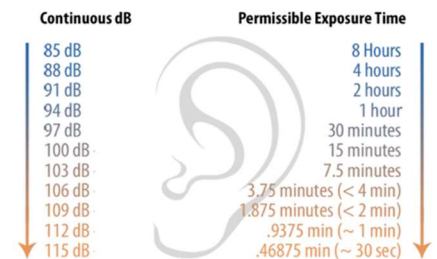


Respirators are passive or mechanical masks that have canister-type filters (typically charcoal based) or a mechanical filtration system and might even have a face shield. These devices are used in industrial or hazardous areas to filter out microscopic hazards such as smoke, vapors and exhaust fumes. You may see these used by mechanics, fire fighters and painters.

Earplugs/Earmuffs



Noise-induced Hearing Damage (NHD) is related to the duration and volume of exposure to loud noises. Government research suggests that the safe exposure limit is 85 decibels for 8 hours a day. Earmuffs and earplugs are used to block out the noises that generate harmful decibels created by shop machinery, tools and processes while still allowing normal speech to be heard.



To properly wear (foam type) earplugs, pinch the smaller tip until it forms a point. Insert the compressed end into the ear canal. After a few seconds, the plug will expand back to its normal size, filling the ear canal (Fig 2.6).

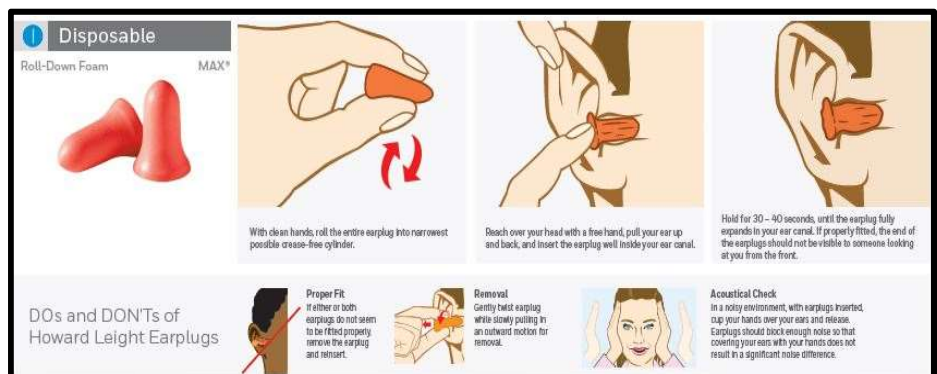


Fig. 2.6

NEVER substitute ear buds, air buds or headphones (even wireless) for earplugs or earmuffs. Ear buds/Headphones do not block out the noises that generate harmful decibels. In fact, they do not allow normal speech to be heard in cases of emergency and can even generate or cause the loud, harmful decibels if the volume is turned up unreasonably high.

All hearing protection has a Noise Reduction Rating (NRR). This is the decibel level reduction a person can expect from a properly fitting hearing protective device. Earplugs have an NRR of up to 33 dB, earmuffs (forming a tight seal over the ear) have an NRR of up to 30 dB and Canal caps just use pressure from the headband to hold the plugs in place and have a lower NRR.

Emergency Stops (E-stops)

Emergency stop, or E-stop, buttons are the wall-mounted, Red push buttons located in the wood and metal shops that turn off power to the all of machines in the shops in case of an extreme emergency. The buttons only work for the machines that are in the same room (the E-stop buttons in the metal shop do not cut off power to the machines in the wood shop). Keep in mind that some machines do not have brakes that stop the motor once power is removed. These machines will continue to move due to inertia (*the tendency of objects to keep moving in a straight line at a constant speed, when no forces are upon them*) until they naturally slow down and stop. One of the E-stop buttons in each room has a lighted Green “on” button that will restore power to the machines when it is pressed.

It is important to know **EXACTLY** how many and where the E-Stops are in each room.

There are three (3) E-stop buttons in the Wood Shop: One on the wall directly above the teacher’s desk (this has the Green reset button) (Fig 2.7), one on the wall directly across from the teacher’s desk (Fig 2.8) and one toward the back of the shop on the wall to the left of the common door leading to the Metal Shop (Fig 2.9).



Fig. 2.7



Fig. 2.8



Fig. 2.9



Fig. 2.10



Fig. 2.11

There are two (2) E-stop buttons in the metal Shop: One on the wall directly above the teacher’s desk (this has the Green reset button) (Fig 2.10), and one toward the back of the shop on the wall to the left of the common door leading to the Metal Shop (Fig 2.11).

Hand/Power Tools

Follow these simple steps when using hand and power tools:

- Always cut away from your body or body parts
- Make sure materials are mechanically safely secured while working with them (C-clamps or Quick Clamps). Do not have someone hold material for you.



- Make sure whole using corded power tools are away from the blades or other moving parts that can get caught
- Make sure that wires are not exposed, broken or frayed
- Make sure mechanical guards are in place and in proper working order¹
- Make sure you are wearing proper PPE equipment while operating your tools
- Beware of Pinch Points.²
- Make sure you have proper lighting while using tools
- **NEVER** distract someone who is operating a power tool
- Stay in a comfortable and stable body position , don't stretch, strain or over-reach



Shop Machinery

Follow these simple steps when shop machinery:

- Wear proper PPE
- Have proper lighting
- Beware of Pinch Points.²
- **No horseplay or distractions**
- Make sure there are no lockout tags on your machine
- Make sure all machines are in proper condition (check blades, guards, cords, guides, and adjustable parts)¹
- Know where your E-stop is on the machine
- Make sure you're approved to use machine
- Make sure all keys are removed and secured away from chucks
- Make sure to work with a partner if your material is too large for you to handle alone
- Make sure cutting tooling (i.e. drill bits, band saw blades, and milling bits) are properly oiled while in use.
- Make sure ventilation system is connected and working if required



¹ **Machine Guards** protect against direct contact with moving parts, flying chips, kickbacks and splashing of metal or corrosive liquids. Always check to be sure that the proper guards are in place and in good condition before operating machinery. Guards must be designed so a person cannot reach over, under or through to contact the moving parts of a machine. Guards should never be adjusted or removed unless by authorized personnel. If you find that a guard has been removed, is missing or needs repair, report to a team Safety Captain or Mentor and follow the Lock-Out, Tag-Out (LOTO) procedure.

² **Pinch Points** are points in and around machinery, tools or moving surfaces where there is a chance of a body part getting caught between one moving and one stationary part, two moving parts, or one moving part with some other material.



Lock-Out, Tag-Out (LOTO)

Lock-out/Tag-out is a safety procedure that is used in commercial and industrial machine shops. It ensures that damaged machines and tools are prevented from being used prior to the completion of maintenance or servicing work. It requires that hazardous energy sources are to remain "isolated and rendered inoperative" before any repair procedures are started.

How Lockout Tag-Out works:

- Use a lock or energy clasp to lock out the power source of the damaged device (Fig 2.12).
- Tag the damaged device's disconnect switch indicating that it is not permitted to be used/turned-on until signed-off and removed by the responsible maintenance and management personnel (Fig 2.13).
- No two locks or keys should ever be the same.

Fig. 2.12



Fig. 2.13



Ventilation

Some manufacturing processes cause a great deal of dust, dirt and debris. Our Wood Shop has a dust collection/ventilation system connected to each machine that uses a powerful vacuum to suck dust and particles from the material as it is in process, being cut and sanded. Make sure you know where the switch for the ventilation system is located in the Wood Shop (to the left of the storage closet) (Fig 2.14 and Fig 2.14a) and turn it on each and every time you use a machine. Please be aware that the use of the dust collection system is absolutely **NO SUBSTITUTE** for wearing proper PPE while working in the shop.



Fig. 2.14a



Fig. 2.14

Safe Lifting

It is important to use proper lifting procedures to avoid injury due to excessive and/or irregular strain on muscles.

Asses the weight of an item, and if its size and weight allow it to be easily lifted manually, with both hands, use the following technique (Fig 2.15):

- *Position yourself in front of the object with your feet spread shoulder width apart (this ensures a stable base, proper balance and center-of-gravity).

- *Bend at the knees to a squatting position in front of the object

- *Grab the object firmly with both hands on opposite sides

- *BREATHE IN before lifting as it helps support the spine.

- ***Keep your back straight and lift with your legs**

- *Make sure you keep the object close to your body as you lift, and your arms are at a 90 degree angle. This will reduce strain on your back, neck and shoulders.

- *Don't carry a load that obscures your vision.

- *Lift slowly and smoothly, avoid jerky movements and do not twist your body when lifting or carrying.

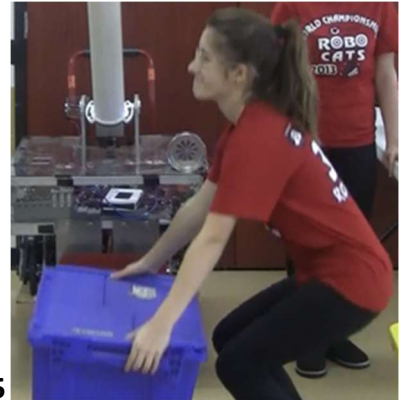


Fig. 2.15

When putting an object down, reverse the order of these instructions. If placing the object on a shelf or table, make sure it is waist high or get someone to help you if the height causes awkward positioning or muscle strain.

Average safe lifting weight is approximately 35-45 pounds, and never store items in excess of this weight limit, overhead. All items in our pit must be stored **AT** or **BELOW** average head level (about 5 ft.).

When lifting an item that is too heavy for one person, get a teammate to help (Fig 2.16). Both people should stand on opposite sides of the item and follow the safe lifting procedures stated above.

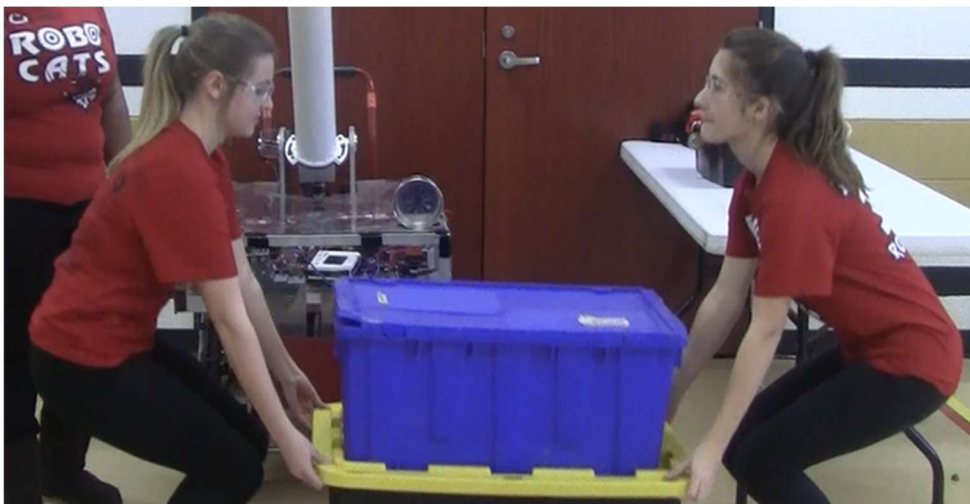


Fig. 2.16

Section 2:3 Review Questions

Please answer these questions on a separate sheet of paper and turn it in at the beginning of class.

- 1) What is the acronym to use for the procedure when discovering a fire?
- 2) What is one of the most important aspects of shop safety?
- 3) What machine or tool safety feature protects against direct contact with moving parts?
- 4) True/False – Safety Glasses should be worn in the shop even if you are near or just watching someone work on a machine or with tools.
- 5) True/False – Gloves should always be worn when working with material in the shop.
- 6) _____ is the practice of minimizing your exposure to hazardous substances and preventing the spread of germs and disease.
- 7) What are the 5 Classes on fire extinguishers and what types of fires are each rated for?
- 8) What is the acronym Team 48 uses to identify the 4 main acceptable colors of safety glasses and what colors do they represent?
- 9) What 2 features must prescription eyeglasses have in order to be recognized by **FIRST** as legal safety glasses?
- 10) What does PPE stand for and give 5 examples.
- 11) What is one of the easiest and most effective hygiene practices?
- 12) What are the E-stop buttons in the shops used for and how many are there total?
- 13) What is the difference between a dust mask and a respirator?
- 14) True/False - Wireless earbuds/headphones are an acceptable substitute for earplugs/earmuffs because the wires cannot get caught in machines or power tools.
- 15) True/False - Locked-out or tagged-out equipment can be used with the tag on as long as you know for sure that the equipment has already been repaired.
- 16) True/False – When using cutting tools, always cut toward your body to prevent the tool from slipping and causing harm to any nearby team members.
- 17) How long should a worker make sure all surfaces of their hands are lathered and scrubbed?
- 18) What is the safe decibel level limit you can have, over an 8 hour period, without using hearing protection?
- 19) True/False – Colors such as Purple, Orange or Green colored safety glasses are okay to wear, as long as the lenses are light enough to see the person's eyes.
- 20) What does NRR stand for and what is the NRR for properly fitting earplugs?

CHAPTER 3

Section 3:1 First Aid

General Care

General first aid care covers any type of injury from bumps and bruises to cuts, scrapes, punctures and/or smashes. While more severe injuries can, and have, occurred, these are the most common types of injuries we would expect to find while in the shop and during competitions. For more severe injuries, notify an adult, medical professional and/or call 911. Follow these steps for more common injuries:

For **bumps, bruises or smashes/crushes** apply *COLD* to the injured area (for pain relief). Place a plastic bag or damp cloth with an ice-water mixture (or a cold pack) on the injured area to reduce swelling and pain. Put a barrier such as a cloth between the plastic bag and the skin. Apply this cold pack for 10 – 20 minutes, depending on the level of discomfort it may cause. Remove the pack for 30 minutes, then reapply for another 10 – 20 minutes. Repeat as necessary.

For **cuts, scrapes or punctures** First wash your hands and put on gloves, if available. Wash the wound with large amounts of room-temperature water, with or without soap, to remove dirt and foreign matter. If the wound is a puncture, gently press around the edges of the wound to promote bleeding. Pat the wound dry but Do Not put any medication such as alcohol, hydrogen peroxide or iodine on/in a puncture wound. Apply an antibiotic ointment only to an abrasion (scrape or scratch) only if the victim is not allergic to the ointment. Cover the wound with a sterile dressing and bandage. Then seek medical attention.

If you get a **foreign object in your eye** NEVER rub the eye or blow air into the eye, this could cause more damage. Using a sink or eyewash station (or water bottle in an emergency), flush the eye with clean water for about 15 minutes. If you see the particle still remaining in the eye, pull the eyelid out away from the eye and swab the particle out with a sterile dressing. Make sure you cover the unaffected eye because movement of the unaffected eye causes movement of the affected eye. If the particle still remains, cover the eye (Do Not apply pressure) with a sterile cloth or dressing and seek medical attention.



Fainting

Fainting is caused by lack of blood flow (which carries oxygen) to the brain. The heart is not pumping strong enough to overcome gravity and supply blood to the brain. This low blood flow can be caused by various issues. In order to care for a fainting victim, first clear the area of bystanders and anyone not giving care.



Lay the victim on the ground or a flat surface, flat on their back and check for breathing. If the victim is not breathing or appears to be choking, refer to the CPR section, later in this section. If the victim is not choking, raise their legs so that they are horizontally above the victim's heart and head level. This will force blood from the lower parts of the body back to the heart where it can supply the brain with enough blood for the victim to regain consciousness. If you did not witness the fainting, it is always a good idea to have the victim checked by medical personnel in case of any head injuries.

Seizures

A seizure is a sudden, uncontrolled electrical disturbance in the brain that can be caused by many different things such as sleep deprivation, nervous exhaustion, head injury or medical conditions such as epilepsy.

There are 3 phases of seizures; Tonic, Clonic and Post-ictal.

Tonic Phase is indicated by:

- *Loss of consciousness
- *Stiffening of the body and arched back (15 – 20 seconds)
- *Scream or groan referred to as an “*epileptic cry*”.
- *Clinched teeth, biting tongue and/or jaw
- *Incontinence, loss of bladder control
- *Cyanosis – Blueish skin tone, nails and lips (caused by lack of oxygen in the blood)



Clonic Phase is indicated by:

- *Convulsions, jerking of arms and legs and blinking eyes (1 – 2 minutes)
- *Shallow breathing with drooling or foaming at the mouth
- *Clinched teeth, biting tongue and/or jaw
- *Incontinence, loss of bladder control
- *Cyanosis – Blueish skin tone, nails and lips (caused by lack of oxygen in the blood)



Post-ictal Phase is indicated by:

- *Normal breathing
- *Weakness and limp limbs
- *Headache
- *Amnesia (Memory Loss), Confusion
- *Drowsiness/Sleepiness (for about an hour)
- *Additional weakness for 24-48 hours



Tonic and Clonic are also known as Grand mal seizures

Follow these **Do's** and **Don'ts** to treat someone having a seizure:

Do:

Clear the area of all loose objects and onlookers
Cushion the person's head
Loosen tight clothing (collars and ties), remove glasses
Look for medical I.D. information
Turn the person on their side (Recovery position)
Time the Tonic and Clonic seizure periods

Don't:

Hold the person down or try to restrain them
Put anything in the person's mouth, especially your fingers
Panic – Stay calm and ask for help/call 911
Give the person any food or drink until they have fully recovered



Section 3:2 Documentation/Reporting

Many domestic and international corporations have begun to introduce safety programs and committees into their companies to promote and improve employee safety awareness. One such company sends out a periodic safety bulletin to their employees and requires a signature to state that the employee has read and understands the safety message. This bulletin is called, “**Toolbox Talk**”. To emphasize the reality that our team's safety program mirrors the safety principles of real-world corporations, we are collecting the Toolbox Talk bulletins that reflect the exact lessons we teach in **FIRST** to keep our teammates safe. The Toolbox Talk binder can be located in our safety document library.

SDS (Safety Data Sheets)

An SDS is a document that lists information relating to occupational safety and health for the use of various substances and products and is a widely used system for cataloging information on chemicals, chemical compounds, and chemical mixtures. SDS information may include instructions for the safe use and potential hazards associated with a particular material or product, along with spill-handling procedures. The **Globally Harmonized System** of Classification and Labelling of Chemicals (**GHS**) contains an internationally recognized, color-coded, 16-section standard format that safety data sheets all follow:

Section 1, Identification
Section 2, Hazard(s) identification
Section 3, Composition/information on ingredients
Section 4, First-aid
Section 5, Fire-fighting measures
Section 6, Accidental release
Section 7, Handling and storage
Section 8, Exposure controls/personal protection
Section 9, Physical and chemical properties lists the chemical's characteristics.
Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.
Section 11, Toxicological information



Section 12, Ecological information*

Section 13, Disposal considerations*

Section 14, Transport information*

Section 15, Regulatory information*

Section 16, Other information, includes the date of preparation or last revision.

Incident Report/Near Miss Forms

Accidents, injuries and illnesses can occur at any time. It is important to know the Who, What, Where, When, How and Why one of these incidents happen if a safety program wants to continue to advance and protect and defend its members from hazards.

Incident Report forms are documents that detail when an illness or incident has occurred, the treatment for the injury or illness and any resulting corrective action (such as further training for team members, repair to faulty tools/equipment or changes to processes or procedures).

The Incident Report Form is a structured document for recording safety incidents. It includes fields for 'Incident Date', 'Time', 'Location', 'Incident Type', 'Incident Description', 'Witnesses', 'Investigation', 'Corrective Action', and 'Follow-up'. It also has a section for 'Incident Summary' and 'Incident Analysis'.

Near Miss forms are documents that alert to conditions that can potentially lead to an incident or illness (such as liquid spills on the floor, team members not wearing proper PPE, accidents that do not result in injury or illness or improperly stored supplies).

The Near Miss Form is a structured document for recording near-miss incidents. It includes fields for 'Near Miss Date', 'Time', 'Location', 'Near Miss Type', 'Near Miss Description', 'Witnesses', 'Investigation', 'Corrective Action', and 'Follow-up'. It also has a section for 'Near Miss Summary' and 'Near Miss Analysis'.

Safety Cross

The Safety Cross is a way that our team tracks our safety success with incident and near miss reporting on a daily basis. The days of the current month are arranged in a cross and will be filled in Green for days without an incident, Yellow for days with a Near Miss and Red for days with an injury. The goal is to have the entire month without incidents and the cross filled completely Green.

***Fun Fact** – Green, not Red, is actually the official color for the First Aid cross.



Section 3:3 First Aid Equipment and Training

First Aid Kits

We believe in being prepared for any possibility in order to be responsive to emergency situations. While FRC teams are required to have at least two (2) first aid kits (one for the team and one on the robot cart for the drive team), we actually have 16 first aid kits:

- *1 ANSI/OSHA kit in the pit station
- *1 OSHA Kit on the robot cart (war wagon)
- *1 OSHA Kit in the stands
- *1 Blood Borne pathogens kit in the pit station
- *1 Diabetic kit in the pit station
- *1 Female First Aid kit in the pit station
- *1 Female First Aid kit in the stands

- *6 mini OSHA kits (1 on each safety escort)
- *2 mini OSHA kits on the Safety Trooper
- **Bonus** 1 Mini OSHA Kit on mentor's backpack

There is a difference between an OSHA and an ANSI first aid kit. Let's first start off with a few definitions.

ANSI- American National Standards Institute: Oversees the creation and use of thousands of regulations and guidelines that directly impact businesses in nearly every sector, from construction equipment to energy distribution.

OSHA- Occupational Safety and Health Administration: Assure safe and healthful working conditions by setting standards and providing training, outreach, education and assistance.

ANSI writes safety and conformance regulations, while **OSHA** enforces companies and businesses to be compliant to them.

If you are looking for an "**OSHA Approved First Aid Kit**" or an "**OSHA Certified First Aid Kit**", there is no such thing. OSHA sets forth first aid kit guidelines for general industry, construction, and industry-specific first aid requirements, but OSHA does not "approve" any manufacturer's products. Also OSHA standards do not require specific first-aid-kit contents. OSHA standard 1910.151 (b) states an employer must have "adequate first aid supplies ...readily available".

While OSHA does not require specific first-aid-kit contents, an ANSI rated first aid kit does. The minimum requirement for workplace first aid kits and supplies is found in the (ANSI/ISEA Z308.1) Code of Federal Regulations (CFR).

ANSI /ISEA Z308.1-2009
Minimum Requirements for Workplace First Aid Kits and Supplies
Basic Kit - Minimum Contents

First Aid Item	Minimum Quantity
Absorbent Compress, 32 Sq. In. (No side smaller than 4")	1
Adhesive Bandages 1" x 3"	16
Adhesive Tape 3/8" x 2.5 yards	1
Antibiotic Ointment	6
Antiseptic 0.14 oz. (0.5 g) Application	10
Burn Treatment 1/32 oz. Application	6
First Aid Guide	1
Medical Exam Gloves	2 Pairs
Sterile Pads, 3" x 3"	4
Triangular Bandage 40" x 40"	1

As an additional complement to our wide array of first aid kits and equipment, we also have a **blood pressure/pulse rate monitor** and an **oximeter (oxygen level monitor)**. These two devices are used when treating someone in a medical emergency to check blood pressure, heart rate and oxygen level in your blood – important in evaluating blood circulation and respiration. Most commonly, we would use these devices while caring for a fainting victim or victim of a seizure.

An **AED (Automated External Defibrillator)** is a portable life-saving device that uses an external shock to restore the heart to a normal, healthy rhythm. The key to using this device is to listen to the verbal instructions being given by the unit. When using an AED, make sure that the area is clear around the victim, all restrictive clothing (including bras – modesty is not a concern when your life is at stake) and jewelry are removed and no one is touching the patient. The AED is used as a supplement to performing CPR.



CPR (Cardio Pulmonary Resuscitation) is the act of manually circulating blood to the brain by pumping the heart and should be used whenever someone is not breathing and when the heart is not beating. While no one on Team 48 is licensed to officially certify anyone for CPR, many of our members have taken CPR classes and are individually CPR certified. While the CPR methods change slightly from year-to-year, the basic procedures are the same. The following is a compilation of notes taken by several team members during an official CPR certification class in 2015 but is NOT a substitute for official training. Always consult professional medical or CPR certified personnel before performing CPR.

CPR Class - Taught by Bill Lovitz, 3-21-15

“It’s better to give even if it is not needed, than not give it when it is needed.”

Terms:

CPR Cardio Pulmonary Resuscitation – manually circulating blood to the brain by pumping the heart. Used only when the heart is in an unhealthy or unstable rhythm. Not needed if the heart has no rhythm.

Adult refers to individuals who are older than, or equal to, the age of puberty.

Child refers to individuals who are older than 1 years, but younger than the age of puberty. If you are unsure of the person’s age, assume they are an “adult”.

Compression refers to pushing on the chest

*ABC’s of CPR – Airway, Breathing and Compression/Circulation has now changed to CAB

*Now, CAB - Compression/Circulation, Airway, Breathing. *Changed because Compression is the **MOST IMPORTANT**.

Adult Chain

1. Make sure scene is safe
2. Check patient for a response (tap victim on shoulders)
3. Ask someone to call for help and get an AED
4. Check victim for breathing (5-10 seconds)
5. Start CPR immediately
6. If patient does not respond, use AED. Use in conjunction with CPR and leave pads on.

Timing is most important. The victim can be brain dead in 6 minutes; therefore, "checking for a pulse" is no longer required.

CPR Cycle is 30 Compressions and 2 breaths. **If you are a responder and are alone, perform 5 cycles before calling 911.

Chest Compressions

- Do 100 compressions per minute.
- You are performing the work of the heart, so compressions must be performed "*hard and fast*".
- Compressions help keep the blood flowing to the brain until more advanced help arrives.

*Technique/Procedure

-Lay victim flat on the floor on his/her back.

-Loosen restrictive clothing

-Place heel of one hand on the bottom of the breastbone

-Place the heel of your other hand on top of your first hand.

-Press straight downward so that the chest compresses 2 inches.

-Give 2 rescue breaths for every 30 compressions. The time between stopping compressions, giving breaths and starting compressions again should not be more than 10 seconds.

-Initial sets of compressions are the most critical. Even if you're not tired you should switch with a partner every 2 minutes.

(Rescue) Breaths

To reduce the likelihood of transmitting/contracting infectious diseases, it is recommended to use a shield or ventilating device to give (rescue) breaths.

*Technique/Procedure

- Open the victim's airway by placing one hand on the forehead and two fingers on the jawbone. DO NOT place your finger in the soft part of the neck or it will cut off the airway and restrict breathing.

- Tilt the patient's head back slightly to open the airway and place a mask (forming a tight seal) over the victim's nose and mouth.
- Insert a one-way valve into the ventilator mask. Take a normal breath and then blow into the mask while watching the patient's chest to see if it rises. This indicates an open airway.
- If performing breaths without a mask, pinch the patient's nose closed and form a seal around their mouth with your mouth to give (rescue) breaths.

!!!CAUTION!!! Do not OVER-aspirate the patient. This could cause "Aspiration Pneumonia". Too much air could cause the patient to vomit, and the vomit to travel back into their airway and lungs. The patient could suffocate and die.

CPR on a "Child"

Follow the same procedure for CPR on a child as with an adult, except:

- The AED may have smaller, child-sized, pads. If none are provided, then use the adult size.
- Use a child-sized ventilator mask.
- You may be able to do chest compressions with one hand if you are strong enough. Still, compress 2 inches.

CPR on an "Infant"

Follow the same procedure for CPR on a child or adult, except:

- Tap infant on the bottom of the feet to check for a response.
- Use an infant-sized ventilator mask.
- Perform chest compressions with two fingers at the base of the nipple line, compress 1 inch.
- Perform 100 chest compressions for every 2 breaths.

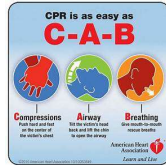
Choking

The universal sign for choking is both hands around your neck. If someone does this, verify by asking them if they are choking. If they say yes, follow these steps (for adult or child):

- Stand the person up and stand behind them.
- Make a fist with one hand with the knuckle of your thumb slightly sticking out.
- Wrap your arm around their waist, under their arm and place your fist in their abdomen with your thumb just above the navel.
- Wrap your other arm around their waist and grasp your fist with the other hand.
- Pull inward and upward giving firm upward thrusts. This simulates coughing.
- The patient should eject the obstruction.
- If the patient does not cough up the obstruction and becomes unresponsive, lay them on their back on the floor and try to remove the obstruction by pulling in out of their mouth – ONLY IF

YOU CAN SEE IT! Do not use your finger to swipe the obstruction, as this could push it in further.

- If this does not work, perform CPR. The chest compressions could dislodge the obstruction as well.
- If performing this procedure on a larger person, wrap your arms around their upper body, with the thumb pointed in toward their upper chest.



Section 3:4 Review Questions

Please answer these questions on a separate sheet of paper and turn it in at the beginning of class.

- 1) What condition causes fainting?
- 2) What are the 3 main characteristics of SDS (Safety Data Sheets)?
- 3) How many cycles of CPR should you perform before calling 911?
- 4) True/False - ANSI does not require specific first-aid-kit contents, but OSHA rated first aid kits do.
- 5) Which document alerts to conditions that can potentially lead to an incident or illness?
- 6) How long should you flush your eyes out with clean water in order to remove a foreign particle?
- 7) When treating a bump or bruise:
 - a. Why do you apply a cold pack, and how long should you apply it?
 - b. How long should you remove the pack before re-applying it?
- 8) What are the 3 phases of a seizure?
- 9) Which organization assures safe and healthful working conditions by setting standards and providing training, outreach, education and assistance?
- 10) What qualities or items must a first aid kit have in order to make it OSHA Certified or Approved?
- 11) How many first aid kits do we take to competitions?
- 12) If a person has stopped breathing or their heart has stopped beating, how long does it take before they can become brain dead?
- 13) True/False – Make sure to properly restrain an individual who is having a seizure so they do not hurt themselves while going into convulsions.
- 14) What is the relation/connection between OSHA and ANSI?
- 15) What document does our team use to track our safety success on a daily basis?
- 16) What is the CPR cycle for an adult how many chest compressions should be performed per minute?
- 17) In giving CPR, what should the time interval be between stopping chest compressions and giving rescue breaths?
- 18) What does CAB stand for?
- 19) True/False – Never turn a seizure victim over onto his/her side.
- 20) True/False – Rub alcohol or antibiotics into an open wound or puncture in order to kill germs.

CHAPTER 4

Section 4:1 Battery Spills

Spill Kit Contents

FRC robots are most commonly powered by an MK ES17-12 type non-spill-able sealed Lead acid battery. These batteries contain Lead compounds and Sulfuric acid in the form of a gel electrolyte. While these are sealed batteries, certain conditions (such as mishandling, dropping, extreme temperatures, etc.) may cause the battery housing to become deformed (Fig. 4.1) and/or crack and leak the electrolytes. The electrolyte is extremely dangerous and can cause burns if it comes in contact with the skin. Each FRC team is encouraged to have 2 battery spill kits; one in their pit station and one with the drive team on their robot cart. Every team member should know the exact contents of a proper battery spill kit (Fig. 4.2):



Fig. 4.1



Fig. 4.2

- A non-metallic, leak proof container
- A Base (Baking soda) to neutralize acid
- Chemical resistant rubber gloves
- Small broom and dust pan

Cleanup Procedure

If you encounter a battery spill, follow these safe handling instructions for proper clean up and disposal:

- Clear the area of bystanders and pedestrian traffic and notify a mentor or adult (people walking through the acid spill may track it on their shoes and spread it to other areas).
- Put on chemical resistant rubber gloves and pour a base (such as baking soda) on the battery and any acid (electrolyte) spills around it.
- Put battery in the non-metallic, leak proof container and seal it (make sure the container is large enough to completely contain the battery when it is closed).
- Sweep up the baking soda and dispose of it (the neutralized acid and baking soda mixture is safe to throw away with regular garbage).
- Then take the container to Pit Administration, a mentor or an auto parts store for disposal.

Section 4:2 Electrical Safety

Power Cord Care

Power cords are the life line for electrically powered hand tools and machinery. It is important to make sure power cords are in good condition BEFORE using the equipment it is attached to.

Make sure the cord has no punctures or cuts or has not been pinched or bent. Make sure there are no frayed or exposed wires. Check for exposed wires at the connection between the cord and the plug, and also at the connection between the cord and the equipment. Make sure the metal blades on the plug are not cracked, bent, broken or discolored (discoloration may be a sign of an electrical short inside the cord or tool).

Take proper precautions when working with corded power tools. Make sure the power cord is out of the way of any traffic walking through the shop. You don't want anyone to trip or snag the cord as the tool is in use. Work with a partner who can help keep the cord out of the way of the blades of the tool and material being worked on. Make sure you can see the power cord at all times so you do not accidentally cut into it – do not have it running under the material you are working on. And be sure to keep the cord away from any hot surfaces while in use or at rest (such as a heat gun or a soldering iron). The heat can melt the outer insulation and expose the inner wiring causing electrocution or a fire.

When removing a power cord from an outlet, always grasp the cord by the plug – NEVER pull using the cord/outer insulation. This can cause the wires to break inside the cord or separate from the terminal blade connection inside the plug causing a short circuit and/or dangerous faulty operation of the tool (Fig. 4.3).

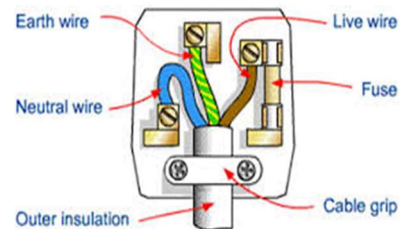


Fig. 4.3

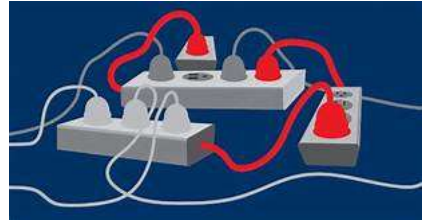
Outlet Overload

Multi-socket outlet adapters make it very convenient to expand the capacity of a standard wall outlets in order to power a variety of equipment, appliances and tools; but it also makes it much more dangerous. Simply put, overloading an outlet can cause a fire. More current is being drawn through the outlet by the equipment than what the outlet was designed for. The flow of electricity, or current, naturally generates heat. The outlets and wires are designed to handle a certain amount of current. Too much current flow through the wires causes heat build-up and eventually a fire. If an expansion adapter must be used, it would be best to use one that has a built in circuit breaker. This is a thermal activated switch that will cut off the current flow from the outlet through the adapter if the temperature of the wires rises too high. You can reset the switch and be forced to plug fewer devices into one outlet.



Daisy Chaining

Daisy Chaining is plugging a series of extension cords, power strips and adapters together in a line in order to power a device or multiple devices and/or tools over a large distance away from a power source. This is incredibly dangerous because of the likelihood of starting a fire.



Extension cords, power strips and even adapters have an amperage (Amp) rating. Amperage is the unit of measure for the quantity or amount of electrical current flow. Think of electricity like water; the flow (or movement) of electricity through wires is the same as the flow of water through a garden hose – both are called “current”. Different amounts of electricity can pass through different sizes and types of wires or be used by a device, much like there is a difference in the amount of water that can pass through a garden hose versus a fire hose. The difference in flow is that water is pushed from a faucet (the water outlet) but electricity is pulled out of, or drawn, from the electrical outlet into a device. That is where we get the term “amp draw”.

Now, when we daisy chain, the tool is drawing the maximum amount electrical current it is rated for, through all of the connected cords and power strips from the wall socket to itself. Any other tool or device that is connected to one of the extension cords or power strips in that chain is also drawing its own maximum amount of current. Electrical current generates heat, and if the combined amp draw of all of the tools and devices is larger than the amp rating for any of the cords or power strips connected back to the outlet, then there will be problems.

Many people try to rely on the fact that power strips and some extension cords have fused circuit breakers with a reset switch. This means that if the maximum amps are exceeded for the cord or strip, then the safety switch will shut off the electrical connection. This is one of the two dangers of daisy chaining!!!! 1) Most people are NOT going to do the math to check and make sure that they are not exceeding the rated amperage for any of the cords or strips in the chain. And 2) even if you would do the math, what would happen if the cheap power strip(s) you bought at the dollar store had a defective circuit breaker? So, the best and safest rule to follow is.... Don't Daisy Chain!



Section 4:3 Review Questions

Please answer these questions on a separate sheet of paper and turn it in at the beginning of class.

- 1) What are the two types of hazardous substances that our robot batteries contain?
- 2) What is the first step in responding to a battery spill?
- 3) When removing a power cord from an outlet, why should you always grasp the plug?
- 4) Define the term “current”.
- 5) If you use an outlet expansion adapter, use one that has what?
- 6) What is Daisy Chaining?
- 7) What substance neutralizes battery acid?
- 8) What are the exact contents of a battery spill kit?
- 9) Define the term “amperage”.
- 10) Power strips and some extension cords have what safety feature?
- 11) How many battery spill kits does **FIRST** encourage teams to have at competitions?
- 12) Explain the Amp Draw of a device or tool.
- 13) True/False – It is safe to daisy chain as long as the power strips have circuit breakers and a reset switch.
- 14) What condition of the metal blades on a plug may be a sign of an electrical short inside the cord or tool?
- 15) The two hazardous substances contained in a battery are in a gel form called what?

CHAPTER 5

Section 5:1 Travel

Buddy System/Hotels

Safety is of the highest concerns in every area of the competition weekend. When at all possible, use the “Buddy System” – walk with at least one other teammate. Use the buddy system in and around the competition arena, in and around the hotel and especially if on a sight-seeing tour of the city we are visiting. Make sure you and your buddy have working and fully charged cell phones that are turned on and set to a volume or vibration level that will get your attention when you are needed.

Be smart, never go into the hotel room of a stranger – this includes students from other teams at the completion. If anyone is persistent in asking you to come into their room, politely decline and explain it is against team rules. Next, tell a team mentor of the incident and make sure you stay with at least one team member at all times.

Never travel outside of the designated boundaries of the arena, hotel or tour area. Do not take unauthorized transportation anywhere! And, though you may feel you are being a Good Samaritan, never give money (even change) to the “homeless” and pan-handlers.

Team Representation

In ***FIRST***, your reputation is everything. Our team is known for being loud and proud with very noticeable team uniforms. We have often been credited with our team uniforms being integrated into our safety culture. We have a standing rule that team members do not wear hoodies, jackets or any other clothing over team shirts during competitions. In an emergency, we need to account for every team member and it is much easier to pick our members out of a crowd by our unique uniforms rather than trying to use other methods. If you become cold, you can wear additional clothing, but make sure your team uniform is clearly visible on top.

Also, our team uses I.D. and medical badges. These custom made badges tell a first responder important information about you if you become ill or injured and not able to communicate.

Section 5:2 Competition/Arena

Pit Area and Pit Stations

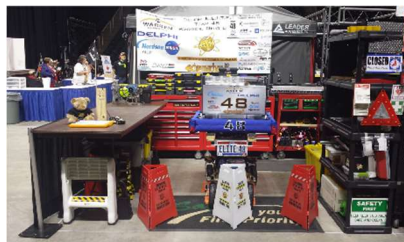
The **FRC** competition venue is divided into two sections, the arena and the Pit Area. The pit area is sensory overload; it is full of crazy sights, sounds and smells, so having a heightened sense of awareness will keep you, and others around you, safe.

The Arena side of the venue has the playing field. Teams and spectators sit on this side to watch the actual competition matches and scout teams in action. Team must obey all safety rules as they apply to the competition. Anyone on the drive team handling the robot **MUST** wear gloves to prevent being cut on sharp edges or being caught between “pinch points”. Anyone on or around the playing field area **MUST** wear safety glasses. When loading and unloading the robot from the cart, drive teams **MUST** use proper lifting techniques – the UL Safety Advisors will be specifically watching for this.

The **Pit Area** is behind the arena, typically separated by a large Black curtain. The pit area is where you will find all of the individual team pit stations. Safety glasses are mandatory **EVERYWHERE** in the pit area. In the pit area you will see tour groups, mascots, judges and possibly the practice field.



The **Pit Station** is a 10 ft. wide x 10 ft. deep area assigned to your team for the competition weekend. Also, no structure (towers, banners signs, etc.) can be taller than 10 ft. high.



This is where your team will service your robot, keep and use tools, present to judges, network, scout and strategize with other teams. This is also the location of Pit Administration and any shipping/freight services that may be needed. Depending on the location, the pit stations are separated either by taped lines on the floor or by convention type poles and curtains. All teams must respect each other's areas and keep everything within their own pit boundaries.

The following is a list of rules that **MUST** be followed in the Pit Area and Pit Stations:

- Safety Glasses must be worn **EVERYWHERE** in the Pit Area at **ALL TIMES**
- Wear proper PPE's
- Long hair must be tied up or back when working with tools and equipment within your pit station.
- No food or drink allowed in the Pit Area (Varies by location)
- Children 12 years old and under must be accompanied by someone 18 years old or older at all times in the Pit Area
- **ABSOLUTELY NO RUNNING IN THE PITS!**

- **Mascots** must be accompanied by an escort or “spotter” at all times. Large groups usually form to take pictures of/with mascots, so try to move them to an isolated area out of the aisle ways.
- All team equipment and supplies must be contained within the boundaries of their pit station.
- Report any safety violations to a Safety Advisor or Pit Administration

A full explanation of pit rules can be found in the **FIRST** Safety Manual on the firstinspires.com website.

6S Housekeeping

Housekeeping is one of the most important aspects of shop safety, and the pit is a mini workshop. Our team follows a commonly held safety philosophy of many corporations today called 6S; 6S=SUCCESS! There is a methodical method to improve your housekeeping and standardize your processes making them more efficient and less stressful called 5S; the 6th “S” was later added for general “Safety”. Remember these principles to ensure the safe operation of our shops and pit area:

1. **Sort**: Keep only what you need. Throw out unnecessary items.
2. **Set in order**: Easy access to frequently used tools and supplies
3. **Shine**: Clean tools and work space. It is easier to identify defects/damage.
4. **Standardize**: Same set-up and process everywhere, every time.
5. **Sustain**: Keep your processes, procedure and culture going strong, no matter what!
6. **Safety**: Make/Keep it the foundation of our team!!

Safety Services (Escorts)

One of the signature elements of our team, known throughout the Northeastern United States and parts of Canada, is our Safety Services group. Originally called “Safety Escorts”, our Safety Services team was created in an effort to help teams transport their robots throughout the pit area



during the very busy and crowded portions of the weekend. This special team of students became so popular that we were requested for special volunteering roles and assignments at various regional competitions, and so we changed the name to “Safety Services” to incorporate our ever expanding roles at competitions. This position is very demanding and often comes with great sacrifice. We have been equally praised and criticized for

our efforts, but in the end we have made an impact on **FIRST** as a whole. Many teams have started their own *Robot Escort* teams and we have worked together with them to make the FIRST

community more safety conscious. But make no mistake, we are the originators, the pioneers; the team that started it all!

Safety Services members have a set of equipment specifically selected for their duties. This equipment includes:

- ISEA Class 2 reflective safety vest**
- Red/Green (Stop/Go) traffic control gloves
- Traffic control flag/light baton
- Mini Flashlight
- OSHA mini First Aid kit
- (Optional – if allowed/necessary) Walkie Talkie Radio

****ISEA (International Safety Equipment Association)** is a trade association of manufacturers of personal protective equipment, other safety equipment and safety technologies/systems that enable people to work in hazardous environments. The ISEA developed the ANSI standard for high visibility safety apparel. The standard is ANSI/ISEA 107-1999 and defines 3 garment categories, or “classes”. These classes are based on worker hazards and tasks, complexity of the environment and vehicular traffic and speed.

Class 1 apparel is intended for use in activities that require the worker’s full attention to approaching traffic. There should be ample separation of the worker from traffic, which should be traveling no faster than 25 mph. Some examples of workers that wear Class 1 apparel are:

- Parking lot attendants
- Workers exposed to warehouse equipment traffic
- Roadside or sidewalk maintenance workers
- Grocery/Department store workers retrieving shopping carts from parking lots
- Gas station attendants

Class 2 apparel is intended for working environments where greater visibility is necessary – inclement weather conditions – or in environments with risks that exceed those for Class 1. This class also includes workers whose jobs divert their attention from traffic and/or put them in close proximity to traffic traveling 25 mph or higher. Some examples of workers that wear Class 2 apparel are:

- Roadway construction / cleanup
- Survey crews
- School crossing guards
- Delivery Vehicle drivers
- Emergency response and law enforcement personnel

A Class 2 safety vest is larger than its class 1 counterpart because they require more high visibility and reflective areas to be present. A Class 2 vest must have at least 775 inches of safety yellow or safety orange background material and 201 square inches of reflective striping.

Class 3 apparel provides the highest level of visibility and is intended for workers who face serious hazards and have responsibilities that take their attention away from their work. These clothing items provide more enhanced visibility to more body parts such as arms and legs. Some examples of workers that wear Class 3 apparel are:

- Roadway construction / flaggers
- Survey crews and utility workers
- Emergency response personnel

Section 5:3 SAFETY ADVISORY/JUDGING

Safety Awareness and Recognition Program

During the competition weekend, all teams are eligible to earn the Industrial Safety Award sponsored by Underwriters Laboratories. For those that choose to participate, this is a highly competitive program with many opportunities to earn several safety related awards and recognitions.

The key objectives of the *Safety Awareness and Recognition Program* are:

- a. Ensure participants, volunteers and spectators have injury-free competitions
- b. Motivate participants to learn and follow safe individual and group practices as a life skill using a positive coaching approach
- c. Select the winning team for the *Safety Award* sponsored by Underwriters Laboratories
- d. Publicly recognize other teams and individuals for safe practices

Throughout the event, the easily recognizable, red-shirted safety advisors with the support of student safety captains, will



continuously tour the event to observe activities in the pit, practice field, queue line, and playing fields to observe the safety habits of the teams. This includes observing the un-crating/un-bagging of robots and transporting them between the pit and playing fields. Safety advisor(s) will assess the culture of safety at the event and that demonstrated by individual teams and rate overall safety performance programs in the following areas in determining opportunities for award recognition:

1. Safe Behavior (Personal Protective Equipment (PPE) Usage)
2. Physical Conditions (Housekeeping)
3. Safety Innovation
4. Safety Program presentations (Interview with the judges)

The culture of safety at *FIRST* is exemplified directly by its participants. In order to have a better view and understanding of the culture of safety at each *FIRST* events, *FIRST* Robotics Competition teams are provided with *Safety Champion Cards* to provide feedback to submit to safety advisor(s) and recognize the contributions of peers to the enhancement of the culture of safety at *FIRST*.



The safety advisor(s) will use this information, as well as the following criteria, to assess candidates for safety recognition and awards:

Safety Champions

My Team Name: _____ Team #: _____

Directions: Select the team that exemplifies the principles stated. Cards are to be handed in 1 hour before close of competition each day.

Best Team Safety Culture Team #: _____
 (Team that exhibited safe practices at all times, wearing safety glasses, proper use of tools, use of PPE.) Set an example for others to follow.

Best Pit Safety Team #: _____
 (Clean, organized, smart design using the Safety manual.) Maintain a healthy attitude regarding safety.

Star of the Day Name: _____ Team #: _____
 (Student or Mentor who went out of their way to assure you or others were safe today.)

Working for a Safer World

UL promotes safe living and working environments for people by the application of Safety Science and Hazard-based Safety Engineering.

UL supports the production and use of products which are physically and environmentally safe and to apply our efforts to prevent or reduce loss of life and property.

We advance safety science through research, standards development and education.

We concentrate our efforts and resources on public safety in those areas where we can make valuable contributions.

UL works with integrity and a focus on quality to enhance the trust conveyed by our certification marks and services.

1. Program Presentations (Team Safety Program)
2. Safety Initiatives (at the event)
3. Community Outreach
4. Safety Innovation

This program uses coaching, positive reinforcement and public recognition to meet its objectives. The safety advisor(s) with input from *FIRST* Robotics Competition participants will select the teams that best meet the program objectives. Safety advisors will:

1. Provide positive verbal feedback for safe behavior and conditions.
2. Indicate unsafe behavior and coach to correct unsafe behavior.
3. With input from the *FIRST* Robotics Competition participants and student safety captains, will select:
 - a. “*Star of the Day*”: a mentor, volunteer or student
 - b. *FIRST* in Pit Safety
 - c. *Hard Hat Pin Award: Safety Award* Finalists
 - d. *Safety Award*, Sponsored by UL



The **UL Safety Award** celebrates the team that progresses beyond safety fundamentals by using innovative ways to eliminate or protect against hazards and spread the principles and culture of safety throughout and beyond their team to enhance the understanding and recognition of safety principles to the larger community.



Teams should not hesitate to talk with the safety advisors and ask questions.

Section 5:4 Review Questions

Please answer these questions on a separate sheet of paper and turn it in at the beginning of class.

- 1) True/False – You must wear safety glasses everywhere, at all times in the pit area.
- 2) What is the name of the association of manufacturers of personal protective equipment and other safety equipment that enable people to work in hazardous environments?
- 3) What are the 3 dimensions of a team's pit station?
- 4) Which special team of students was created in an effort to help teams transport their robots throughout the pit?
- 5) What is the ISEA rating of our safety vests?
- 6) What item must teams submit to Safety Advisors that provide feedback and recognize the contributions of peers to the enhancement of the culture of safety at *FIRST*?
- 7) True/False – It is okay to wear a jacket over your team uniform as long as your ID badge is still showing.
- 8) What principle do we use to improve our housekeeping and standardize our processes to ensure the safe operation of our shops and pit area?
- 9) True/False – a Mentor is eligible to win Safety Star of the Day.
- 10) True/False – Safety Advisors watch for safe work practices even when un-bagging the robot?
- 11) What color are the Safety Advisor's shirts?
- 12) What are pinch points?
- 13) Why did we change the name of Safety Escorts to Safety Services?
- 14) How many awards are listed as part of the Safety Awareness and Recognition Program?
- 15) True/False - Children 10 years old and under can be accompanied by someone 13 years old or older in the Pit Area.
- 16) True/False – It is okay for students to enter the hotel rooms of other students from different teams as long as they are of the same gender.
- 17) Which class of safety apparel do roadway construction personnel, emergency response personnel and survey crews and utility workers wear?
- 18) Where can a full explanation of the pit rules be found?
- 19) When must your hair be tied up/back?
- 20) Which class of safety apparel is worn around traffic going no faster than 25 mph?



NOTES