



2020 Safety Manual

Boba Bots 253



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General Safety Guidelines

General Goal of Safety

Safety is always first. This manual's purpose is to prevent robotics and machinery related injuries, illnesses, or emergencies. By following the guidelines set in this safety manual, you can help keep yourself and the people around you safe.

General Safety Rules

1. Always put your own and others' safety first during meetings, when working on the robot, and during competitions
2. Mills High School Code of Conduct and safety rules apply to all students in the Makerspace
3. During competitions, always wear safety glasses in the pit
4. In the Makerspace Construction area (behind the tape), always wear safety glasses
5. No vehicles in the Makerspace
6. Keep food and drink in the regulated Food Table
7. Horseplay is prohibited in the Makerspace

All members of Team 253 are required to:

1. Understand and follow safety manual rules and directions
2. Ask a member of the safety team, or any robotics managers if assistance is needed

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE)

All members of the Mills Robotics Team (mentors, leads, general members, etc.) are responsible for making sure that they and all other members are wearing proper protective equipment.

Proper PPE Includes:

Suitable Clothing:

- When working or observing within fifty feet of a machine or inside the Makerspace, pants must be worn at all times
- When inside the Makerspace, closed-toed shoes must also be worn at all times
- Open-toed shoes, such as sandals, flip-flops, slippers, or high-heels are not allowed
- Loose, baggy clothing, hooded sweatshirts, and other clothing with dangling strings are not permitted within ten feet of a machine or robot. However, this can be circumvented by making sure they are not dangling (Ex: tucking in the dangling strings of a hooded sweatshirt inside of the sweatshirt)
- When working or observing within ten feet of a machine, wearing jewelry is not recommended as they can be caught inside the machine, potentially harming the wearer and others around them

Hearing Protection:

When operating any loud equipment (CNC Machines, circular saw, etc.), earmuffs, earplugs, or other hearing protection are highly recommended

Personal Protective Equipment (PPE)

Eye Protection:

- Safety Glasses with proper side shields are required at all times when in the Construction department's workspace (behind the yellow and black tape) and in the pit at competitions
- Safety Glasses are also required within ten feet of any soldering, wire cutting, or work involving power and electricity (including any work on the robot)

Hand Protection:

- Plastic or rubber gloves are required when handling solvents, acids, or any other potentially dangerous chemicals
- Latex gloves (not plastic or rubber) are required when administering first aid to an injured person

Hair Protection:

- If you have hair that goes down to your shoulders or below, you should tie it back in order to avoid having it caught in equipment or getting in the way of your work

Respiratory Protection:

- When operating machines such as the band saw or belt sander, it is important to wear proper respiratory protection, as they produce small particles that can be inhaled
- It is especially important to remember to wear them when working on wood or plastic/acrylic; these materials produce the most dust and fumes

Safe Behaviors and Procedures

Safe Behaviors and Practices

A key aspect of safety in the workspace is developing good habits and practices. Doing so can help dramatically reduce the likelihood of an accident, and subsequently, an injury.

Establishing safe habits also helps with the growth of a good safety culture.

Robot Operation:

- Safety rules for robot operation encompass all aspects when dealing with the robot, whether it be handling it for transportation, testing its functions, or driving it.
- When lifting the robot, remember to lift with the legs, not with the back
 - Keep your back straight and vertical when lifting. The robot is very heavy
- Always have somebody else help you when lifting the robot. Never lift it by yourself
- Lift the robot by the frame, never the bumpers. Doing so not only damages the bumpers, but also increases the chance of the attachments failing, causing the robot to fall
- When turning the robot on to test functions, be sure to inform all teammates around you, as well as ensuring that all hands are off the robot
- If testing the drivetrain and other mobility function of the robot, make sure that it is rested on blocks with the wheels raised from the work surface
- Ensure that any sharp edges or corners are filed down to prevent injury when interacting/working on the robot
- When driving the robot, make sure that the space around the robot is clear and that everyone knows it is on
 - Only qualified members or members who receive permission to may drive the robot

Programming Safety

Programming Safety Rules

These rules encompass the hazards that occur in the programming department, such as running or testing the robots code. Rules are not limited to these, as different circumstances arise.

General Safety:

- Make sure people are aware that the robot is running before conducting tests in order to avoid accidents. For example, yell “ROBOT ON” when turning on the robot
- Do not run the robot at full speed on the ground
- Do not enable the robot while people’s hands are inside
- Make sure teammates are aware before actuating any mechanisms
- Use caution when handling fragile components to avoid anything breaking. (ie. the Jetson)
- Ground yourself when using components that are sensitive to static shock
- Stay aware of your surroundings and others around you when working
- When testing the robot’s autonomous code, always keep hand over the Emergency Stop to prevent injury in case the robot runs farther than expected

Organization:

- At the end of every meeting, shut down laptops and plug them in
- Keep wires and cables organized to eliminate any tripping hazards

Sanitization:

- Consuming food or drink near computers is prohibited. If needed, eat at the designated Food Table

Electrical Safety

Electronics Safety Rules

These rules encompass the hazards that occur in the electronics department, whether it be with electricity, while handling the robot, or when using electronics tools. Rules are not limited to these, as different circumstances arise.

General Safety:

- Be careful when taking components off the board, be mindful that adhesive is sticky
- Keep liquids and food away from any electronic devices, if needed, eat at the designated Food Table. Wash your hands when complete
- Wear shoes with rubber soles to prevent electricity from flowing through you into the ground
- Never work alone when working with electricity
- Turn off power before working on electronic circuits, except for energized testing
- Replace defective cords and plugs
- Inspect cables for defects such as frayed wiring, loose connections, or cracked insulation and replace them
- Remove metal jewelry, watches, rings, etc. before working on electrical circuits
- Work with just one hand when possible, keep the second hand away from anything that conducts electricity
- Never install a fuse of higher amperage than specifically listed for your circuit
- Make sure equipment chassis or cabinets are grounded
- Discharge capacitors in equipment before working on the circuits
- Do not attempt to solder electronic devices that are still connected to a power source

Electrical Safety

Organization:

- Put things back where you found them (usually in the toolbox or shelves)
- Label cords/wires and components

Sanitization:

- Wash hands before working with electronic devices

Cables, Wires, Extension Cords, etc.

- Do not touch exposed metal pieces, including wiring, when robot is turned on
- Make sure all cords are unplugged before touching the soldering iron and hot glue gun
- Unplug any tools when finished
- Exposed cables should be covered with electrical tape to prevent brownouts

Electrical Safety

Battery Safety:

- Batteries contain dangerous chemicals and must be handled properly in order to avoid spilling
- Never pull/pick up the battery by the wires. Always hold the battery by the body
- Batteries are very heavy. Use both hands when carrying them
- Never throw the battery when giving it to another person. Always carefully hand the battery to them, or set it down on a surface and let them pick it up
- Inspect the batteries on occasion to check for any damage to the battery itself, or any loose connections at the battery posts or connector
- If the battery is visibly damaged in any way, tell a lead, safety captain, or mentor
 - Never use a battery that is damaged

Construction Safety

Construction Safety Rules

These rules encompass the hazards that occur in the construction department, ranging from using the correct tool for the job to how to use tools correctly and safely. Rules are not limited to these, as different circumstances arise.

General Safety:

- Always wear safety goggles in the construction area (the area behind the yellow and black tape) or when handling power tools
- Be mindful of your surroundings, as debris from drilling/sawing may fly around and harm others
- Do not throw any tools or materials
- Unplug all power tools when not in use
- Do not point any power tools at anyone
- Clamp everything down properly before drilling or cutting
- Use the correct tool for the task at hand
- Remember to follow PPE rules (see above)

Construction Safety

Organization:

- Return all tools and bits to the power tool station
- Have a clean workspace by the end of the meeting
 - This includes returning tools to their designated storage areas and vacuuming any debris that may have been created during the meeting
- Throw away any unneeded boxes or packaging

Sanitation:

- Sweep debris off tables and ground after you finish working
- Vacuum the bandsaw and drill press as well as their surrounding areas after use
- No eating, especially in work areas, if needed, eat at designated Food Table

Guidelines for Equipment:



Jigsaw:

- Used to quickly cut out pieces by hand that don't require much detail or cannot fit in the band saw
- Always hold with two hands
- Clamp down the object that your are cutting, either with the quick-clamps or a C-clamp
- Never turn on the jigsaw while the blade is in contact with your object; let the blade move for a second before cutting
- Keep your fingers clear of the blade
- Unplug it if not in use



Portable Band Saw:

- Used for cutting straight lines in a short piece of metal or wood (e.g., pipe, 2x4)
- Always hold with two hands when in use
- Clamp down the object that you are cutting
- Keep fingers clear of the blade when the saw is turned on



Drill Press:

- Used to accurately drill holes into metal or wood
- Always clamp down the object you are drilling into
- Do not wear gloves while using the press, as it can get caught on the drill bit and cause injury
- Make sure that the drill bit is tightened and secure before turning the machine on

Guidelines for Equipment:



Belt Sander:

- Used to smooth out rough surfaces
- Hold it with two hands when in use
- Always clamp down the object you are sanding
- Do not use it on metal
- Wear earplugs or earmuffs
- Let the belt reach top speed before making contact with the object you are sanding
- Wear a facemask in order to avoid breathing in sawdust
- Empty out the sander after each use
- Never touch the sanding belt while the sander is powered on



Circular Saw:

- Used to cut pieces of metal or wood, better for straight lines
- Always clamp down the object you are cutting
- Hold it with two hands when in use
- Wear earplugs or earmuffs when using; the saw is very loud
- Let the saw run for a few seconds before cutting

Guidelines for Equipment:



Band Saw:

- Used to cut both straight lines or rough curves in pieces of metal or wood
- Wait until the blade reaches full speed before you begin cutting your object
- Do not wear gloves while using the bandsaw
- Clean out the bandsaw with a vacuum after you're done using it; the accumulation of sawdust can cause a fire
- Always check to make sure that the right type of blade is being used when cutting metal or wood
- Unplug the bandsaw from the wall outlet when not in use
- Never turn the bandsaw on when the gates are open



Portable Hand Drill:

- Used to drill holes into wood or metal
- If drilling a large hole, start with smaller bit sizes and slowly work your way up
- If drilling into metal, make sure to use a punch on the spot you want to drill
- Always hold the drill with two hands when in use
- When not drilling, be sure that the safety is on
- Make sure that the drill bit is secure before drilling
- Always wear safety glasses

Guidelines for Equipment:



Dremel:

- Used to grind off edges on rough pieces of metal
- Be wary of kickback when using the dremel, and position yourself away from the direction of kickback
- Always wear safety goggles when using
- Anyone within a 5 foot radius must also be wearing safety goggles
- Never hold the object that you are working on and the dremel at the same time
- Always clamp the object that you are working on onto a secure surface



CNC Router:

- Used to precisely cut metal or wood. Can also be used to mill out parts
- Make sure to check oil and pressure gauges before use
- Never put any body parts inside the router when it is turned on
- Never turn off the CNC without parking it first
- Never use it without informing a mentor or administrator

Guidelines for Equipment:

Soldering Iron:

- Used to connect small metal wire together to create a circuit
- Never touch the metal tip when it is on
- Always clamp down the two wires you are soldering
- When not using the soldering iron, it should be placed in the metal rack
- Always dab the iron on the sponge when not in use



Heat Gun:

- Used to shrink heat shrink around wires to ensure that they don't disconnect
- The silver metal nozzle at the front of the heat gun can get extremely hot. Never touch it
- The air that the heat gun produces is also extremely hot. This isn't just like a blow dryer
- Dont point it at people ya dumb dumb



Operations Safety

Operations Safety

These rules encompass the hazards that occur in the Operations department, put in place to assist the assembly and ensure safety in the use of various visual displays that promote FIRST and our team.

Display Safety:

Indoor:

- The display should not block emergency exits or hinder evacuation
- Ensure that the display can support its own weight and stand without falling over or collapsing
- Always securely anchor the display to the wall or floor when given the opportunity
- Shelves and tables should lack sharp edges or corners, and should only carry the amount of weight they are rated for
- Organize all electrical cords in a manner that ensures that they aren't tripping hazards, cannot be accidentally snagged, and are out of the reach of children
- Ensure that all flammables and combustibles are not in contact or in close range of hot devices
- The display should follow all power and battery rules

Operations Safety

Outdoor:

Outdoor displays should follow all the same rules as indoor displays

Keep all objects (poles, banners, flags, robots, etc) a reasonable distance away from power lines

Weigh down all objects in a manner that would prevent them from falling in the wind

Pit Safety:

The Pit area at competitions is a 10 ft x 10 ft area that FIRST provides for a team to assemble and fix their robot before and after matches. In order to optimize the space given while maximizing efficiency, comfort, and safety, certain rules must be put in place.

A pit should also present a welcoming and positive atmosphere in an effort to eliminate as many stressful and possibly harmful conditions as possible.

A proper pit should include (but not limited to):

- First Aid Kit
- Battery Spill Kit
- Safety Captain or Pit Manager
- Organized toolboxes
- Separation of department equipment
- Fire Extinguisher
- Set-aside area for robot to stay while being worked on
- Inviting marketing display

Emergency Safety Protocol

Emergency Safety Protocols

The following precautions are put in place so that maximum safety is ensured in the case of an emergency. This also includes emergency response, please note that if you are not qualified or prepared to assist in an emergency situation, please do not put yourself or the victim in danger by attempting to do so.

Battery Spills:

- Robot batteries contain Sulfuric Acid, or H_2SO_4
 - Do NOT touch battery acid. It is extremely dangerous, and can cause severe burns when in contact with skin
- Report the spill to a Mentor, Lead, or Safety Captain
- Follow the emergency procedures listed in the MSDS sheet for Sulfuric Acid
- If you are cleaning up the spill, you must be wearing rubber gloves and educated in handling dangerous materials
- Place the battery in a leak-proof container
- Neutralize the acid with baking soda
- Safely dispose of the battery acid
- If any chemicals comes in contact with any skin, quickly wash it off with water and immediately seek medical attention

Emergency Safety Protocol

Earthquakes:

- If outside, do not go back indoors, and stay away from trees, streetlamps, and other tall structures
- If indoors, take cover by hiding underneath the nearest sturdy table or any other object that can protect you from falling debris. (e.g. one of the lab/work tables)
 - Stop, Cover, and Hold On
- Stay inside and under cover until the earthquake stops. It is extremely dangerous to try and run outside during an earthquake
- Electricity may shut down or fire sprinklers may go off during an earthquake
- After the earthquake stops, be sure to frequently check in on warnings via radio or news
- Be wary, aftershocks may still continue after the initial quake

Fires:

During the event of a fire, always follow R.A.C.E. fire procedures in order to keep yourself and those around you safe.

- Rescue/Remove:
 - Rescue or remove any persons from the immediate scene
- Alert/Activate:
 - Pull the nearest alarm and call 911, then the following numbers
- Confine:
 - Close all doors to the hazard or fire area
- Extinguish/Evacuate:
 - Extinguish using the closest fire extinguisher if the fire impedes your evacuation. Evacuate to your designated meeting location.

Injury Protocol

Injury Protocol

Minor:

- Consult a safety captain, lead, or mentor in case of minor scrapes, burns or injuries
- Keep calm in case of any injuries, increased heart rate creates chance of further injury
- Take action, if bystanders crowd the area of injury, encourage them to make room for any safety captain, lead or mentor to attend to those injured, and prevent panic

Major:

- Consult a safety captain, lead, or mentor in case of injury
- Call 911 immediately in any life threatening emergency/injury
- Notify a First Aid/CPR certified person
- Take action, if bystanders crowd the area of injury, encourage them to make room for any safety captain, lead or mentor to attend to those injured, and prevent panic

Injury Protocol

CPR (from the American Heart Association):

“For healthcare providers and those trained: conventional CPR using chest compressions and mouth-to-mouth breathing at a ratio of 30:2 compressions-to-breaths. In adult victims of cardiac arrest, it is reasonable for rescuers to perform chest compressions at a rate of 100 to 120/min and to a depth of at least 2 inches (5 cm) for an average adult, while avoiding excessive chest compression depths (greater than 2.4 inches [6 cm]).”

“For the general public or bystanders who witness an adult suddenly collapse: compression-only CPR, or Hands-Only CPR. Hands-Only CPR is CPR without mouth-to-mouth breaths. It is recommended for use by people who see a teen or adult suddenly collapse in an out-of-hospital setting (such as at home, at work, or in a park).”

2 steps to Hands-Only CPR:

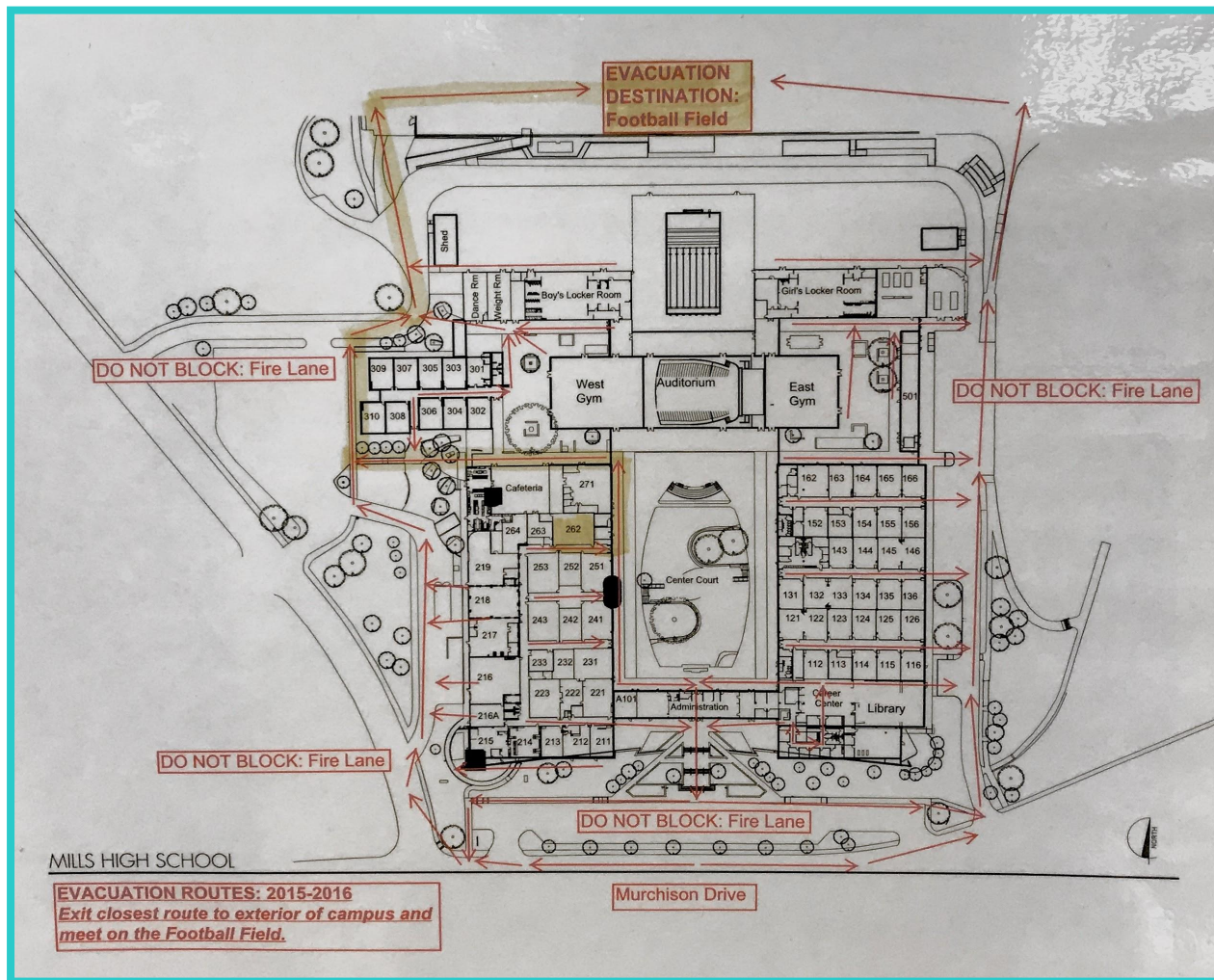
1. Call 9-1-1 (or send someone to do that)
2. Push hard and fast in the center of the chest

Remember:

1. Minimize interruptions in chest compressions
2. Provide compressions of adequate rate and depth
3. Avoid leaning on the victim between compressions
4. Ensure proper hand placement
5. Avoid excessive ventilation

Safety Documents

Evacuation Map:



Safety Documents

Safety Checklist:

No.	ITEM	Y	N	N/A	LOCATION/NOTES
A	<u>HAND & PORTABLE TOOLS</u>				
1	Are powered tools in good condition with no evidence of damage?				
2	Are tools properly stored when not in use?				
3	Are guards and safety devices in place and operational?				
B	<u>CHEMICALS</u>				
1	Are chemical containers properly labeled and in good condition with no sign of damage?				
2	Are SDSs posted/readily available and team members aware?				
C	<u>ELECTRICAL</u>				
1	Are cords and plugs free of broken insulation, exposed wiring, and provided with grounded connections, or double insulated?				
2	Are electrical outlets overloaded? (1 power strip used per outlet)				
3	Is the battery charger situated so there is air circulating around it?				

Serious Injury Report Form

Name: _____ Date: _____ Time: _____

Address: _____ City: _____ State: _____ Zip: _____

Phone: _____ Age: _____ Location of incident: _____

Identified Injury: _____

Medications: _____

Other illnesses or allergies: _____

Treatment given: _____

Recommendations: _____

Go to hospital: YES NO

Go see a doctor: YES NO

Released to: Self Team Mentor Parent Doctor
Ambulance

Time released: _____

Name(s) of person(s) providing first aid: _____

Signature of person giving aid: _____

Signature of adult (if the person giving aid is under 18): _____