

# FRC: 7902

# MARKHAM FIREBIRDS

*Igniting STEAM in Markham*



**2018 - 2019  
SAFETY MANUAL**



# **Safety Manual**

Version: 2019 Season

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## ★ Introduction

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What is safety? Safety is the basic set of principles which are meant to protect a person from harm. So why do that on a robotics team? Well there is so much risk that comes with this great experience. Tools, robot mechanisms, machines, and a workshop environment all present risks to safety, and if you are not careful, those risks could come to pass. At the most basic level, **injured people can not build robots**, which is why it is important to be knowledgeable on basic safety to prevent injury.

This manual details FIRST's safety program which is customised to their organisation. This program has been taken and formatted for optimal usage on Team 7902. Additionally, it contains features not found in the FIRST Safety Manual, including:

- Common Sense, the first step for safety
- Acronyms to help you remember pit and robot lifting safety
- Additional information specific to the 7902 experience
- FIRST Aid, a trial emergency response and treatment program by Team 7902 to quickly attend to injuries in the workshop and at competitions

We hope that you find this work useful, and we hope that you have an interesting, character-building, fun, and safe experience in FIRST and on Team 7902: Markham FireBirds.

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## ☆ 1.0 Culture of Safety

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Instilling a culture of safety is a value that every individual in the FIRST community must embrace as we pursue the mission and vision of FIRST. FIRST Robotics Competition has adopted safety as a core value and has established the framework for safety leadership in all aspects of the program. FIRST believes that the teams that take the lead in developing safety programs and policies have a positive and lasting impact on each team member and Mentor, in addition to their communities and present and future workplaces. FIRST recognizes the teams that demonstrate safety throughout their programs and are truly committed to developing a culture of safety.

## ★ 2.0 Scope and Participants

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This safety manual is a guide to important safety standards and information. It is designed to provide participants with a set of basic skills and tips in order to maintain a safe environment during build season and FIRST Robotics Competition events. The contents of this guide apply to all participants, Mentors, volunteers, and spectators involved with FRC.

### **2.1 Key Objectives**

- Eliminate or minimize identified hazards and adapt to prevent them
- Foster a safe work and build environment
- Encourage safe behaviors in everyone, regardless of situation
- Lead by example and nurture future leaders

### **2.2 Competitors and Participants**

- Each and every individual who wishes to compete or participate in FIRST events should be familiar with this manual and be able to understand and follow established safety requirements applicable to each environment.
- Always familiarize yourself with any site restrictions and/or safety warnings outlined on-site.
- Work in a safe and responsible manner regardless of the situation at hand. Do not allow competitive spirit nor stress to put you in a potentially dangerous situation.
- Always use and maintain personal protective equipment (PPE), safeguards, and other safety equipment as required.
- In the event an incident or unsafe/hazardous condition arises, immediately report to the safety captain, safety advisor, or Mentor. Unsafe work habits must also be reported so that they may be resolved in a correct manner.
- Even if you are practicing safe behaviours yourself, you should also encourage safe behaviors in everyone around you.

### **2.3 Mentors and Volunteers**

- Lead by example. Always practice the same safety behaviors that are expected from the students and never encourage students to act in an unsafe or irresponsible manner.
- Provide guidance and mature encouragement on a safe working environment. Do not allow the stress of competition to break good habits.
- Provide leadership and guidance on matters of general safety, including the use of personal protective equipment during the lifting, handling and transportation of robots 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.

- Familiarize yourself with relevant event safety and restrictions outlined by FIRST. Go over these considerations with the team prior to an event.
- Coach the student safety captain to ensure that he/she understands and adequately fulfills the position's responsibilities.
- Collect, organize, and store Safety Data Sheets (SDS) for any chemicals, chemical compounds or chemical mixtures (e.g. in paint, and batteries) used by the team. 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.

## **2.4 Student Safety Captains**

- It is the student safety captain's responsibility to develop a team safety program manual (like this one) that outlines your team's safety culture with consideration to the elements in the seasonal safety manual released by FIRST.
- You should be encouraging your team to display positive safety behaviours at all times and respond accordingly. Poor behaviours should be improved on and good behaviours should be rewarded.
- Provide support for any safety questions or concerns that may arise from a variety of situations. Seek guidance, if required, from Mentors.
- Conduct regular safety inspections of the general work site, and pay careful attention to 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. Add to the collection of SDS as required.
- Coordinate, deliver, and track safety training for the individual team members as well as team wide safety procedures. You may bring training logs and procedures to events continue to make comments about infractions and/or areas of continuing improvements. There is always something to improve on.
- Lead the FIRST culture of safety as safety leader by maintaining safety at FIRST Events procedures for your team, volunteers and spectators. Advise those around you of safe practices in line with these procedures and do not hesitate to speak with a Mentor or event safety advisor to escalate the situation.
- Ensure safety practices are compliant 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 are informed about the proper emergency procedure. This would include a meeting spot to gather as well as a list of participants to assure everyone is safe.

## **At Competition:**

- Participate in checkpoint safety meetings with the event safety advisor to collaborate and provide feedback on any event safety needs:

### **Typical Safety Meeting Schedule:**

- First full day: morning student safety captain meeting (normally 1 hour after pits open)
- First full day: late afternoon student safety captain meeting (normally 3 hours before pits close)
- Second full day (if applicable): afternoon student safety captain meeting (normally 2 hours after lunch)
- Final day: morning student safety captain meeting (normally 1 hour after Opening Ceremonies)
- 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.

## ★ 3.0 General Safety

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### **3.1 General Safety Tips**

\*These points of safety will be constantly observed by event safety advisors, Mentors and the student safety captain.

- Running and horseplay is not permitted at any time. Act professional and mature, and not just in front of the judges and other adults.
- Follow safe work practices, including safe use of all tools and personal protective equipment (safety glasses, shoes, gloves, hearing protection, etc.). Maintain a healthy attitude regarding safety.
- Always walk and work in a controlled and thoughtful manner. Keep full control of robot at all times. Be ready to disable the robot immediately in case the robot is acting in a way not intended.
- Be especially careful around high-speed rotating components, both on and off the robot. If you are putting a high-speed rotating component (wheels, gears, etc.) on the robot, make sure the component is designed to be used the way you are using it.
- Take special care when working above normal height or ground level. You never know when you could slip. Always have someone spot you when working above normal height.
- Always fully open a ladder and never stand on a non-approved step. Chairs and tables are not acceptable ways to reach high places.
- Be careful using tools that generate heat, such as heat guns and soldering irons. Be aware of objects that may be in the vicinity of the heat source. Also, know that these tools often retain heat after being shut off, and should be set down only on appropriate surfaces. Be cautious of those around you, and avoid swinging tools that generate heat.

### **C.H.E.C.K. - Pit Safety**

**Clothing** - Sleeved shirt and long pants, free of loose parts

**Hair** - Long hair and loose clothing is tied back

**Eyes** - Protective eyewear is worn at all times

**Closed toes** - Closed-toe shoes are worn at all times

**Key objectives** - Key objectives in mind, the safety of participants, volunteers, and spectators

## **3.2 Personal Protective Equipment**

The proper use and maintenance of personal protective equipment (PPE) is one of the most vital elements in ensuring the safety of participants at FIRST Robotics Competition events. Work areas during build season and at competitions are not hazard-free, so extra care must be taken to ensure that PPE are worn during the construction, use, maintenance, and transport of a robot. All PPE must be ANSI-approved, UL-Listed, CE EN166 rated, AS/NZS certified or CSA rated, as applicable.

### **3.2.1 Appropriate Clothing**

Each participant is responsible for wearing appropriate clothing to each build season meeting and competition. This includes a pair of long pants, a sleeved shirt and appropriate shoes. Be dressed to get your clothes dirty and be ready to do work in the clothes. Non-permitted clothing includes dresses with frills/or laces, skirts, tank tops, crop-tops, short-shorts, long coats, baggy pants, ties, and scarves.

### **3.2.2 Hair and Loose Extremities**

Ensure that team members or Mentors are not wearing ties, scarves, loose clothing, jewelry, hanging key chains or similar objects when near or working on moving or rotating machinery so as to avoid the potential risk of draw in to rotating parts. In the case of individuals with long hair, this risk should be mitigated by tying back or covering long hair. Once the hair is caught, it is already too late, so measures to prevent the incident from occurring at all must always be in place.

### **3.2.3 Eye Protection**

There are several forms of eye/face protection available to provide protection from related hazards, including safety glasses, side shields, goggles, and face shields. The most common is safety glasses. Safety glasses and protective eyewear are designed to provide a shield around the entire eye to protect against hazards such as splashes of liquids, burns from steam, compressed air, and flying wood or metal debris. Before use, inspect equipment for damage and if necessary, report to a Mentor or the student safety captain. Defective PPE should never be returned to storage.

If you wear prescription glasses that do not have a marked safety rating, you must wear rated safety goggles over them to achieve adequate protection. If you wear marked safety rated glasses, you may use **ANSI-approved, UL-Listed, CE EN166 rated, AS/NZS certified** or **CSA rated side shields**. Safety rated glasses, side shields and frames can be identified by markings stating the standard that they are rated to (ex. Z87.1).

#### **Eye protection is expected to be worn when you are:**

- Performing any work on the robot (grinding, drilling, soldering, cutting, welding, etc.)
- At risk of exposure to flying particles or chemical exposure (such as splashes, splatters, and sprays).
- Anywhere in the pit station, including walkways and team pits.

- In the vicinity of the arena, including the playing field.
- On the practice field.
- In any area posted with signs requiring the use of eye protection (such as the machine shop).

### **3.2.4 Hand Protection**

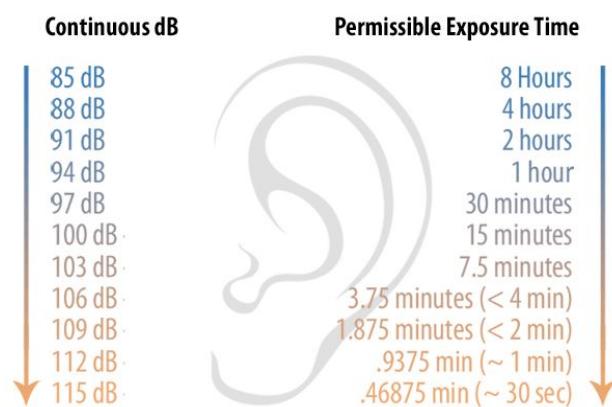
Hand protection is designed to protect against heat, electrical, chemical and mechanical hazards. Although not entirely mandated by FIRST like safety glasses are, gloves and mechanical tool guards should still be used when working with tools and the robot. FRC participants should work with their Mentor to ensure the selected glove is the correct one to use for each activity. For example, wear chemical-resistant gloves when handling chemicals and fabric gloves for robot transportation. Always check your gloves for proper size, absence of cracks and holes, and good flexibility and grip before you wear them. Report any damages if necessary, to a Mentor or the student safety captain. Defective PPE should never be returned to storage.

### **3.2.5 Foot Protection**

When engaged in FIRST activities, FRC participants must wear shoes that completely cover the entire foot. This means that the footwear must be substantial and have closed-toes and heels to protect against foot injuries. Examples of footwear not permitted near the robot include flip-flops, sandals, mules, lightweight slippers. In some cases, safety shoes or toe guards are appropriate for areas where heavy objects can fall on your foot. However, a team Mentor or the student safety captain should be notified if you encounter such situations, in order to determine the safest way to deal with the situation.

### **3.2.6 Hearing Protection**

At events or in a robot work space, there will be a variety of noises of different sound levels. It is important to make hearing protection devices such as earplugs available when sound levels reach a high level and cannot be terminated. An example is the noise emitted from loud power tools such as table saws and angle grinders. Noises measured at higher than 85 decibels (decibel: a measure of sound pressure, non-linear scale) can cause permanent hearing loss through extended periods of exposure. At events, hearing protection is often available at pit administration. A Mentor can provide assistance in evaluating high-noise tasks and determining appropriate hearing protection devices.



### **3.2.7 Spectators**

Spectators attending FIRST competitions 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 pits or in any locations where robots are being worked on. Loose sandals (like flip-flops) or bare feet are not permitted in the pit area under any circumstances. Teams should assist in the enforcement of these rules and make sure spectators are aware of these regulations.

## ★ 4.0 Tool Safety

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### **4.1 Hand Tools**

Constructing a robot will require the use of hand tools. Most people think of hand tools as wrenches, screwdrivers, chisels, and so forth, but the term also applies to any hand-held tool used or implemented to accomplish a task. This means that handheld power tools such as a drill is a hand tool. Always use the proper tool for the job. Do not use a wrench as a mallet or hammer. If the correct tool is not available, be sure to purchase one or borrow one from another team. At competition, others teams are more than happy to share their tools/parts provided they are returned undamaged and in a timely fashion.

#### **4.1.1 Tool Storage**

Store sharp-edged or pointed tools in a safe place. When carrying tools, cover the point or any sharp edges with shields and **NEVER** carry unshielded tools in your pocket. Don't leave tools on overhead work surfaces as they may fall and strike someone below. Store equipment in a location where it will not create a safety hazard or get damaged. Toolboxes or tool carts are good forms of storage. Always make sure to return a tool back to its proper place after you are done using it. Damaged or lost tools should be reported to a Mentor or the student safety captain.

#### **4.1.2 Avoiding Injury**

When using knives/blades or heat generating tools (soldering irons, heat guns), direct your strokes away from your hand and body and be aware of those around you. Wear the proper pair of gloves. When using a tool, place the work on a bench or hard surface rather than in the palm of your hand. C-clamps or clips should be used to secure down parts when drilling, filing, or working on a part. In the event of an incident, the event must be reported to a Mentor or the student safety captain and recorded on an accident log.

#### **4.1.3 Damaged Tools**

Before using any tool, check to see if it is in good condition. Don't use defective, dull, or broken tools. Tools with unintentionally exposed parts or damaged insulation on the power cord should be removed from use immediately. Don't put them back on the shelf, remove them from service, and notify the safety captain and Mentor so the tool can be disposed of and replaced, or sent for repair.

## **4.2 Power Tools**

Although convenient and handy, handheld and mounted power tools are extremely dangerous if used improperly or without the proper safety procedures. Extra care should be taken when using power tools. Blades, mechanical arms, wheels will continue to spin, oblivious of the person that is caught in them. Always have the emergency off switch within an arm's reach and educate each member on the proper use of each power tool. Power tools are expensive and dangerous, but very useful, so only trained members should be using them.

## **4.3 Mechanical Guards**

Provide safety guards for power tools where required. Never use any equipment without safety guards in place. If blades, arms, wheels, gears, or other moving parts are exposed and could threaten the safety of the power tool operator, then the machine must be put out of service until there are proper guards in place. Notify your safety captain and Mentor of any broken or defective equipment, and take it out of service until repairs are made.

## **4.4 Soldering**

Soldering can be dangerous because of the heat from the iron and the chemical fumes/vapours released from the solder and flux. Never touch the iron/gun because it heats to extreme temperatures that will cause severe burns and possibly permanent damage if used in an unsafe manner. Only lead-free solder and electrically heated soldering irons/guns should be used and no torches or open flames of any kind are allowed in event venues, except by authorized personnel in specified areas (such as the event machine shop).

Eye and face protection should be worn when working with a heated tool and burns can be prevented by wearing cotton clothing that covers your arms and legs. Soldering should be done in well-ventilated areas and on a fire resistant surface. Be sure to always wash your hands thoroughly with soap and water after handling solder. Do not leave any hot tools where someone can accidentally contact the hot element by keeping your soldering iron in its protective holder when not actually being used.

## ★ 5.0 Robot Safety

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### **5.1 Robot Transportation**

#### **5.1.1 Robot Cart**

To protect team members from muscle strains and other injuries as they transport the robot between the pits and the competition area, we use a cart to transport the robot.

#### **Important Tips Regarding Robot Carts**

- Carts must remain in the team pit area when not in use for robot transportation.
- Carts must be safe and easy to maneuver with.
- If a safety advisor declares a robot cart is unsafe, then the cart must be taken out of use until it is adjusted to be safe.
- All carts should be able to fit through a standard 30-inch door.
- Wheels on the cart must not damage site flooring and should be kept clean in order to keep venue floors clean as well.
- Do not add music or other sound-generating devices to the cart, unless the sound is intended to alert people of an oncoming robot. It is still recommended to tap people on the shoulder instead of shouting or playing a sound. Loud sounds may startle people and possibly cause injury.
- The team number should be visible on the robot cart in order to help field personnel identify the robot and team.

#### **5.1.2 Lift Preparations**

One of the most important skills to have as an FRC competitor is being able to lift a robot safely. During one competition, a robot may be lifted several dozen times, so it is important that all members follow the correct procedure. By practicing these safety techniques, your team members will also develop a quick, fluid routine.

Before making any attempt to lift a robot, the team must make sure that it safe to do so. Ensure all transporters are wearing appropriate PPE (safety glasses at a minimum are required.) Gloves are highly recommended. Before lifting, hold a short discussion to determine the direction and path you will be lifting. Also be sure to ask yourself these questions before you even think about laying a finger on the robot:

1. Are all parts of the robot secured?
2. Is the robot powered off?
3. Is anyone still working on the robot?
4. Are there enough people to perform the lift safely? Two to four people are preferred.
5. Are all the areas and paths are clear of debris and hazards?

### **5.1.3 Lifting Procedures**

Before making an attempt to lift, someone must be chosen to coordinate the lift and make sure it is safe to begin the lift. Proper lifting procedure is paramount in making sure that all members who are performing the lift are as safe as possible and there is less room for error. Follow these rules to lift in the safest way possible:

- Each lifter should place his/her feet close to the robot and adjust into a position where the whole body is balanced.
- All persons should lift at the same time using proper body mechanics; these include:
  - Lift with your legs, keeping your back straight.
  - Do not twist your body. If you need to turn, turn your whole body by maneuvering your feet. The legs form the basis of support for the body and robot, so they should never be in an unstable position.
- Use proper hand holds to grasp the robot and make sure you have a safe, secure lift point before starting the lift. Be sure to avoid any sharp points, wheels, or places that may potentially cause your hands to slip off.
- Bend your knees to a comfortable degree and get a good hand hold. Maintain normal spinal curves.
- Tighten your stomach muscles and commence lifting the robot, using your leg muscles if you are lifting the robot up from the floor. Your back should never be hunched forward. If your back starts to bend, notify the other lifters and restart the lifting procedure.
- Keep the robot close to your body, and coordinate lift speed with the others. Make sure you are not moving too quickly as the team can only move as fast as the slowest person. In general, moving slower is safer than faster.
- Appoint someone to make sure the cart is stable and will not roll, then coordinate correct placement of robot on the cart. Ensure the robot will not fall over or slip off the cart after placing it down.
- When lifting the robot into the playing field, use the gate opening to enter the playing field. Climbing over the railing is strictly prohibited.

### **5.1.4 Transporting Procedures**

Once the robot is placed down on the robot cart, it is important to make sure the robot is completely stable and the cart is secure:

- Keep the cart under control at all times, especially when removing or placing the robot.
- Lead the cart with a team member who can ensure the safety of those in the path of the travel area.
- Use patience and control when moving the robot, especially in crowded areas (do not run).
- Ensure that the cart will not roll away or pose a hazard, especially upon robot removal (use a chock block if necessary or appoint someone to keep watch).

## **A.L.O.F.T. - Robot Lifting Safety**

**Alert** - Everyone is aware the robot is being moved

**Legs** - Everyone is using their legs, not their backs to lift

**Off** - The robots is powered off before making any attempt to lift

**Four People** - Two people to carry, one to spot, one to control the cart

**Target** - Everyone knows where the robot is going to be moved to prior to lifting

## **5.2 Stored Energy**

Plan the required activities when servicing or making repairs to the robot. Make sure all team members are aware that work is being done on the robot. Address the following:

Avoid working on an energized robot during repairs unless absolutely necessary.

### **5.2.1 Electrical Energy:**

- Disconnect the electric power source
- Best Practice: Always de-energize the robot before working on it by opening the main circuit breaker (press the red reset button on the circuit breaker) and unplugging batteries

### **5.2.2 Pneumatic Energy:**

- Always vent any compressed air to the atmosphere (this applies to all parts of the pneumatic system)
- Open the main vent valve and verify that all pressure gauges on the robot indicate zero pressure

### **5.2.3 Miscellaneous Energy Sources:**

- Relieve any and all compressed or stretched springs or tubing that could release
- Lower all raised robot arms or devices that could drop down to a lower position on the robot. Lower the arms/parts on slowest speed setting or by hand if possible.

## **5.3 Robot Signal Light**

The robot signal light is included on every robot and for good reason. Because it displays the robot's current status, it is one of the most important parts of any FRC robot. When off, it signifies that the robot is not energized. When on and solid, it signifies that the robot is energized, but disabled. When on and flashing, it signifies that the robot is energized and enabled to move. Members should respect the light when it is solid or flashing as the robot could make a sudden move at any time. The person who enables the robot on a laptop should also notify anyone near the robot and make sure they are clear of the area surrounding the robot before enabling it.

## ★ 6.0 Battery Safety

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12 volt batteries are essential to powering FRC robots, but they can be very dangerous if handled improperly. Inside each battery contains sulphuric acid ( $H_2SO_4$ ), one of the strongest acids. Careful thought must be put into the maintenance and use of these batteries.

### **6.1 Proper Battery Charging and Inspection**

- Do not leave batteries uncharged for too long as the internal leads can get corroded if the battery is left with low voltage for long periods of time. A multimeter can be used to check the charge of a battery.
- Use a proper charger that has cooling built in.
- Inspect for leaks.
  - Any battery that is visibly damaged in any way is dangerous and unusable. Damaged Batteries contain stored electrical energy and can cause the battery to heat up quickly and explode due to short circuits in the battery. The sulphuric acid inside the batteries will also burn skin and flesh on contact.
- Keep the battery-charging area clean and orderly.
- Place your battery charger in an area where cooling air can freely circulate around the charger. These chargers can fail without proper ventilation.
- To avoid the possibility of shorting out the battery terminals and creating a hazardous situation, it is required to cover all exposed battery terminals and connections with appropriate insulating material such as electrical tape or tubing.
  - If metal tools/parts contact the terminals simultaneously, it will create a direct short circuit. This may cause high heat to develop in the battery terminal/part/tool area and the battery could explode.
- Do not charge battery at greater than the manufacturer's maximum recommended rate voltage (12V-13V is enough).
- Periodically inspect your battery for any evidence of damage, such as a cracked case or leaking electrolyte. Also check bent terminals as they can also be a potential leak source.
- Inspect the battery before and after each round of competition.

### **6.2 Battery Handling**

- Batteries should never be plugged into another battery, uninsulated or wire that is not connected to any load. Doing any of these, may create a short circuit and an explosion may follow.
- Grabbing by the power cables of the battery is completely unsafe. Both hands should be used to carry the battery from its base. The 12V batteries are quite heavy, so the insulation could break from the terminals if the battery is held from the connector.

- Only a sufficiently charged battery should be loaded into the robot, as insufficient voltage may cause problems with robot. It is recommended that adequately charged batteries are labelled so members can quickly identify a charged battery to load into the robot.

## **6.3 Battery Spill Cleanup**

### **6.3.1 Dangers of Batteries**

12V Batteries contain acid. This substance, sulphuric acid ( $H_2SO_4$ ), is a corrosive, colorless liquid that will burn your eyes, skin, and clothing. The team Mentor and student safety captain should post the safety data sheet (SDS, see example in Appendix) for the battery in use and train all team members about battery safety. You can find emergency handling and first aid procedures on the SDS, along with information for handling cracked or damaged batteries, and disposal of the battery.

- Immediately flush any contacted skin with a large quantity of water.
- Seek medical treatment immediately.
- Accidents can be avoided if you periodically inspect your batteries for any signs of damage or leaking electrolyte. If a battery is ever dropped, be sure to thoroughly inspect it for cracks, as they may not always be entirely obvious.
- Treat the battery as a hazardous material and process it in accordance with the battery's SDS.
- If the battery shows any signs of damage, don't risk using it.

### **6.3.2 Battery Spill Cleanup Procedure**

As soon as the battery spill occurs,

1. Neutralize it by pouring the sodium bicarbonate on all wetted surfaces. The bicarbonate of soda itself is not dangerous, and will react with the acid in the electrolyte leaving a safe residue that can be disposed of in a conventional manner such as rinsing with water.
2. Follow emergency handling instructions of the SDS and notify a Mentor.
3. Put on gloves before handling the battery.
4. Place the battery in a non-metallic and leak-proof container for removal.
5. Be sure to neutralize any acid on the gloves before removing and storing them.
6. Seek medical attention if skin came into contact with any chemicals.

At a FIRST event:

- a. Immediately send the person in contact with acid to the First Aid Station/EMTs.
  - b. Report incident to the pit administration supervisor so that the individual can fill out a Medical Incident Report form. Provide team number and available information.
7. Properly dispose of the battery, which is now a hazardous material.

## **B.A.S.I.C. - Battery Spill Cleanup**

**Baking Soda** - Neutralize all leaking acid with sodium bicarbonate (baking soda,  $\text{NaHCO}_3$ )

**Acid Resistant Gloves** - Use thick rubber or plastic gloves when dealing with a leaking battery

**SDS** - Consult the safety data sheets for information on how to clean up and dispose of the battery

**Inform Safety Heads** - When a spill occurs, a Mentor, the student safety captain, a safety advisor, and the safety table should be notified immediately

**Container** - Use a non-metallic and leak-proof container to store the leaking battery

### **6.3.3 Battery Spill Kit**

FIRST recommends that teams keep the following items readily available whenever working with batteries:

1. A box of sodium bicarbonate (baking soda) to neutralize any exposed acid electrolyte.
2. A pair of acid-resistant rubber or plastic leak-proof gloves to wear when handling a leaking battery. Regular cloth or latex gloves are not acceptable as they are too thin.
3. A suitable non-metallic and leak-proof container in which to place the defective battery. A plastic container is suitable.

## **6.4 Battery Disposal**

A defective battery is of no use to the team, so be sure to dispose of all batteries properly and safely. Over time, old batteries will hold less charge, so it is also recommended that batteries are disposed of every few years and replaced with fresh ones. Most retailers of automotive batteries and recycling depots will accept and properly dispose of them at no cost.

## ★ 7.0 Pit Safety

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### 7.1 Electricity

#### 7.1.1 Power Strips

- DO NOT “daisy chain” – plug a power strip into another power strip. This could cause the potential for fire or electric shock due to overloading of the circuit.
- Avoid the following electrical power supply setups to prevent overloading:
  - Extension cord plugged into another extension cord.
  - Extension cord plugged into a power strip.
  - Multi-device receptacle plugged into a power strip or extension cord.
- Power strip wires should be taped down to the ground to avoid tripping.

#### 7.1.2 Charging Cords

- Any cords used for charging batteries, laptops, phones, etc. should be set up in a way so that they are not possible tripping hazards
- If a charging cable is not being used to charge at the moment, they should be unplugged from the power bar and put away to a safe place.
- Cables should always be unplugged from the thick end that goes into the power bar as opposed to the wire. Yanking on the wire could cause wire insulation to break and is generally a poor way to remove a charging cord.

## 7.2 Pit Restrictions

### 7.2.1 Pit Height, Border, and Aisles

Each pit is a square measuring 10 feet by 10 feet or smaller. The team occupying the pit is responsible for the entire square area and its surrounding aisles. There should not be any structures outside of the pit perimeter and the aisles should be clear at all times. The maximum height of any structure in the pit is 10 feet. This includes any banners, stands, and tent setups.

### 7.2.2 Load-In and Pit Setup

Bring and use work gloves for uncrating and re-crating, if a crate is in use. Design and set up your pit station safely and use proper tools to construct any components and structures (displays, shelves, banners, etc.). Use ladders; don't climb on items not meant for the task, such as tables and chairs. Observe the ten-foot height limit for all portions of your pit station, including banners. Small, bench-top band saws and drill presses, with appropriate guards, are allowed in team pit station.

## **7.3 Pit Safety**

Many members of the team will be spending a good amount of time in the pits, so it is important that the pits are safe and hazard-free most of the time.

Follow these tips to have a safer pit:

- Control access to your pit station. Do not allow people to enter the pit if there are too many people inside already.
- Keep the work area neat and orderly. There should not be any tools or parts on the floor of the pit.
- Properly use power strips. Do not 'daisy chain' (plugging power strips into one another) or overload the rated capacity of the power strip.
- Keep the aisle immediately outside your pit station clear for pedestrians and robot transit. If the pit is so crowded that people must stand on the edge and into the aisle, then there are too many people in the pit.
- Participants and spectators should be wearing approved personal protective equipment, PPE, in the pit at all times. Do not allow anyone without proper PPE into the pit.
- Teams may not build any structure to support people or items for storage over the top of the work area in their team pit station. Overhead storage is extremely dangerous.
- Team structures, signs, banners, or displays cannot be higher than 10 feet above the floor. All of these components must also be securely mounted to a secure structure.
- Be aware of your neighbors. Alert them if there is a hazard in your pit or near theirs. Maintain a clean, neat, and orderly pit station at all times. There are inspections after teams leave so be sure to do the following:
  - Clean floor in and around your pit station.
  - Properly organize and store tools.
  - Take proper care of batteries and battery chargers.
  - Keep a tidy storage of personal belongings and equipment.
  - When transporting your robot, politely keep pedestrians alert to your movement. A tap on the back and a friendly notice is more than enough. Do not be rude and abrupt about it.

## **7.4 Pit Organisation**

At an event where there are so many teams and people, organization is critical. After using any tools or parts, they must be returned to the proper place. Leaving tools and parts on the floor is not acceptable as they can be tripping hazards and may easily become lost. It should not be just one person's job to clean up the mess of many, so each person must do their own part in maintaining the cleanliness and organization of the team pit.

## **7.5 Age Requirements and PPE**

Children twelve (12) and under must have a person eighteen (18) or older accompany them at all times. There will be child safety glasses available to borrow and return at the safety glass station. Child strollers and baby carriages are not allowed within the individual pit stations. If a spectator wanders into the pits without PPE, kindly remind them that it is mandatory to wear safety glasses and politely direct them to the safety glasses sign out table.

## **7.6 Food and Drinks**

Food and drinks, except water, are strictly prohibited in the pits. Dropped food and spilled sugary drinks attracts pests and critters as well as pose a threat to electronics and tools. If a member of the team would like to take a food or drink break, they should go to the stands or somewhere else outside the pits to consume their food or drink. These rules also extend to any spectators. If someone is consuming food or a beverage in or near your pit, kindly tell them to exit the pits and finish their consumables before returning to the pits.

## ★ 8.0 Field Safety

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### **8.1 Practice Fields**

If your event has a practice field/area, be sure to obey the rules for maintaining an “exclusion zone” around the area. This zone will help ensure that robots and moving parts will remain within the practice area. It will also help prevent accidents to those persons viewing the sessions or traveling nearby who may not be aware of the movement of the robots. Be sure to wear proper personal protective equipment (PPE) and use safe lifting practices. Before leaving, make sure the practice field is clear of debris, and be gracious by picking up any foreign materials. The designated volunteers are there to help maintain a safe area. Please cooperate with them and help them do their job.

### **8.2 Alliance Stations and Robot Queue**

While in queue and at the alliance stations, it is very important that you remain professional and respectful of other teams. Practice safe robot lifting procedure and cooperate with other teams. Everyone wants to win, but that doesn’t mean it can’t be done with gracious professionalism. Share your tools and keep an eye out for the safety of other teams as well as your own. Do not think that just because they are competing against you that you do not need to look out for their safety as well. In the world of safety, everyone is an ally. If something unsafe is happening in robot queue or at the alliance stations, stop it before it causes harm.

### **8.3 Robot Removal and Field Cleanup**

After each match, the competing robots must be removed from the field and the field must be reset. Because you will be near members of other teams and close to their robots, you should be wary of where you are moving with the robot. There are many tripping hazards such as game pieces and other robots. Before you leave the field, any robot parts and unwanted debris on the field must be removed. If you stumble upon parts that are owned by other teams, do them a favour and return the pieces to them. By clearing the field well, you are helping the volunteers reset the field faster so matches may continue quicker.

## ★ 9.0 Chemical Safety

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### **9.1 Safety Data Sheets (SDS)**

- Obtain Safety Data Sheets (SDS) for the chemicals your team uses. These sheets provide information on the correct handling of a spill or injury.
- These data sheets can be found on chemical manufacturer websites or by calling the manufacturer. Almost every chemical used will have a safety data sheet online.
- You don't have to memorize the contents of each SDS, but it is good to be familiar with them and have them in an easy to reach place.
- If you are exposed to a chemical, notify the student safety captain and a Mentor immediately. Refer to the SDS if necessary.

### **9.2 Chemical Storage**

- Keep chemical containers in good condition and use the correct containers for each type of chemical. Do not store corrosive chemicals in metallic containers and store liquids in leak-proof containers.
- Make sure all chemical containers have labels placed by the manufacturer. These labels contain valuable information on the substance and their correct usage.
- Ensure all labels are legible. Replace any labels that are faded or damaged.
- Become familiar with the chemicals you may use as part of the FIRST Robotics Competition. Even something as simple as grease for motor gearboxes has proper usage instructions. Always read safety precautions and instructions for use located on the chemical's label.
- Store all chemicals in an orderly way. They should be organized in such a way that they can be easily identified and will not spill.

## ★ 10.0 Emergency Response

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### **10.1 Competition First Aid Table**

In the case of an injury that can not be treated quickly in the pits, always go find first aiders at the designated station. Familiarise yourself with the location of this station at the beginning of every competition.

### **10.2 Emergency Plans**

In case of an emergency, it is always important to have a plan of action to reduce the impact. Mentors, student leaders, and the student safety captain should work together to decide how to handle emergency situations. Some questions to ask while creating these plans are:

- Who should be informed in the event of an emergency?
- What will be the different roles of members helping mitigate an emergency?
- How can other teams assist during an emergency?

### **10.3 Emergency Contact Information**

It is recommended that every member of the team submit contact information of their legal parents, guardians, or someone who can be contacted in case they are injured. On FIRST Inspires' Team Management System, all members should have parent contact information. A Mentor should always have this on hand for quick access.

In addition to the FIRST Inspires information, it also a good idea to supplement this with data collected by the team. That way students can give more than one contact, just in case one does not respond. Additionally, this can be taken as an opportunity to collect other facts such as allergy information, and previous medical conditions.

### **10.4 Incident Documentation**

If a serious incident breaks out, it is important to document it for a few reasons. It will serve as a reminder of when things go wrong, it will serve as an official record of incidents, and it can be used to improve future safety programs to prevent similar incidents. [Appendix E](#) shows an example form that Team 7902 uses.

### **10.5 Team First Aid Kits**

A team first aid kit has many tiers depending on the cost and complexity of it. At the very least, an FRC team should stock a Basic kit. The size of the kit depends on the amount of people on the team.

### **10.5.1 Basic First Aid Kit**

- Fabric scissors
- Latex-free gloves
- Adhesive bandages
- Antiseptic towelette or antiseptic solution
- Sterile telfa pads
- Sterile gauze pads
- Tweezers
- Cotton swabs
- Absorbent pads (i.e. paper towel, napkins, tissues, etc.)
- Adhesive tape
- Cloth triangular bandages
- Crepe bandages
- Popsicle sticks
- Ziplock bags (to make ice packs)

### **10.5.2 Advanced First Aid Kit**

Everything in the [Basic First Aid Kit \(10.5.1\)](#) as well as:

- Paraffin gauze wrapping
- Metal or plastic splints
- Extra cloth triangular bandages
- Instant chemical cold packs
- ASA tablets

### **10.5.3 Luxury First Aid Kit**

Everything in the [Advanced First Aid Kit \(10.5.2\)](#) as well as:

- Thermometers
- Blood pressure cuff and stethoscope
- Moulded arm and leg splints
- Metal finger splints
- Pressure dressing
- Penlight
- Saline solution

## ★ 11.0 FIRST Aid

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Thus far, this manual has prepared you to prevent injuries, but the FIRST Safety Manual does not anticipate when things go wrong. For this reason, FRC 7902 introduced FIRST Aid. FIRST Aid is a trial emergency response program created by Team 7902 in the 2019 season. It is a curriculum of essential first aid skills which are relevant to injuries at a FIRST Robotics Competition.

FIRST Aid is in no way professional medical treatment, nor a long-term solution to serious medical issues. It does however, equip members of an FRC team with the skills they need to quickly treat an urgent medical situation in the pits or workshop, which should always be preceded by professional care.

### **11. 1 Bleeding and Cuts**

This section deals with open wounds that discharge blood. Below you can find out how to treat scrapes, minor cuts, heavy bleeding, and embedded objects.

#### **11.1.1 Minor Cuts, Abrasions, Avulsions**

For cuts with light or no bleeding and small size (i.e. 1-2 cm). The most common places for small cuts are on the hands, and the following treatment can be employed so that they will be back in action in no time:

##### Materials

- Cloth (i.e. tissue, paper towel, fabric)
- Antiseptic (i.e. wipes, ointment, etc.)
- Small bandages
  - Can also be adhesive bandage

##### Treatment

1. Use a cloth to wipe away any blood and apply moderate pressure for a few seconds.
2. Apply antiseptic to another cloth or use an antiseptic wipe on the wound. Press down (do not wipe) until the injured person feels some stinging.
3. Remove the antiseptic and apply an adhesive bandage, or wrap regular bandages tight enough to stop the bleeding, but not so tight as to cut off circulation.

##### Post-Treatment

- Continually monitor for persisting bleeding. If the bleeding does not stop after a few hours, seek medical attention immediately.
- Ensure that circulation is not inhibited. This can be identified by a numbness and blue colour in the part of the body after the wound. Loosen the bandages if this is seen.

### **11.1.2 Severe Bleeding and Cuts**

For large wounds which are gushing blood, it is critical that bleeding is stopped so that the casualty does not lose too much blood.

#### Materials

- Long bandages, cloths, or other clean material to wrap a wound

#### Treatment

1. Apply the two Ps, Position and Pressure
  - a. Position: lay the casualty in a safe position, ideally on the ground in case they become unresponsive and collapse.
  - b. Pressure: apply direct pressure to the wound to promote clotting by tightly wrapping in bandages. Do not remove bandages on your own as that will interrupt clotting.
2. Contact the first aid table for extra assistance. They will contact EMS if bleeding increases.
3. Apply more gauze and bandages if blood seeps out from under existing ones.



#### Post-Treatment

- Continually monitor for persisting bleeding. If the bleeding does not stop after a few hours, seek medical attention immediately.
- Ensure that circulation is not inhibited. This can be identified by a numbness and blue colour in the part of the body after the wound. Loosen the bandages if this is seen.
- Bandages should not be removed except by a trained medical professional.

### **11.1.3 Embedded Objects**

In the case where a large object penetrates the skin and causes bleeding, it is necessary to take special precautions. For small objects (i.e. splinters, thin needles, metal splinters, etc.) it is okay to remove them and treat the wound as a minor cut. However, if removal puts the casualty at risk of losing much more blood, follow the treatment below:

#### Materials

- Long bandages, cloths, or other clean material to wrap a wound
- Towels, thick bandages, or other clean material to build up around the object



### Treatment

1. Stabilise the object using one of the following methods:
  - a. Rolling a bandage into a 'donut' shape and wrapping it around the object. Keep stacking these until the object can not easily move.
  - b. Criss-crossing flat bandages until they are high enough to immobilise the object.
  - c. Placing folded bandages or fabric around the object to immobilise it.
2. Control bleeding as you would [heavy bleeding \(11.1.2\)](#)
3. Contact the first aid booth at competition, a Mentor, or EMS.

### Post-Treatment

- Continually monitor for persisting bleeding. If the bleeding does not stop after a few hours, seek medical attention immediately.
- Place the casualty in a position where the object will not be disturbed or jostled.
- Bandages should not be removed except by a trained medical professional.

## **11.2 Bruising, Fractures, and Sprains**

This section deals with damage done to the bones of a casualty and are commonly known as 'breaks'. These can easily be identified by large amounts of pain, an inability to move the broken part, swelling, and discolouration.

### **11.2.1 Bruises**

Bruises result from trauma to a part of the body which causes bleeding under the skin. This can be diagnosed by red or blue swelling and a feeling of pain.

#### Materials

- Ice pack (or chemical cold pack)

#### Treatment

1. Place the ice pack on the swollen body part for 10-15 minutes.
2. Wait 45 minutes and repeat until swelling reduces.

#### Post-Treatment

- Monitor bruised part over a few days to make sure that swelling does not return.

### **11.2.2 Finger Fractures**

Finger fractures are the most likely fracture at FIRST Robotics Competitions and will put the casualty out of operation for at least a few weeks. It is important to treat this injury quickly as to limit further damage. A damaged finger can be identified by pain, swelling, discolouration, and difficulty moving that digit.

### Materials

- Stiff finger-length object (i.e. popsicle stick, pencil, etc.) or a proper finger splint
- Medical tape
- Ice pack (or chemical cold pack)

### Treatment

1. Immobilise the finger using a stiff object wrapped in adhesive tape or a splint.
2. Place an ice pack on the broken finger, careful not to impact it. Hold the pack on the finger for 15 minutes, remove for 45 minutes, and repeat until swelling reduces.
3. Ask a casualty to place their hand over their head to elevate the finger and reduce blood pressure.
4. Contact the first aid table at competitions, a Mentor, or EMS, as with all fractures.



### Post-Treatment

- Ensure that the injured person is treated by a medical professional to ensure proper healing.
- Monitor for increased swelling. Contact EMS immediately if swelling increases rapidly.

### **11.2.3 Closed Fractures**

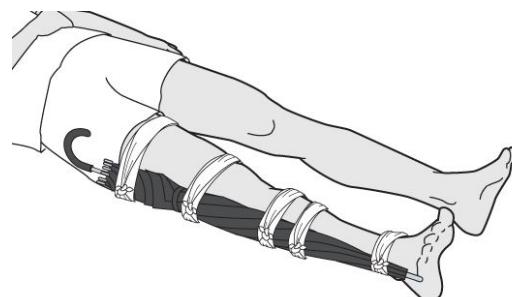
Closed fractures have to do with broken bones on arms, legs, wrists, ankles, elbows, or knees. In this case, bones stay within the body and are relatively simple to treat.

### Materials

- Stiff, long objects for splinting (i.e. aluminum tubing, wooden dowel, folded cardboard, etc.)
- Bandages
- Ice pack (or chemical cold pack)

### Treatment

1. Use the acronym **RICE** to treat a fracture. This stands for Rest, Immobilise, Cold, Elevate.
  - a. Rest: bring the broken part to a comfortable position where it will not be disturbed or move around too much.
  - b. Immobilise: limit the motion of the broken part depending on the injury.



If it is to a limb, splint the limb using a long stiff object and bandages. For broken joints, wrap them in a thick layer of bandages.

- c. Cold: use an ice pack to reduce swelling. Press the pack to the injury for 15 minutes, wait 45 minutes, and repeat until swelling significantly decreases.
  - d. Elevate: elevate the injured part to reduce blood pressure on it. This may involve propping it up on a stack of objects or asking the casualty to hold it above their head. Be very careful not to bring discomfort to the individual or further aggravate the injury.
2. Contact the first aid table at competitions, a Mentor, or EMS, as with all fractures.

#### Post-Treatment

- Ensure that the injured person is treated by a medical professional to ensure proper healing.
- Monitor for increased swelling. Contact EMS immediately if swelling increases rapidly.

#### **11.2.4 Open Fractures**

Open fractures are quite similar to [closed fractures \(11.2.3\)](#) except they are more serious in the sense that a bone is protruding.

#### Materials

- Stiff, long objects for splinting (i.e. aluminum tubing, wooden dowel, folded cardboard, etc.)
- Bandages
- Ice pack (or chemical cold pack)
- Towels, thick bandages, or other clean material to build up around the bone

#### Treatment

1. Rest the broken part in a comfortable position where it will not be disturbed or move around too much.
2. Limit the motion of the injured part as it was found. Do not attempt to move it.
3. Place a clean bandage or other material around the protruding bone to keep it stable. Be careful not to impact it.
4. Contact the first aid table at competitions, a Mentor, or EMS, as with all fractures.
5. Ice the wound for 15 minutes, wait 45 minutes, and repeat until swelling significantly decreases.

#### Post-Treatment

- Ensure that the injured person is treated by a medical professional to ensure proper healing.

- Monitor for increased swelling. Contact EMS immediately if swelling increases rapidly.

### **11.2.5 Dislocations**

A dislocation is a displacement of a bone from its joint. Usually fingers, toes, and shoulders will be dislocated. Pain, swelling, discolouration, and difficulty moving the dislocated joint all indicate this injury.

#### Materials

- Ice pack (or chemical cold pack)

#### Treatment

1. Rest the injured part in a comfortable position.
2. Ice the wound for 15 minutes, wait 45 minutes, and repeat until swelling significantly decreases.
3. Contact the first aid table at competitions, a Mentor, or EMS.

#### Post-Treatment

- Ensure that the injured person is treated by a medical professional to ensure proper healing.
- Monitor for increased swelling. Contact EMS immediately if swelling increases rapidly.

### **11.2.6 Spinal Injuries**

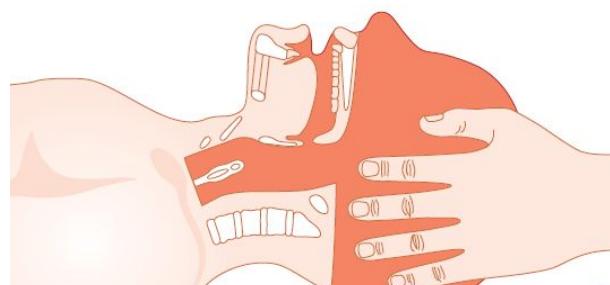
A spinal injury is when trauma impacts the upper neck and there is a risk of the spinal nerve being damaged. This can be diagnosed by a casualty's inability to move their body below their neck.

#### Materials

- None required, only a firm grip

#### Treatment

1. Move the casualty to a position where they can rest their head without moving too much. If they are standing, find a wall. If they are on the ground, ask them to lay their head down with their body flat.
2. Hold the casualty's head stable with your hands. Be very careful not to move the head.



3. Treat for bleeding if there is any on the site using the procedures outlined in [Severe Bleeding and Cuts \(11.1.2\)](#).
4. Contact the first aid table at competitions, a Mentor, or EMS.

#### Post-Treatment

- Ensure the casualty's head remains still.

## **11.3 Head Trauma and Shock**

This section deals with injuries to the head, both physically and mentally. Blows to the head can cause dizziness, pain, and anxiety, but so can mental stress. It is important to know how to react appropriately to prevent both of these ailments from escalating.

### **11.3.1 Head Injury Via Fall**

If a person were to trip and fall on their head, it is likely that their skull or brain would be injured. This is the most vital part of your body and treating it quickly is crucial to a quick recovery. Injury can easily be recognised by a casualty being dizzy, nauseous, confused, or by their head swelling or discolouring. Falls, unlike blunt force trauma, may cause a spinal injury, which adds another layer to treatment.

#### Materials:

- None

#### Treatment

1. Immobilise the head in the position it is found, as outlined in [Spinal Injuries \(11.2.6\)](#).
2. Assess breathing to the best of your ability.
3. Contact the first aid table at competitions, a Mentor, or EMS.
4. Treat the injured area accordingly for [bruising \(11.2.1\)](#) and [bleeding \(11.1\)](#).

#### Post-Treatment

- Assess breathing information (count for 30 seconds, multiply by 2 for one minute) and tell trained medical personnel.

### **11.3.2 Head Injury Via Blunt Force Trauma**

Injuries to the head can come from falling, but also by being impacted in the head by a dull object. This is slightly easier to treat than an injury from a fall, however, it is still necessary to treat it quickly to ensure limited damage and quick recovery.

#### Materials:

- Ice pack (or chemical cold pack)

### Treatment

1. Assess breathing to the best of your ability.
2. Contact the first aid table at competitions, a Mentor, or EMS.
3. Treat the injured area accordingly for [bruising \(11.2.1\)](#) and [bleeding \(11.1\)](#).
4. Ice the impacted area for 15 minutes, wait 45 minutes, and repeat until swelling significantly decreases.

### Post-Treatment

- Assess breathing information (count for 30 seconds, multiply by 2 for one minute) and tell trained medical personnel.

### **11.3.3 Stress and Shock**

Shock is the slowdown of the body's circulatory system. Shock takes its roots psychologically and is a result of a stressful situation. Shock should be treated directly after all physical medical problems are mitigated and before the casualty is handed over to trained medical professionals. EMS should be contacted before shock treatment begins. A person can be identified to be in shock if they have pale, cool, or clammy skin, weakness, fear, anxiety, disorientation, or irregular breathing. Someone with proper first aid training will know how to properly treat someone in shock, though for the purposes of FIRST Aid, the treatment below will suffice.

#### Materials:

- A blanket or other insulating cloth

#### Treatment:

1. Ask the casualty if they are cold. If they are, help them wrap a blanket around themselves.
2. Assess breathing to the best of your ability.
3. Help the casualty into a comfortable position. One of the most versatile positions is semi-prone, as shown in the image.  

4. Continually assure your casualty that everything will be alright. Slowly breathe and encourage them to match your breathing pattern.

#### Post-Treatment

- Assess breathing information (count for 30 seconds, multiply by 2 for one minute) and tell trained medical personnel.

#### **11.3.4 Tiredness, Dizziness, Headaches**

Robotics competitions are stressful events, and as a result, some participants may endure painful headaches and dizziness. Additionally, not all participants get enough sleep, and that combined with the long day may also cause such mental ailments.

##### Materials:

- None

##### Treatment:

1. Help the casualty into a comfortable position, such as sitting or lying down.
2. Figure out if the casualty needs to rest or can continue participating in the event. Consult Mentors, Safety Captain, parents, and other experienced people at the event. Send the casualty home if necessary.

##### Post-Treatment

- Encourage the casualty to rest and recover.

#### **11.3.5 Nosebleeds**

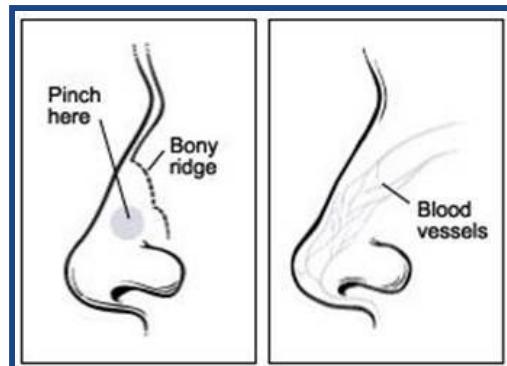
Nosebleeds result from damaged blood vessels in the nose. They often follow head trauma, but may also occur spontaneously or as a result of environmental conditions. A short bleed can be treated without professional medical attention, though an extended one may result in dangerously high amounts of blood loss and need proper care.

##### Materials:

- Cloth (i.e. tissue, paper towel, fabric)

##### Treatment:

1. Pinch the nose where soft flesh meets hard cartilage to help clotting.
2. Ask the casualty to tilt their head forward so that blood does not drain into the throat and choke them.
3. If the bleeding lasts more than 5 minutes, contact the first aid table at competitions, a Mentor, or EMS.

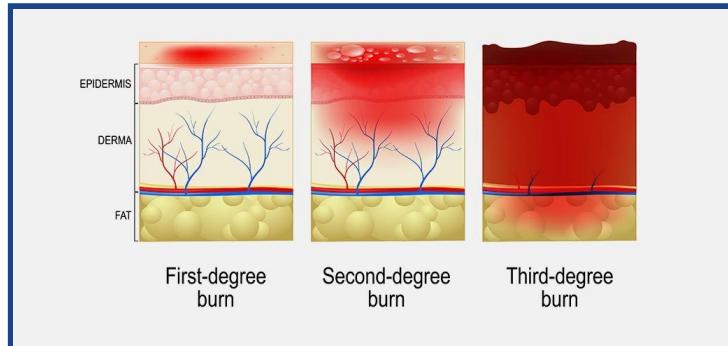


##### Post-Treatment

- Monitor for recurring bleeding. If nose bleeds frequently occur, contact the first aid table at competitions, a Mentor, or EMS.

## **11.4 Burns**

Burns are the erosion and damage to flesh by heat, electricity, or chemicals. They vary in severity from first-degree being the least severe to third-degree being the most severe.



### **11.4.1 First Degree**

The least severe kind of burn is first-degree, which only affects the surface of the skin. Nonetheless, they are quite painful and can be identified by seeing redness and swelling.

#### Materials:

- Cool, clean water (or chemical cold pack)

#### Treatment:

1. Flush the burned area with cool, clean water or apply a cold pack. **Never use ice on a burn.**
2. Continue flushing or cold pack application until casualty notes that the heat in the area has decreased.
3. If the burn is large or to the neck or face, contact the first aid table at competitions, a Mentor, or EMS.

#### Post-Treatment:

- Monitor for increased swelling or blisters. Contact the first aid table at competitions, a Mentor, or EMS if damage seems severe.

### **11.4.2 Second Degree**

The next most serious kind of burn is second-degree, which affects the surface of the skin and some layers beneath. A telltale sign of second-degree burns result in blisters in addition to redness, swelling, and pain.

#### Materials:

- Cool, clean water (or chemical cold pack)
- Dry, sterile bandages

#### Treatment:

1. Flush the burned area with cool, clean water or apply a cold pack. **Never use ice on a burn.**

2. Continue flushing or cold pack application until casualty notes that the heat in the area has decreased.
3. Apply a dry, sterile bandage around the burned area. Use multiple bandages to separate fingers and toes.
4. If the burn is large or to the neck or face, contact the first aid table at competitions, a Mentor, or EMS.

Post-Treatment:

- Monitor for increased swelling or blisters. Contact the first aid table at competitions, a Mentor, or EMS if damage seems severe.

**11.4.3 Third Degree**

The most serious kind of burn is third-degree, which goes all the way through the skin to reveal muscles, nerves, and sometimes bones. In addition to massive amounts of pain, there will be red, black, and grey tissue, exposed nerves, and possibly revealed bones.

Materials:

- Cool, clean water (or chemical cold pack)
- Dry, sterile bandages

Treatment:

1. Flush the burned area with cool, clean water or apply a cold pack. **Never use ice on a burn.**
2. Continue flushing or cold pack application until casualty notes that the heat in the area has decreased.
3. Apply a dry, sterile bandage around the burned area. Use multiple bandages to separate fingers and toes.
4. Contact the first aid table at competitions, a Mentor, or EMS immediately.

Post-Treatment:

- Monitor breathing.

**11.4.4 Electrical Burn Notes**

High current electricity may also cause burns. They can be treated as thermal burns, but first there are some precautions to take as to reduce the risk of injury for the rescuer:

- Make sure the current is off before touching the casualty.
- Stand in a dry area.
- Locate and be ready to treat wounds where current entered and exited the casualty's body.

## **11.5 Chemical Injuries**

In FIRST Robotics, multiple chemicals are used, many of which pose a hazard to human health. For all chemicals, refer to the safety data sheet for specific treatment, though if there is no SDS present, the steps in this section should apply to most chemicals.

### **11.5.1 Skin Contact**

Many chemicals will negatively react with skin causing burns, irritation, swelling, and/or redness. Each chemical will be different, but most can be treated using the steps below:

#### Materials:

- Cool, clean water

#### Treatment:

1. Flush the area with cool, clean water until all of the chemical appears to be washed off
2. Treat the injured area accordingly for [bruising \(11.2.1\)](#), [bleeding \(11.1\)](#), and [burns \(11.4\)](#).
3. Contact the first aid table at competitions, a Mentor, or EMS immediately.

#### Post-Treatment

- Monitor the affected area for abnormalities.
- If there was no SDS, ensure one is found and brought to the worksite as soon as possible.

## **11.5.2 Eye Contact**

Eyes are made of very sensitive tissue, and contact with chemicals will be more harmful for them than it would be for regular skin.

#### Materials:

- Cool, clean water

#### Treatment:

1. Flush eyes with cool, clean water for 15 minutes. Ensure to get under eyelids and remove all of the chemical residue.
2. Contact the first aid table at competitions, a Mentor, or EMS immediately.

#### Post-Treatment

- Monitor the affected eyes for abnormalities.
- If there was no SDS, ensure one is found and brought to the worksite as soon as possible.

### **11.5.3 Inhalation**

Many chemicals will release harmful vapours when exposed to open air. These can be very dangerous, impede breathing function, and even affect the brain.

#### Materials:

- None

#### Treatment:

1. Move the casualty to an open area, outside if possible.
2. Have the casualty deeply exhale and inhale multiple times.
3. Contact the first aid table at competitions, a Mentor, or EMS immediately.

#### Post-Treatment

- Monitor the affected person for abnormalities.
- If there was no SDS, ensure one is found and brought to the worksite as soon as possible.

## **11.6 Extra FIRST Aid Notes**

In addition to the procedures above, there are a few overarching rules for any treatment to ensure efficient treatment and reduced chance of further injury:

- When possible, send another person to seek medical attention as you are helping the injured person.
- If the injury is too complex, let it be and seek medical attention immediately.
- Never leave an injured person alone unless staying will endanger your own safety.
- Your safety comes before the safety of the casualty. If helping the casualty will harm you, do not treat them. Seek medical attention immediately and stay by the casualty's side or have someone else watch over them.
- Do not panic. If you are panicking, leave treatment of an injured person to someone else.
- Always hand the leadership of treatment over to the person with the highest level of first aid experience who is present. Make sure they are willing to help.

## ☆ Appendix A: Safety Checklist

### FRC 7902 Pit Safety Checklist 2018 - 2019

#### Human Safety

- Does everyone have eye protection?
- Is everyone wearing closed-toe shoes?
- Is there access to hand protection?
- Is there access to hearing protection?
- Is everyone wearing appropriate clothing?
- Is all loose clothing secured down?
- Is all long hair tied back?
- Have dangling accessories been removed?
- Is all PPE available for FIRST Robotics Competition participants and visitors?
- Are PPE properly maintained and stored?
- Is everyone aware of all possible hazards?
- Are there 5 or fewer people in the pit?

#### Tools and Chemicals

- Are tools stored away safely and organized?
- Are powered tools in good condition with no evidence of damage?
- Are chemical containers properly labelled and in good condition with no sign of damage?
- Are the batteries visibly ok, terminals not bent, and no cracks in case?
- Is the battery charger situated so there is air circulating around it?

#### Pit Environment

- Is the pit neat and tidy?
- Is the pit clear of tripping hazards?
- Is the aisle around the pit clear?
- Does the area conform to the 10' height restriction? This includes banners, signs, and all construction.
- Are the battery spill kit, fire extinguisher, and first aid kit easily accessible?
- Are SDSs posted/readily available and team members aware?
- Does the team ensure no one is working on the robot while it is enabled?
- Is power distribution safe? (No daisy chaining)
- Are cords and plugs free of broken insulation, exposed wiring, and provided with grounded connections, or double insulated?

#### Safety Initiative

- Are surrounding teams' pits safe and members aware of possible hazards?
- Is safety equipment (i.e. spill kit, first aid kit, etc.) available at the front of the pit for other teams to access?

#### Points of Improvement

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Event: \_\_\_\_\_  
Date: \_\_\_\_\_ Time: \_\_\_\_\_  
Safety Captain: \_\_\_\_\_

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## ★ Appendix B: Technician Checklist

### **FRC 7902 Technician Safety Checklist 2018 - 2019**

\*To be completed by the technician before and after each match

#### **Pre-Match**

- Is the entire drive team present?
- Is everyone wearing adequate personal protective equipment (i.e. glasses, gloves, etc.)?
- Is the robot in starting position inside the frame perimeter and under 4' tall?
- Are the bumpers securely fastened at all sides?
- Is the robot signal light functional?
- Are there enough people to safely lift the robot?
- Is the robot battery securely fastened, adequately charged and damage-free?
- Are there any loose, broken, disconnected or hanging wires?

Event: \_\_\_\_\_ Match Number: \_\_\_\_\_  
Date: \_\_\_\_\_ Time: \_\_\_\_\_

#### **Post-Match**

- Are all moving parts at their lowest point of potential energy?
- Are all game pieces removed from the robot?
- Are all tools safely stored away and accounted for?
- Is the field completely clear of loose robot parts?
- Has the main circuit breaker on the robot been opened to relieve all stored energy?
- Does the robot require any repairs?

Required Repairs: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Technician: \_\_\_\_\_



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## ★ Appendix C: Acronym Posters

A.L.O.F.T. - Robot Lifting Safety		C.H.E.C.K. - Pit Safety	
<b>Alert</b> Everyone is aware the robot is being moved	<b>Clothing</b> Sleeved shirt and long pants, free of loose parts	<b>Hair</b> Long hair and loose clothing is tied back	<b>Eye Protection</b> Protective eyewear is worn at all times
<b>Legs</b> Everyone is using their legs to lift, no lifting with backs	<b>Closed Toes</b> Closed-toe shoes are worn at all times	<b>Target</b> Everyone knows where the robot is going prior to lifting	<b>Key Objectives</b> Key objectives in mind: the safety of participants, volunteers, and spectators
<b>Off</b> The robots is completely powered off before making any attempt to lift			
<b>Four People</b> Two people to carry, one to spot, one to control the cart			

B.A.S.I.C. - Battery Spill Safety	
<b>Baking Soda</b> Neutralize all leaking acid with sodium bicarbonate (baking soda, NaHCO <sub>3</sub> )	<b>Acid Resistance</b> Use thick rubber or plastic gloves when dealing with a leaking battery
<b>SDS</b> Consult the safety data sheets for information on how to clean up and dispose of the battery	<b>Inform Safety Heads</b> When a spill occurs, a mentor, the student safety captain, a safety advisor, and the safety table should be notified immediately
<b>Container</b> Use a non-metallic and leak-proof container to store the leaking battery	

## **★ Appendix D: Safety Captains' Meeting**

At the beginning of every competition, there will be a meeting with all of the teams' Safety Captains and the UL Safety Advisors. They will go over the this season's initiatives and goals. It is also a good time to network with other Safety Captains, discuss safety innovations, and exchange useful ideas.

## ★ Appendix E: Accident Reporting Form

FRC 7902: Markham FireBirds  
2018-2019



### Accident Report

*\*Only fill out this form after the incident has been resolved and the casualty is not in immediate danger or at risk of further injury.*

Time: \_\_\_\_\_ Date: \_\_\_\_\_ Location: \_\_\_\_\_

Person(s) injured: \_\_\_\_\_

Witnesses: \_\_\_\_\_

Describe the injury and body parts affected:

Events leading to injury (History):

Mechanism of injury (What physically caused the injury?):

First aid administered and by whom:

What could have been done to prevent injury? (Steps for improvement)

I verify the information above to be completely true:

Mentor Signature: \_\_\_\_\_

Student Safety Captain Signature: \_\_\_\_\_

## ★ Sources

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