FIRST ROBOTICS COMPETITION

BOB 319

Safety Manual

Prospect Mountain High School

Alton, NH

(revised 2/2023)

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SECTION 1: SAFETY AND FRC

Instilling a culture of safety is a value that every facet of the *FIRST* community must embrace as it pursues its mission and vision. We encourage the whole *FIRST* Robotics Competition (FRC) to adopt safety as a core value and establish the right framework for safety leadership in all aspects of our endeavors. *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, mentor, their communities, and their present and future workplaces. *FIRST* recognizes the teams who "get it," those who demonstrate safety throughout their program and are truly committed to developing and nurturing a safety culture.

Purpose

This safety manual is an easy to use guide to important safety information and has been compiled to provide FRC participants with a basic set of requirements to maintain a safe environment at the home based work environment and at competition events.

Scope

This manual applies to anyone involved with the *FIRST* Robotics Competition including all student team members, mentors, and support personnel.

Responsibilities

Everyone is responsible for safety during team meetings and the design and build, travel, and event phases of the competition. Please read below for some specifics.

Participants

As an FRC participant, you are expected to:

- Be familiar with this manual as well as the safety-related requirements applicable to their work area.
- Be familiar with any site restrictions listed in the "site info" listed on the web regarding your event(s).
- Work in a safe and responsible manner.
- Understand and follow established safety requirements.
- Use personal protective equipment (PPE), safe guards, and other safety equipment when needed or as required.
- Identify and report any unsafe or hazardous conditions to the student safety captain including work practices that may cause an accident.

Student Safety Captain

- Coordinate, deliver, and track training for the team.
- Provide support for any safety questions or concerns that may arise. Seek guidance, as appropriate, from your team mentors.
- Conduct safety inspections of the general work site, especially near the robot construction area. This also applies to the pit station during competition events.
- Encourage their team to display positive safety behaviors at all times.
- Know where to find, and become familiar with the MSDS contents.

Mentor

- Provide guidance on the safe working requirements associated with the various tasks and tools involved with constructing a robot.
- Offer safety design considerations to the team so the robot itself is designed to eliminate or minimize hazards to an acceptable level.
- Familiarize yourself with relevant event safety and restrictions by reading the web-posted "At the Events" section of the FRC manual and "site info" for your event(s), go over it with the team, and work with the safety captain to monitor safety behaviors.
- Coach the student safety captain to ensure that they understand and adequately fulfill the position's responsibilities.
- Collect MSD sheets for any chemicals the team uses. Inform the safety captain of their whereabouts.

Injury Reporting Requirement

Regardless of severity, report all accidents, injuries, and near misses to your team's mentor and your team's safety captain. Even injuries that you determine as minor may become serious if proper medical attention is not rendered in a timely manner. Remember, each minor event is usually a precursor to a major event.

When at *FIRST* events, report any injuries to the pit administration supervisor. They will document the injury or illness on an incident report sheet.

Safety Inspections

The safety captain should inspect the work areas on a routine basis. Determine and document the frequency of inspections by the potential risk of the work. Where applicable, develop and close out corrective actions for identified deficiencies in a timely manner.

SECTION 2: PERSONAL PROTECTIVE EQUIPMENT (PPE)

The proper use of personal protective equipment (PPE) is an important element to help ensure FRC Participants are protected from hazards in the work area. The following describes the common PPE that you are required to wear as part of constructing a robot. Eye and Face Protection Eye and face protection is required when there is a risk of exposure to the following:

- Flying particles
- Chemical exposure such as splashes, splatters, and sprays
- Wear ANSI-approved eye protection in the following areas:
    - ❏ Your team's "at home" workstations when doing any work on the robot, grinding,
    - ❏ Drilling, soldering, cutting, welding, etc.
    - ❏ In the pit and of course within the team pit stations
    - ❏ Playing field
    - ❏ Any area posted with signs requiring the use of eye protection

There are several forms of eye/face protection available to provide protection from these hazards, including safety glasses with side shields, goggles, and face shields. Inspect equipment for damage each time it is worn. If you wear prescription glasses, and they are not approved safety glasses, you must wear approved safety goggles over them to achieve adequate protection.

Hand Protection

Hand protection is designed to protect against heat, electrical, chemical, and mechanical hazards. Use the proper gloves for the task you're accomplishing.

Gloves:

- FRC participants should work with their team mentors to ensure the selected gloves are the correct ones to use for the project at hand. For example, chemical-resistant gloves afford a measure of chemical protection when handling chemicals.
- Check your gloves for proper size, absence of tears and rips, and good grip before you wear them.

Mechanical Guards:

- Never use any equipment without safety guards in place.
- Notify your safety captain and mentors of any broken or defective equipment and take it out of service until repairs are made.

Hearing Protection

Hearing protection should be worn at all times when operating machinery.

Foot Protection

When engaged in *FIRST* activities, all FRC participants must wear shoes that completely cover the entire foot. Shoes must be closed-toed.. Flip-Flops, Sandals, Mules, Crocs, etc. are not acceptable shoes when working on or near the robot or while attending *FIRST* competitions.

In some cases, steel or composite toed boots are appropriate for areas where heavy objects can fall and strike your foot. Notify your team mentors if you encounter such situations and determine the safest way to perform the task.

Other Preventives

Ensure that team members or mentors are not wearing ties, loose clothing, jewelry, or hanging key chains when near or working on moving or rotating machinery. Tie hair back or cover it.

SECTION 3: SAFETY REQUIREMENTS

The following are some areas, practices, and functions for which teams will be inspected/monitored for safety conformity and innovation. This list is not all-inclusive, and the safety advisors will constantly watch for any positive and negative safety practices or breaches. Horseplay is not permitted at any time.

General Safety

- Follow safe work practices, safe use of all tools, and maintain a healthy attitude regarding safety.
- Always walk and work in a controlled and thoughtful manner.
- Take special care when working at higher than normal height.
- PPE use: Wear ANSI-approved non shaded safety glasses, closed toed shoes, gloves where needed, and use hearing protection if necessary.
- Keep full control of the robot at all times with no one in the robot's path at any point.
- Assist other teams with safety issues. Display Gracious Professionalism and act with good behavior at all times.
- Always fully open a ladder and never stand on the top step.
- Be aware of your location, name or address in case of an emergency.

Competition Safety

- Use the buddy system when traveling and while at the event.
- Travel safely and carefully between the pit and the playing field.
- Demonstrate safe behaviors in the heat of competition.
- Exhibit a planned, safe lifting procedure of the robot, including cart removal after the lift.
- Make sure the robot is properly secured if you must work underneath it or if the robot is on an unstable surface.
- Assist other teams when requested.
- Read the team handbook for additional information

Pit Station Safety

- Control access to your Pit area; visitors are required to comply with PPE rules.
- Keep your aisle clear for pedestrians and robot transit.
- When transporting your robot, politely keep pedestrians alert to your movement.
- Adhere to the specifics in the FRC Manual, “At the Events” section
    - Teams cannot build any structure to support people or items for storage above the work area in their team pit station.
    - No team station structures, signs, banners, or displays can be higher than 10

feet above the floor.
    - Securely mount team pit station signs, banners, and displays to the structure.
- Be aware of your neighbors. Alert them if there is a hazard in your station or near theirs.
- Maintain a clean, neat, and orderly pit at all times. Remember, there are inspections after teams leave so be sure to include:
    - The floor in and around your pit
    - Proper tool storage
    - Proper care of batteries and battery chargers
    - Tidy storage of personal belongings and equipment

SECTION 4: HAND TOOL SAFETY

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 or implement used to accomplish a task. This includes all sorts of things used to grasp, lift, push, pull, carry, or clean. Always use the proper tool for the job.

Example: DO NOT use a wrench for a hammer or a screwdriver as a chisel.

Tool Rules

- Before using any tool, check to see if it is in good condition. Don't use defective, dull, or broken tools. Don't put them back on the shelf; remove them from service and notify the Safety captain and mentor so they can be replaced or sent for repair.
- When using a screwdriver or other tools, place the work on the bench or hard surface rather than the palm of your hand.
- When using knives/blades, direct your cutting strokes away from your hand and body.
- When in an environment with other team members or mentors be constantly aware when they or yourself are handling tools of any kind, especially blades or tools with fast moving parts.

Tool Storage

- Store sharp edged or pointed tools in a safe place. When carrying, cover the point or edges with shields. NEVER carry unshielded tools in your pocket.
- Don't leave tools on overhead work surfaces. They may fall and strike someone below; if the tool is to fall however NEVER attempt to catch the object as this can very easily lead to injury.
- When not in use, store equipment in a location where it will not create a safety hazard or get damaged.

SECTION 5: STORED ENERGY

Plan out the required activities when servicing or making repairs to the robot. Make sure all of your teammates are aware that you are working on the robot. Address the following:

Ensure no one is working on the robot when it will be energized during repairs.

Electrical Energy

Disconnect the electric power source

- Always de-energize the robot before working on it by unplugging the 12V and 7.2V batteries.
- Also, open the main circuit breaker (“reset” lever is released).

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.

Miscellaneous Energy Sources

Relieve any compressed or stretched springs.

- Lower all raised robot arms or devices that could drop down to a lower position on the robot.

SECTION 6: BATTERY SAFETY

CAUTION: Batteries contain acid. This substance, H_2SO_4, is a corrosive, colorless liquid that will burn your eyes, skin, and clothing. The team mentor and safety captain should post the Material Safety Data Sheet (MSDS) and train all team members about battery safety. You can find Emergency handling and first aid on the MSDS, proper protection for handling cracked or damaged batteries, and disposal.

General Damaged Battery Information/Warnings

Any battery that is visibly damaged in any way is dangerous and unusable, and should be set aside and handled accordingly because:

1. It contains stored electrical energy that could cause the battery to rapidly heat up due to an internal electrical short circuit, and possibly explode
2. The 12V batteries *FIRST* provided in your kit contains sulfuric acid that will burn human tissue on contact.
    - Immediately flush any contacted skin with a large quantity of water.
    - Seek medical treatment.

Periodically inspect your batteries for any signs of damage or leaking electrolyte. Remember that a dropped battery may be cracked, but the crack may not be visible and might eventually leak electrolyte.

- Don't take a chance and use it.
- Treat it as a hazardous material and process it in accordance with the battery's MSDS.

Necessary Safety Materials

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

1. A box of bicarbonate of 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
3. A suitable non-metallic leak-proof container in which to place the defective battery

Procedure for Handling a Leaking Battery

When an electrolyte leak occurs:

- Neutralize it by pouring the bicarbonate of soda 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.
- Put on the gloves before handling the battery.
- Place the battery in the leak proof container for removal.
- Be sure to neutralize any acid on the gloves before removing and storing them.
- Follow emergency handling instructions of the MSDS, and notify a mentor.
- Seek medical attention.
- Properly dispose of the battery, which is now a hazardous material.

At a FIRST event:

- Immediately send the person in contact with acid to the First Aid Station/EMTs
- Report incident to the pit administration supervisor so they can fill out an Incident Report. Provide team # and available information.
- Obtain sodium bicarbonate from the pit administration Supervisor and carefully sprinkle the sodium bicarbonate on the spill, then clean it and dispose of the now neutralized cleanup materials in the trash.
- Dispose of the battery.

Battery Disposal

The Interstate Batteries Company has volunteered to accept and properly dispose of any *FIRST* team's batteries, and you can find a location near you from their website: http://www.interstatebatteries.com

Most retailers of automotive batteries will also accept and properly dispose of them at no cost.

Charging and Handling

- When a battery is neither connected to the robot nor the battery charger, use the battery protector safety plugs *FIRST* provides in the kit of parts.
- Keep the battery charging area clean and orderly.
- Place your battery charger in an area where cooling air can freely circulate around the charger. Battery chargers can fail without proper ventilation.
- Do not short out the battery terminals. If metal tools/parts contact the terminals simultaneously, it will create a direct short circuit, which will result in high heat to develop in the battery terminal/part/tool area, and the battery could explode.

- If a quick disconnect is not available and you must use tools to disconnect the battery, make sure metal tools don't contact both terminals at the same time.

Ongoing Battery Inspection

- Periodically inspect your battery for any evidence of damage, such as a cracked case or leaking electrolyte.
- Bent terminals can also be a potential leak source.
- After each competition round, inspect the battery.
- Check your battery prior to competing in each round.

Chemical Safety

- Keep chemical containers in good condition.
- Make sure all chemical containers have labels placed by the manufacturer.
- Ensure all labels are legible.
- Become familiar with the chemicals you may use as part of the FRC. Read safety precautions and instructions for use located on the chemical's label.
- Store all chemicals in an orderly way. If possible, obtain material safety data sheets.
- (MSDS) for the chemicals your team uses. These sheets provide information on the correct handling of a spill or injury.
- If you are exposed to a chemical, notify your safety captain and team mentor immediately and consult the MSDS if necessary.
- Do not use any highly flammable materials, such as cleaning solutions, etc., at FIRST events.

Respecting Electricity

Proper use and respect for electricity is paramount. The following are general guidelines for ensuring basic electrical safety requirements are met.

- Inspect your equipment cords and extension cords routinely to ensure they are in good condition.
- DO NOT overload electrical fixtures and/or receptacles.
- Avoid the following electrical / power supply setups to prevent overloading.
    1. Power strip plugged into another power strip
    2. Extension cord plugged into another extension cord.
    3. Extension cord plugged into a power strip.
    4. Multi-device receptacle plugged into a power strip or extension cord.

SECTION 7: WELLNESS & FIRST AID

The safety of a team relies on the members inside of it. That's why it's important for individual members to take responsibility for their and their peers' wellness, as a team who is healthy, awake, and happy are far more likely to be focused and less prone to safety hazards.

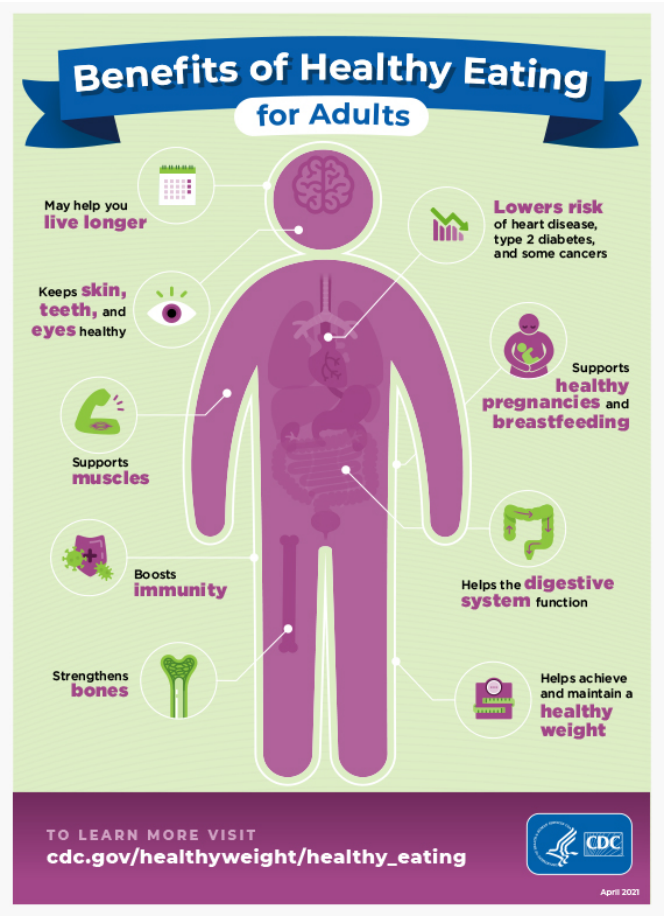
Mental Wellness

If you see something occur concerning emotional or mental safety, **TALK TO A TRUSTED ADULT.** Unless you are certified to deal with an emotional emergency, let a mentor or other trusted adult know so that way the sufferer can get the correct help they need. The instructions below are for low level events that don't require professional intervention. Find out if anyone on your team is certified as soon as possible, for example on FRC team 319 both mentors Michelle Kelley and Melissa Catauro are both CPR and mental health first-aid certified.

- Teammates can easily become overly stressed during an event or inside the workshop, or go so far to the point where they are having an anxiety breakdown. If this happens, try to step out of the situation and talk to a teammate, trusted adult, or mentor so they can help you or another team member.
- Be aware that other team members may also have disabilities, they however have the final call whether to share this information or not. Respect the fact that they might not want to talk about it, don't push them to talk about it, but let them know you're there to talk to if they need it. If they are ok with it, be aware and ask them if they need any assistance such as taking them out of a situation if it calls for it or just regular check-ins.
- Keeping your anger under control is key to having a safe and positive work environment, whether that's at an event or a home meeting. If you notice yourself or someone else have an emotional episode or break down take the following steps...
    1. Guide them/yourself outside of the event, the noise and stress of an event or workshop can easily overload someone with too much stimuli. The quiet room provided by *FIRST* at events can work as well.
    2. Sit them/yourself down in a safe environment.
    3. Breath and take your time, wait until they/you have settled down .
    4. While heading back to the event try and remember what may have caused the emotional stress and take preventive measures if possible such as ear protection or regular breaks if necessary.

Physical Wellness

- Water is essential for keeping a body running smoothly, drinking a steady amount through the day will keep one both alert and in a better mood. One 16oz bottle of water every 2 hours to keep a healthy level of hydration, however consuming more may be necessary if you are exerting yourself throughout the day.
- Diet is also essential for keeping the body and mind running smoothly throughout the day. A well balanced diet not also has long term benefits such as reduced risk of heart disease or type 2 diabetes (pictured right), but short term benefits too; Carbohydrates for example provide plentiful energy for the body and brain and proteins make it possible for oxygen to be carried throughout the body which in turn increase the supply of oxygen to the brain making one more aware of themselves emotionally and their surroundings.



- Getting a correct amount of sleep is essential for keeping a healthy balance both mentally and physically. While the benefits of good sleep are well known factors that cause sleep deficits can impact us just as much. The most common factors that can prevent sleep are anxiety, sleep disorders, and consumption of food or drink such as caffeine. While there is no easy solution to solve issues with nightly sleep, being aware of factors can prevent sleep and taking preemptive actions will allow more comfortable and fulfilling sleep.
- Due to the cramped and potentially stressful environments events and workshops propose to team members make them and all others susceptible to heatstroke. Staying hydrated and making sure the environment is well ventilated and at a cool temperature will help prevent heatstoke and its symptoms from showing up. If these conditions cannot be met in a work environment it is essential to take regular 10-15 minute breaks in areas that meet these requirements.

- There are key signs to identifying heat stroke occurring in yourself or in a peer, if you notice any symptoms such as increased body temperature (i.e. fever), nausea, vomiting, flushed skin (turning red), rapid heartbeat, hyperventilation, headache, and alteration in behavior or mood take the following steps:
    - If you believe that you or your peers are suffering an active heat stroke call 911 and report your emergency then take the rest of following steps, heatstroke not properly treated can be fatal or cause permanent organ damage.
    - Take the individual to a well ventilated, shaded, and safe area.
    - If they are unconscious or otherwise requested, use cool available objects at your disposal to cool the individual such as a cold water bottle, an icepack, or other appropriate objects and apply them to their head, neck, or armpits.
    - Wait until symptoms disappear or emergency services arrive.

Ergonomic Wellness

Good ergonomic practices lead to a much happier and more productive team. Which makes them safer and less likely to suffer from short term pains and unhealthy mood changes all the way to long term benefits such as the reduced risk of injuries.

- After about an hour of sitting team members and mentors should stand up and do some rudimentary stretches and take a short walk around the event or work area
- Take frequent short breaks throughout the day.
- Avoid exerting yourself for extended periods of time.
- Avoid doing repetitive flexing of the wrist, extended use of vibrating tools, and avoid poor form and posture as this can result in carpal tunnel syndrome.

First Aid

Tending to Burns

- Get help from others, if needed.
- Put your burned limb under cool water. Do not use ice, as it may cause tissue damage. Do it for about 3 - 10 minutes depending on the severity of the burn.
- 2a.) If aloe is present, then apply it onto the burn.
- Bandage the injury, once finished with the above steps.

Emergencies

- In the case of an emergency meet in a designated spot, which will be decided prior to competitions.
- In the case of a missing person, alert a mentor and do not go looking after them.

Cuts, Bruises, and other Injuries

- Alert a mentor or first aid if at an event.

Seizures

- Call for help if someone is having a seizure.
- Do not touch or move the patient.
- Clear the area of potential hazards.

SECTION 8: PIT & ROBOT SAFETY AT EVENTS

Registration

Follow the following safety considerations when constructing the pit station at the FRC Event(s):

- Safety glasses are required in the Pit at all times.
    - To gain entrance to the Pit, every person will have to wear a pair of safety glasses that are provided at the start of the event.

Setting up the Team Pit Station

- Design and set up your pit station safely - properly use a ladder - don't climb on tables.
- Observe the ten-foot height limit for any portion of your pit station.
- Use proper tools to safely hang banners. Banners must adhere to the ten-foot limit.

Working in the Pit

- Properly use the power supplies; don't daisy chain, for example.
- Keep the work area neat and orderly.
- Participants should be wearing PPE in the Pit at all times, including:
    - ANSI-approved, non-shaded safety glasses with approved side shields.
    - Safety goggles over prescription glasses.
    - Appropriate footwear - no open-toed shoes or sandals.

Using the Practice Area/Field

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 not exceed the practice area. It will help prevent accidents to those persons viewing the sessions or traveling nearby who may not be aware of the movement of the robots.

Of course, be sure to wear safety glasses and use safe lifting practices. Make sure the 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.

Safe Robot Lifting, Handling, and Transporting

Take a few moments to ensure your team knows how to lift your robot properly and safely. Practice the procedures prior to beginning the season so everyone has the same method and goals at the events.

Pre-Lift

- Ensure all transporters are wearing PPE.
- Make sure the robot is safe to move:
    - Are all parts of the robot secured?
    - Is the robot powered off?
    - Is anyone still working on the robot?
- Have a pre-lift briefing to determine direction and path.
- Ensure that the areas and paths are clear of debris and hazards.
- Are there enough people to perform the lift safely? Two to four people are preferred.

During the Lift

If using a lifting device to lift the robot, ensure participants know how to use it properly.

- Appoint a team member to control pedestrian traffic in the area.
- Appoint someone to coordinate the lift to make sure you are all ready to begin.
- Each lifter should place his/her feet close to the robot and adopt a balanced position.
- All persons should lift at the same time using proper body mechanics. These include:
    1. Lift with the legs, keeping your back straight
    2. Do not twist your body. Use your feet if you need to turn.
    3. Use proper hand holds to grasp the robot and make sure you have a safe, secure liftpoint before starting the lift.
- Bend your knees to a comfortable degree and get a good handhold. 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. Keep the robot close to your body, and coordinate lift speed with the others.
- Make sure the cart is stable and will not roll. Coordinate correct placement on the cart.

Post Match

- Relieve all stored energy and open the main circuit breaker on the robot.
- Ensure that the robot is made safe prior to lifting it off the playing field, no dangling parts, etc.

- Remove debris from the playing field.
- Use the above “Pre-lift” and “During the lift” procedures.
- Use the gate opening to exit the playing field. Don’t climb over the railing.

Robot Transporting

- Make sure the robot is secured to the cart.
- Keep the cart under control at all times, especially when removing or placing the robot.
- Use Gracious Professionalism around others to prevent damage or injury. Do not include music on your robot transporter.
- Use patience and control when moving the robot, especially in crowded areas. Walk; don’t run.
- Ensure that the cart will not roll away or pose a hazard, especially upon robot removal.
- Use a chock block if necessary.
- Use the gate opening when entering/exiting the playing field. Don’t climb over the railing.

SECTION 9: MACHINERY

Omio Usage

Before Usage

Before using the Omio ensure that you have a mentor, or qualified person there to observe you as you use the machine, if it's your first time to ensure you are following these safety precautions, and to prevent self harm to our team's members.

- Always wear goggles when using it, along with ear protection
- Only use material like wood, light metals, plastic, and acrylic. Other materials might damage the machine
- Do not use the machine in dirty, or wet environments. It's ok to use coolant during the process, but ensure there are no other liquids being used
- Follow the Omio standard operating procedures

Omio Standard Operating Procedures

- Ref all home
- Plug in coolant, if not already
- Make sure the collar is tight with the correct tool.
- Establish work zero
- Bring up Z

- Check feeds and speeds
- Load Gcode
- Check clamping VS. Toolpath to avoid collisions
- Reduce Feed Rate at the start of the routing until you confirm the tool is following the expected toolpath

*Only qualified people may do this, without help, which shall be kept on the separate piece of paper on the Omio standard operating procedures. Do not use unless, you have one of them with you.

During Usage:

- Always keep your hands clear of the machine while in use
- Think it out, observe the machine, and ensure it's going as planned
- Use coolant as necessary
- Vacuum up chips of material as they come

When Finished:

- Turn the machine off fully, and do not leave the machine unattended
- Cleanup chips
- Unplug coolant
- Take out finished materials

Mill Usage

Before Usage:

Before using, ensure you know what you are doing. If you have no idea, or clue how to operate the machine get help. There is no shame in asking.

- Always wear goggles when using it
- Only use light metal on this machine. It is most often used to drill into metal pieces, and take off the edge of them.
- Do not use the machine in dirty, or wet environments. It's ok to use coolant during the process, but ensure there are no other liquids being used, or present
- Do a quick clean up, if necessary
- Make sure you are using the right drill bit
- Double Check measurements, to ensure you are prepared
- Tighten the vise grip to hold the piece in place
- Make sure you have your X, Y, and Zs set to zeros when needed
- Use a brace to align your X, Y, and Zs
- Set up parallels when being used
- When using code on a USB stick, ensure you don't plug it into the machine before

turning on the computer. Otherwise the computer will not start up as it should.

Setting Up Your Mill Piece

- Put your piece into the vise grip with parallels when being used
- Put the brace and your supports in place wherever needed
- Check to make sure you have the right drill bit, if not change it out
    - If you don't have the proper drill bit, take it out by using a wrench on the top part of the machine, and untighten it. Make sure you pull down on the lever while you do this. Then hit it down once with the rubber mallet when it starts spinning in circles. Afterwards put your new drill bit in, and do the same process, except tightening this time and no hammering
        - Zero your Xs, Ys, or Zs as necessary with taking the radius of the drill bits in consideration

During Usage:

Make sure you have a plan of what you plan to mill. Do not begin milling until you know what you want to do.

- Always keep your hands clear of the machine while in use
- Think it out, observe the machine, and ensure it's going as planned
- Use coolant
- Vacuum up chips of material as they come
- Go at a steady pace. Alternate between going fast and slow when needed

When Finished:

- Turn the machine off fully, and do not leave the machine unattended
- Cleanup chips
- Unplug coolant
- Take out finished materials
- Reset your braces if needed

Horizontal Saw

Before Usage:

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about operation, otherwise you may end up getting hurt.

- Always wear goggles when using it
- Only use light metal on this machine. Most often it is used to cut shafts, or bars of metal.
- Do not use the machine in dirty, or wet environments. It's ok to use coolant during the process, but ensure there are no other liquids being used, or present.
- Do a quick clean up, if necessary
- Always cut a little bit more than you need, as you can always lose some material, but not add
- Set your piece up in place, and then tighten the vise grip on it. To ensure that it won't fly out, and hit someone
- Figure out where the saw blade will land, to make sure you are cutting correctly.
- Adjust your speed if needed
- Put a stool on the other side of the piece to keep it balanced
- Make sure it's plugged in
- Put it in a convenient space for everyone in the shop, when you can

During Usage:

- Have a plan ready, and be ready to execute it with this machine

- Keep your hands clear of the machine's blade while cutting
- Go slow when cutting. We want a cut that isn't going to hurt someone when they instantly touch it
- Use coolant as needed

After Usage:

- Lift the saw up. Ensure it stays in place, so it doesn't fall on your hands.
- Remove the material
- Clean up any mess made
- Put the horizontal saw away, with the cord wrapped up, and unplugged

Bandsaw Usage

Before Usage:

Do not operate the machine unless you know what you are doing, and have a plan of action. Get a mentor over, if you have no clue how to operate it.

- Always wear goggles when using it
- Only use light material on this machine. It's only meant for that
- Do not use the machine in dirty, or wet environments. Keep it completely clean
- Do a quick clean up, if necessary
- Put your hands in a nice position for cutting

During Usage:

- Cut slowly, and always move towards your scrap side
- Keep your hands clear of the blade

After Usage:

- Turn the machine off, wait until the blade stops running
- Take out materials when the blade is done moving
- Clean up any mess made

Lathe Usage

Before Usage:

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- This machine is used for cutting shafts to exact length, drilling, and tapping them
- Make sure to wear safety goggles
- Always ensure the machine is fully off before putting material in
- Put the shafts into the chuck real tight using the chuck key
- Make sure it's off, before you do anything
- Adjust the braces, when needed
- Take the chuck once done tightening the shaft in
- Set your zero if needed
- Make sure you have the right drill bit when drilling
- Make sure you know the amount you want to cut off, if cutting

During Usage:

- Keep hands clear of the lathe if spinning
- Go slowly with the machine
- When tapping, always keep your tap center
- Use coolant, or tap magic when drilling, or tapping respectively

After Usage:

- Turn the machine off, if needed. And wait till it stops spinning
- Clean up the area
- Take out drill bits, for the next user

Drill Press Usage

Before Usage:

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- This machine is used for drilling holes into pieces of metal
- Make sure to wear safety goggles
- Always ensure the machine is fully off before putting material in
- Make sure it's off, before you do anything
- Adjust the table when necessary
- Take the chuck once done tightening the shaft in
- Make sure you have the right drill bit when drilling
- Make sure you know the amount you want to cut off, if cutting

During Usage:

- Keep hands clear of the drill
- Go slowly with the machine

- When tapping, always keep your tap center
- Use coolant, or tap magic when drilling, or tapping respectively

After Usage:

- Turn the machine off, if needed. And wait till it stops spinning
- Clean up the area
- Take out drill bits, for the next user

Belt Sander Usage

Before Usage

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- Wear safety goggles
- Make sure your hands are clear of the machine belt
- Put the material you plan to sand on the table on the machine
- Do not sand extremely small pieces with this machine. You'll probably hurt your hand while holding it
- Turn on when ready

During Usage:

- Grip your material you are going to sand, and slowly push it in towards the sander
- Keep hands away from the sander, and ***do not touch*** in under any circumstances
- When you are done sanding a piece, move it away from the sander

After Usage:

- Turn the machine off, and wait there until the belt stops moving

- Clean up messes made

Arbor Press Usage

Before Usage

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- Wear safety goggles
- This machine is used to press a piece of material onto another piece of material
- Position your piece over the pressing area using the spinning surface at the bottom
- Press down slightly with the press itself. Do not go full force with it, just enough to hold the piece in place
- Make sure your piece is going in straight, and properly. Check by going down on your knees, and checking from all sides of it

During Usage:

- Press down slowly to ensure you are doing it properly.
- If it doesn't feel right going down being pressed, then you are most likely doing something wrong.

After Usage:

- Pull the lever up.

Grinder Usage

Before Usage

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- Wear safety goggles
- This machine is primarily used to grind pieces of metal, to make sharp edges
- Make sure your hands are clear of the machine
- Do not grind extremely small pieces with this machine. You'll probably hurt your hand while holding it
- Make sure you are prepared for any sparks that will come off from this machine as it grinds. Wear proper gear.
- Turn on when ready

During Usage:

- Grip your material you are going to grind, and slowly push it in
- Keep hands away from the grinder, and *do not touch* it under any circumstances
- When you are done sanding a piece, move it away from the sander

After Usage:

- Turn the machine off, and wait there until the belt stops moving
- Clean up messes made

Table Saw Usage

Before Usage

Do not operate the machine unless you know what you are doing, and have a plan of action. Get a mentor over, if you have no clue how to operate it. Most of the time mentors will prefer for themselves to cut the material, to ensure measurements are correct, and material will not be wasted in masse.

- Always wear goggles when using it
- Only use light material on this machine. It's only meant for that
- Do not use the machine in dirty, or wet environments. Keep it completely clean.
- Make sure the machine is plugged in
- Do a quick clean up, if necessary
- Put your hands in a nice position for cutting
- Plug the vacuum in on top in the tube featured above the machine
- Move your lever/wall to where you want it to be cut. Keep in mind the blade will cut part of that
- Bring the saw blade up using a hand crank
- Pull the switch on the front of the machine, and then wait for it to give you a light, then turn it on

During Usage:

- Keep your hands clear of the blade
- Push the material through, and keep it straight against the wall of the adjustable

fence
- When cutting narrow pieces, use a piece of wood to push it along the saw blade. ***Do not use your hands for pushing narrow pieces. You'll hurt yourself.***
- Have another person on the other side of the saw to hold the material, if needed.

After Usage:

- Turn the machine off, wait until the blade stops running
- Clean up any mess made
- Take the vacuum out, and turn it off

Jigsaw Usage

Before Usage

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- This hand operated tool can be found in the bottom drawer of the cabinets in the wood room
- Check the blade for any damages, or warping
- Ensure you have a big area to work
- Clamp the piece down you are cutting to ensure it doesn't move as you do
- Make sure you won't cut anything on the workspace you'll be working on, to prevent damages to tables
- Start with the blade on the edge of where you are cutting

During Usage:

- Go slow with the blade. Always cut going towards your scrap side, as like we say, you can always cut more, but not more on.
- Do not try to do sudden turns. This will break the blade. Do turns overtime. If you have to do a sudden turn, then use a drill to cut turns like that.
- While the machine is on **do not touch the blade under any circumstances.**

After Usage:

- Wait until the jigsaw turns off fully.

- Clean up messes made below the workspace.
- Fix blade if needed.

Circular Saw Usage

Before Usage

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt, especially with this tool.

- This hand operated tool can be found in the bottom drawer of the cabinets in the wood room.
- Check the blade for any damages, or warping.
- Ensure you have a big area to work.
- Clamp the piece down you are cutting to ensure it doesn't move as you do.
- Make sure you won't cut anything on the workspace you'll be working on, to prevent damages to tables.
- Start with the blade on the edge of where you are cutting.

During Usage:

- Go slow with the blade. Always cut going towards your scrap side, as like we say, you can always cut more, but not more on.
- Do not try to do turns with this machinery. It will not work whatsoever
- Do not touch the saw, while it spins. You will cut your hand off

After Usage:

- Wait until the circular saw turns off fully
- Clean up messes made below the workspace
- Pull on the lever featured on the side of the circular saw to bring the saw up, for putting away

Chop Saw Usage

Before Usage

Before using this machinery, please get someone to teach you how to operate it. Do not go straight into using this piece of machinery without prior knowledge, or experience. There is no shame in asking about the operation, otherwise you may end up getting hurt.

- Plug the vacuum in
- The machine is stationary
- Reset your angles, if needed
- Push down on the top part of the saw to take out any locks put in place
- Use light material, like wood, or plastic. Not metal
- Move hands away from the blade
- Get a second person to hold up the other end of wood, if needed
- Push really hard against the material you are cutting

During Usage:

- Bring saw down, and activate it while in midair
- Keep your hands clear
- Make sure to keep pushing for a nice clean cut

After Usage:

- Clean up any mess made.
- Unplug vacuum, if done for the day.
- Put the saw in the locked position, if done for the day.
- Unplug saw, if done for the day.

Soldering

Soldering can be dangerous because of the heat from the iron and the chemical fumes and vapors released from the solder and flux, respectively. When soldering, observe the following points:

- Use lead-free solder only and solder with electrically heated soldering iron/gun only.
- No torches or open flames of any kind are allowed in the buildings.
- Wear eye and face protection.
- Solder in well-ventilated areas.
- Never touch the iron/gun. It heats to extreme temperatures that will cause severe burns.
- To prevent burns, wear cotton clothing that covers your arms and legs.
- Always wash your hands with soap and water after handling solder.
- Work on a fire resistant surface.

Do not leave hot tools where someone can contact the hot element.