

Safety in the Use of Common Facilities

1. Innovation Machine Factory

1.1 Common precautions for using various types of equipment

- (1) Carefully read the Safety Guide for Experiments and Practical Training.
- (2) Wear work clothes and fasten buttons to avoid loose clothing that could get caught in machinery.
- (3) Safety shoes are preferred. Sandals and similar designs are prohibited due to danger.
- (4) As a general rule, no work gloves are worn during work. However, this does not apply to the handling of hot or heavy materials.
- (5) If you are sick or injured, notify a staff member immediately.
- (6) In the event of a disaster or other unforeseen event, the following measures shall be taken:
 - Stop operation of the machine and turn off the power immediately.
 - Provide first aid to any injured person and contact staff promptly.
 - In the event of a fire, first notify the surrounding area of the emergency before extinguishing the fire.
- (7) Before using a machine, obtain permission from the staff in charge and have it inspected before starting work.
- (8) Do not touch other machines, tools, or measuring instruments that you are not authorized to use.
- (9) Secure the tools and workpieces and take care not to injure yourself.
- (10) During machining, be careful of flying chips and check the surrounding conditions.
- (11) After the work is finished, clean the machine and its surroundings, and keep tools and measuring instruments in the designated place.
- (12) Report the completion of the work to the staff member in charge and receive an inspection after the completion of the work.

1.2 Precautions for use and operation of each machine

(1) Contour Machine

- Select the saw blade width, pitch, and rotation speed based on the workpiece material and thickness.
- Turn on the switch and then increase the speed to the specified rotational speed.
- If anything unusual occurs during the cutting operation (such as a broken or fallen blade or chipped blade), notify the staff member in charge immediately.

- When cutting an arc, select the width of the saw blade according to the shape.
- Pay close attention to the rotating saw blade while working.

(2) Drilling Machine

- Receive advice from the staff member in charge regarding machining conditions.
- The workpiece must be securely fastened and must not be forcefully attached.
- Be careful not to break the drill or get it stuck during the machining operation.
- Attach and remove the drill only after spindle rotation has completely stopped and the handle detached.

(3) Double-Headed Grinder

- Only the staff in charge shall replace and mount/remove the grinding wheel.
- Check the clearance between the grinding wheel and the workpiece holder and verify that it is 2 mm or less.
- Always use dust-proof shields or dust-proof glasses.
- To prevent entrapment, never wear gloves or work gloves when holding the workpiece. Also, do not use the side of the grinding wheel.
- After turning on the grinder, wait until the wheel is fully spinning before using it.

(4) Lathe

- Perform the warm-up procedure for the main spindle.
- Take extra care not to pinch your hands or fingers when attaching/detaching the chuck or installing the workpiece.
- The selection of cutting conditions should be made with the advice of the staff in charge.
- Install the cutting tools securely and check the cutting edge height.
- Be careful of flying chips during machining and never touch the chips.
- Be careful of sharp burrs on the workpiece and cutting tools during operation.
- Always pull out the chuck key after tightening the chuck to secure the workpiece.

(5) Milling Machine

- Perform the warm-up procedure for the main spindle.
- Receive advice from the staff in charge on how to mount the workpiece set cutting conditions, such as the cutting direction.
- Use safety glasses to protect your eyes from flying chips during cutting.
- Securely fasten the cutting tools and workpiece mounting screws.

- Receive advice from the staff member in charge on the operation of the equipment.

(6) Surface Grinding Machine

- When a workpiece is mounted on the electromagnetic chuck, check that it is completely secured.
- Do not adjust the grinding range while the table is moving.
- Set the infeed grinding allowance to less than 0.02 mm.
- Do not stand in the direction of the movement of the grinding wheel.
- Receive advice from the staff member in charge regarding the replacement of grinding wheels and equipment operation.

(7) High-Speed Precision Cutting Machine

- Ultra-thin grinding wheels should be mounted securely using the grinding wheel grip.
- The workpiece should be firmly fixed so that it will not move.
- Check the mounting position of the cutting wheel and workpiece, turn on the switch, and adjust the processing fluid flow.
- After starting to cut, adjust the feed rate to avoid overload using the cut meter as a guide.
- Always keep the front and side covers down during cutting.
- Obtain advice from the staff in charge on other handling questions.
- After the work is completed, clean the area and apply a rust inhibitor.

(8) Shearing Machines

- As a rule, shearing operations should be performed by only one person.
- The thickness limit for material to be sheared shall be 5.0 mm.
- Clearance shall be set according to the material and plate thickness.
- Engage the shear only after the flywheel has been turned on and is rotating stably.
- When shearing, always check for safety before pressing the two-hand switch.
- Consult the staff in charge before starting work.

(9) Band Saw Machine

- Check the tension of the band saw blade.
- Securely clamp the workpiece.
- Receive advice from the staff in charge on processing conditions and operation methods.

- Loosen the tension of the saw blade after the work is completed, clean it, and apply a rust inhibitor.

(10) The following equipment can be operated only under the direct supervision of the staff in charge:

- Machining Center
- Wire EDM
- NC Lathe
- NC Milling Machine
- Slotting Machine

(11) In principle, the following equipment is prohibited for use by non-staff.

- Arc Welding Machine
- Gas Welding Machine
- Gas Cutting Machine
- TIG Welding Machine
- MIG Welding Machine
- Casting Machines

2. Engineering Research Equipment Center: General Guidelines

The Center is a research support facility attached to the Faculty of Engineering. This section describes the general guidelines for users.

The center consists of analytical instruments and rental laboratory space that are available to the entire university. In principle, users are required to operate the instruments at the center by themselves after attending operation training. If for some reason it is difficult for the user to operate the equipment, the equipment administrators can perform the requested analysis. For details on any specific analysis, please consult with the administrator of each instrument. The user is expected to comply with the comprehensive safety management rules to prevent accidents from occurring during direct measurement and instrument operation. For your protection, when conducting experiments in the rental lab space, please follow the safety instructions of the faculty member who administrates the space.

- (1) Users must follow the instructions of the equipment administrator, take an operation training course for the equipment they intend to use, and complete user registration.
- (2) Equipment must be reserved through the equipment reservation system.
- (3) Users must comply with notices posted near each device or verbally given by administrators.
- (4) The user must obtain prior permission or instructions from the administrator of the equipment when using flammable or harmful substances during measurement or sample preparation, or when there is a risk of generating toxic gases due to chemical reactions.
- (5) When operating equipment that generates hazards such as high voltage, high pressure, and high temperature, users should not touch or enter areas that are not necessary for measurement.
- (6) Users shall immediately report any equipment failure to the device administrator and ask for instructions on the measures to be taken when a device in operation breaks down. Do not try to fix equipment on your own.

(7) Users shall not change or augment the electrical wiring, gas piping, or other infrastructure in the room without the permission of the administrator.

(8) The user must not leave the equipment (unmanned) for a long period of time during measurement (during operation of the equipment) without the permission of the equipment administrator.

(9) When the measurement is finished, the user must shut down the equipment according to the prescribed procedure. Then, the user shall clean the experiment space, turn off the light, and lock the room. If any aspect of the post-measurement procedure is unclear, follow the instructions of the equipment administrator

(10) As a general rule, always remove any samples brought for analysis.

(11) Eating and drinking is prohibited in all laboratories.

3. Institute of Industrial Nanomaterials

The Explosive Shock Testing Facility of the Industrial Nanomaterials Research Institute is a joint university facility for research on various shock energy generation and propagation phenomena and applications using explosives and high-current generators, as well as on cryogenic and other environments with extreme energy conditions.

The proper use and handling of explosives and high-current generators, which are sources of energy, are necessary because they can cause major disasters if used and handled incorrectly. In particular, explosives are very dangerous, and if they are mishandled or used for illicit purposes such as crime, they can cause great social misery. Strict legal regulations are in place regarding the use and handling of explosives.

In addition, because the experimental building is a communal facility used by many researchers, equipment and fixtures should be handled with care. In view of the above, users of the Explosive Shock Testing Facility shall strictly adhere to the standards given below.

3.1 General experiment procedures

(1) Persons who handle explosives in explosive impact test facilities (hereafter referred to as “experimenters”) must submit a Notification of Use of Facilities and obtain approval in advance.

(2) Experimenters must attend security training, which is conducted twice a year.

(3) Experimenters must always handle explosives under the direction of a safety engineer for the handling of explosives (hereinafter referred to as the “safety engineer”).

(4) Clothing must be suitable for the experiment and casual clothing such as running shirts, short trousers, and sandals are strictly prohibited.

(5) Fire is strictly forbidden during experiments, and if fire is unavoidable in the course of an experiment, the instructions of the safety engineer must be followed.

(6) Experiments using high currents and experiments using electric detonators must not be carried out in parallel at the same time.

(7) The experimenter must seek instructions from a safety engineer in the event of a thunderstorm or lightning. If the interval between lightning and thunder is less than 24

seconds, all work related to the handling of explosives shall be temporarily suspended.

(8) Clean up after the experiment and inform a safety engineer immediately if there is anything wrong with the equipment or instruments.

3.2 Preparation and control of explosives (pyrotechnic workshop)

(1) No more than five persons can be in the pyrotechnic workshop at any one time (one safety engineer plus up to four experimenters).

(2) Electrical equipment and tools, and metal objects other than the ongoing experiment equipment, are prohibited from being brought into pyrotechnic workshops.

(3) The experimenter must carry out the forming and loading of explosives under the direction of a safety engineer. During forming and loading, do not apply excessive friction or impact to the explosives.

(4) The experimenter shall weigh the explosives under the direction of a safety engineer. In doing so, handle the explosives carefully to avoid spilling them, and take care to avoid contamination by foreign substances.

(5) The weighing and loading of pentaerythritol tetranitrate (PENT) shall be carried out by a safety engineer.

(6) Gunpowder, explosives, and pyrotechnics must be transported in separate transport boxes. However, if they cannot be stored in the transport box, ask for instructions from a safety engineer.

(7) When transporting explosives from the pyrotechnic station to the laboratory, the prescribed information must be entered on the Pyrotechnic Station Record form.

(8) The experimenter must lock the pyrotechnic station when leaving it.

3.3 Experiments with explosives

(1) During the experiment, an “Experiment in progress” warning tag must be displayed at the entrance to the experimental building and the name of the person conducting the experiment must be clearly displayed.

(2) As few tools and jigs as necessary should be brought into the explosion laboratory, and they must be removed from the laboratory immediately after use.

(3) Explosives should be brought into the explosion laboratory only after all preparations have been made except for the setting of the explosives.

(4) Explosion experiments shall be carried out in accordance with the Explosion Experiment Record form (check sheet) under the direction of a safety engineer.

(5) Only the safety engineer and number of experimenters required for the work should be the laboratory where explosives have been brought in. Any other people should leave the laboratory.

(6) Short circuits in the electric detonator leg wires shall not be untied until immediately before they are tied to the blasting busbar.

(7) Blasting busbars and electric detonator leg wires shall be sufficiently separated from power lines, light lines, measuring lines, and other electrical energy sources to avoid the effects of leaked, stray, and induced currents.

(8) Do not stand in front of the door of the explosion laboratory if the alarm lamp warning of an explosion experiment is lit.

(9) The amount of explosives in a single explosion experiment shall not exceed 2000 g and the number of experiments per day shall not exceed 30.

(10) After an explosion, enough ventilation and wearing a mask is required before entering the room.

3.4 Experiments using high currents

(1) Charging and grounding/discharging operations must only be carried out by persons

designated by a safety engineer.

(2) Laboratory personnel who operate grounding apparatus must wear electrical rubber gloves and boots to prevent electric shock and must operate the grounding rod while standing on a rubber mat.

(3) After the experiment is completed, always perform a grounding operation, and only after the residual charge has been discharged should the next operation be carried out.

(4) Experiments using high-current generators should be conducted in accordance with the High Current Explosion Experiment Record form (checklist).

4. Kurokami Radioisotope Laboratory (KRI)

The KRI is a university-wide Joint Usage Institution established in 1967. Using radioactive isotopes (RI) is strictly controlled by the Regulation on Prevention of Radiation Hazards.

RI handling within the University is provided in the Facility Usage procedure, Radiation Exposure Dose Limits, and the safe handling policy in the Regulation on Prevention of Radiation Hazards on Kumamoto University. Radioisotope users must register before using RI. The user performs this registration on the PMSR system on Kumamoto University's portal site. After that, the user takes a radioisotope course and has a checkup annually in July and January. A personal exposure dosimeter is distributed by a RI management representative after the registration status is confirmed.

An application form is required when users operate equipment owned by KRI. Please contact the Radiation Control Office (extension 3782) for details about using the facilities.

5. Center for Management of Information Technologies (CMIT)

The CMIT is a University-wide shared facility. Precautions for using this Center are posted in the facility and must be observed. Regarding the use of equipment at the CMIT, you need to be careful when working for a long time in front of a display screen. The following health problems can be caused by long-term use of display terminals (VDTs):

Eyes – Eye discomfort can include visual haze, pain/redness, deterioration of visual function (abnormal color vision and decreased visual acuity), pain in other parts of the body caused by these symptoms, stiffness, dizziness, and fatigue.

Localized body pain – Symptoms can include stiff shoulders, limb pain, cervicobrachial disorder, and headaches.

Mental – Mental effects can include poor motivation, poor concentration and memory, and, in extreme cases, seizures and emotional disturbance.

Among reported cases, many cases manifested poor eyesight and abnormal color vision. Because these symptoms are likely to be caused by a VDT, maintenance of an appropriate working environment (natural posture, correct display settings, and appropriate surroundings) is essential. While keeping in mind the balance of brightness and other settings, users should regularly perform visual acuity checks. If any abnormality is found after undergoing examinations, such as force, adjustment, intraocular pressure, and fundus observation, it is necessary to take immediate action.

However, even with the current VDT equipment, no major problems will occur as long as the work environment and work time are appropriately managed and a use method suitable for each person is observed.

6. Hazardous materials indoor storage

6.1 Overview of hazardous materials

“Hazardous materials” in this chapter refers to hazardous materials defined by the Fire Service Act, which is a Japanese law. Hazardous materials are substances that are combustible or easily ignited as defined by the Fire Service Act. These hazardous materials are classified into Categories 1 to 6 according to their properties, and the handling of each class is different.

Because these materials have properties such as a high risk of spreading a fire and a high degree of difficulty in extinguishing such fires, they should be handled with great care.

6.2 Handling of hazardous materials

When handling hazardous materials, even when using a small amount, be aware of the dangers and physical properties of the substance before using it. Review the material’s Safety Data Sheet (SDS) to learn its hazards and appropriate handling methods.

A hazardous materials engineer’s license is required to handle hazardous materials in a storage facility where the multiple of the designated quantity exceeds 1. Therefore, a person with a Class A or Class B hazardous materials engineer’s license must be present when removing hazardous materials from the storage facility of the Faculty of Engineering.

6.3 Storage of hazardous materials

For hazardous materials, the “designated quantity” is stipulated by law in consideration of the danger. If the value obtained by dividing the amount of hazardous materials in possession by the specified quantity exceeds 1, the Fire Service Act strictly regulates the storage and handling of substances. Therefore, when storing a large amount of hazardous materials, it is necessary to obtain permission from the local fire department to store hazardous materials in a storage facility that meets the standards based on the Fire Service Act, and to notify the local fire department of the storage contents. If the same category of hazardous materials but different substances are stored, divide the storage amount of these hazardous materials by the respective designated quantity and sum the values obtained. If the sum of the quotients exceeds 1, it is subject to the Fire Service Act.

Even if it exceeds 1/5 of the multiple of the designated quantity, it is necessary to notify the fire department under the jurisdiction of the municipality as a “**small-quantity hazardous materials**”. Therefore, if you need to store hazardous materials in your laboratory, store them in the designated hazardous materials storage location, and remove

only the amount you need for immediate use.

6.4 How to use the indoor hazardous materials storage facility

Municipalities must be notified in advance of the identity and quantity of hazardous materials to be stored in an indoor hazardous materials storage area. Thus, the types of hazardous materials and the maximum amount that can be stored in the hazardous materials indoor storage area of the **Faculty of Engineering** have already been decided. The hazardous materials security superintendent, the hazardous materials that can be stored, and the amount are specified in the hazardous materials indoor storage is written on the storage facility. If you want to store unapproved chemicals, the university must obtain storage permission from the municipality in advance, so consult with the hazardous materials security superintendent before acquiring such materials.

When storing hazardous materials in the hazardous materials indoor storage area, to clearly identify the person who manages the chemicals, the name of the laboratory or faculty member should be written on the label or can, and a sticker issued by YAKUMO should be affixed to the can when it is placed in storage. After storing it, be sure to change the storage location to the hazardous materials indoor storage area in YAKUMO.

The hazardous materials indoor storage area cannot store anything other than the specified categories of hazardous materials. However, non-hazardous materials that do not react with hazardous materials can be stored if certain conditions are met. At present, chloroform and dichloromethane can be stored as category 4 materials in the hazardous materials indoor storage area of the **Faculty of Engineering**. When storing these chemicals, place them in a designated storage area that is at least 1 m away from dangerous materials.

7. Creative Design Atelier

7.1 Terms of use

(1) The users of this facility are students and staff of the Faculty of Engineering, and specially authorized people by the Director of the Center.

(2) Users must be covered by the Accident Insurance for Education and Research and Accident Insurance for Disaster and Injury. Students in the Faculty of Engineering should have already taken out such insurance at the time of enrollment. However, students who did not graduate within specified number of years and graduate students should verify that they have coverage.

(3) For the use of facilities and equipment that require individual licenses, users must attend a training course and obtain a license to operate the equipment in advance.

7.2 Licenses

(1) The Atelier issues licenses upon completion of a safety course.

(2) There are two types of equipment, namely, equipment that can be operated by users with a safety course license and equipment that requires an individual license issued under instruction. The type of license required depends on the degree of difficulty and danger in operating the equipment.

(3) Individual license-required equipment includes the lathe, milling machine, welding, laser processing machine, 3D modeler, and other dangerous equipment.

(4) Users must carry their licenses while in the facility. Users can operate equipment for which they do not have a license only in the presence and under the guidance of technical staff.

7.3 Safety Rules for Using Equipment

7.3.1 Common precautions for using various devices

(1) Users must always wear safe clothing and footwear. It is preferable to wear work clothes. At a minimum, users must wear clothing that will not get caught in the machinery. In addition, the use of headphones is prohibited in the facility so that users can detect unusual noises from the equipment. Furthermore, eating and drinking are strictly prohibited.

(2) Clogs, high-heeled shoes, and sandals are prohibited, as they are dangerous. Wearing of safety shoes is recommended.

(3) Before using any equipment, be sure to obtain permission from the staff in charge of the machinery, and receive advice as needed during processing (the most dangerous time is when you are familiar with a machine).

(4) Users who do not know how to operate the equipment or experience a problem should always report to or consult with technical staff and ask for instructions. Arbitrary operation of the equipment may cause serious accidents.

(5) Users shall always perform a test run (dry run) before any work.

(6) Do not wear work gloves when cutting or grinding with machine tools. Gloves are only permitted when transporting workpieces. (Because the machine tool is rotating, there is a risk of getting caught in it. This is very dangerous because machines typically have several kilowatts of power.)

(7) Users should always wear dust-proof glasses for eye protection when using equipment with high-speed motion or rotation that does not have dust-proof shields installed. (When using a grinder wheel, sparks and tiny, sharp metal chips fly. In such cases, there is a risk of eye injury and blindness.)

(8) Do not press any switches other than those on the machine you are using.

(9) After processing, clean and maintain the machine and its surroundings, maintain it so that it can work safely and promptly without causing inconvenience to the next user, and ask the staff in charge to check it. At this time, be sure to report any damage or abnormalities in tools or equipment.

(10) When multiple users are working together, only one user is permitted to operate the machine.

Warning: When one user is setting up a workpiece, another user moving the tool rest or pushing the switch for tool rotation can cause a serious accident. When multiple users are handling a workpiece, only one user should always operate the equipment, and no other person should ever touch the equipment while it is being operated.

(11) Waste and chips generated by work and processing shall be separated and disposed of in accordance with university regulations and separately established workshop waste regulations. Large waste items should be taken out by users. (Burnable garbage should be placed in the dumpster, and non-burnable garbage should be placed in the designated location.)

(12) Users should consult and ask questions to staff members about anything they do not understand, and never make decisions on their own.

7.3.2 Precautions for use and operation of each machine

(1) Lathe (technical staff instructional equipment): individual license required

A lathe is a machine tool that cuts a cylindrical material by rotating the material and applying a tool with a cutting edge. Lathe operations include cylindrical cutting, end face cutting, step cutting, internal cutting, drilling, thread cutting, and parting off.

- a. Take extreme care when removing and installing work materials, as fingers may get stuck.
- b. Do not leave the chuck handle attached during lathe work. The chuck handle will fly off as soon as the lathe starts turning, causing an accident.
- c. Due to the wide variety of lathe operations, the selection of cutting conditions (speed, depth of cut, and feed rate) depending on the material to be machined shall be specified by the staff member in charge on a case-by-case basis.
- d. Mount the bite (cutting tool) securely with the chuck handle after confirming the height of the cutting edge.

(2) Milling machine (technical staff instructional equipment): individual license required

A milling machine is a machine tool in which the material is fixed to the table and the cutter is rotated to process the material. Milling operations include plane cutting, end face cutting, grooving, and drilling.

- a. When using a milling machine, be sure to receive guidance from the staff in charge regarding the size and shape of the material to be processed, mounting method, cutting conditions (up cut/down cut), and cutting speed.
- b. Use dust-proof glasses for cutting operations on the milling machine.

(3) Grinder

Grinders deburr and finish-cut materials.

- a. The maximum peripheral speed of each grinding wheel is determined by the wheel maker. Therefore, the staff member in charge is responsible for attaching and detaching the grinding wheels.

- b. Ensure that the gap between the grinding wheel and the workpiece holder is adequate (2.5 to 3 mm).
- c. The dust-proof glass shield of the grinder or dust-proof glasses must be used when using the grinder.
- d. Do not use the side of the grinding wheel.
- e. To start using the grinder, turn the switch on and wait until the rotation reaches the operating speed.
- f. Note that the grinding wheel continues to rotate due to inertia even when the switch is turned off. Do not grind the workpiece after turning the grinder off, even if the wheel is still rotating.

(4) Drilling machine (drill press)

A drilling machine is a machine tool that rotates drills mounted in a chuck, and drilling is performed by feeding the spindle and drill into the workpiece.

- a. Before starting a drilling operation, select the rotational speed appropriate for the diameter of the selected drill. Generally, the rotation speed is inversely proportional to the drill diameter, so a small-diameter drill will rotate at a higher speed.
- b. The material to be processed must be mounted securely, and must not be mounted forcibly.
- c. For machining of brass, copper, aluminum, and stainless steel on drilling machines, consult a staff member in charge to obtain instructions.
- d. Before attaching and detaching the drill securely, wait for the spindle to stop completely. The chuck handle must be removed.
- e. When using the drilling machine, pay attention to the feed rate (feed little by little), especially at the beginning and end of cutting.
- f. Note that in drilling machine processing, the spindle speed is at least 480 revolutions per minute, which is a high speed so precautions should be made.

(5) Electric furnace (technical staff instructional equipment)

An electric furnace is a device capable of heat-treating samples and melting metals.

- a. When using an electric furnace, wear protective equipment.
- b. Use tongs when handling materials during the use of the electric furnace, as severe burns may result from direct contact. Do not carelessly touch materials with bare hands.
- c. Do not heat materials that generate corrosive gases.
- d. Do not heat items that may cause ignition.
- e. Do not heat materials weighing more than 8 kg.

(6) Arc and TIG welding (technical staff instructional equipment): individual licenses required

Shielded metal arc welding is a welding method in which a high-temperature arc is generated in the gap between the shielded metal arc welding electrode and the workpiece to be welded.

TIG welding is a welding method in which a tungsten rod is used as an electrode in an inert gas atmosphere of argon or helium to generate an arc between the rod and base metal.

Shielded arc welding is used for welding metals, while TIG welding is used for welding nonferrous metals such as aluminum.

- a. Use leather gloves for welding work to prevent electric shock and burns.
- b. During welding work, wear thick work clothes to prevent burns.
- c. During welding work, be sure to use a face shield with UV-protective-colored glasses.
- d. Wear helmets and foot covers during welding operations.
- e. Always seek the advice of the staff in charge before performing welding operations.

(7) Belt grinder

Belt grinders are used to deburr cut woodwork, resin, and other materials and to finish the modeling of curved surfaces.

- a. When using a belt grinder, be sure to use a dust-proof shield and dust-proof glasses.
- b. Because the rotating belt of the machine is exposed, maintain a sufficient clear zone around the belt to avoid entrapment and contact.
- c. Small materials should be secured using a fixture or other means to prevent hands from touching the belt.

(8) Band saw

This machine has two functions: it can be used as a contour machine and a cut-off (parting) tool.

- a. When moving the machine, hang the chain on a hook.
 - b. During use of the machine, mount and dismount cutting materials with the switch off.
 - c. Cutting materials should be securely mounted when the machine is in use.
- Note on the contour function:
- a. The object to be contoured should be fixed with bolts or contour feet.
 - b. Do not cut cylindrical objects.
 - c. When using the machine for contour cutting, minimize the saw blade opening width.

(9) Manual cutting tool

This cutting tool cuts workpiece material less than 1 mm thick.

- a. This cutting tool should be operated by one person holding both the material and the cutting handle.
- b. Do not cut materials thicker than its cutting capacity.

(10) High-speed cutting machine

This machine cuts round bars, pipes, strips, and angle-plates.

- a. Note that the cutting blade of this machine is made of a whetstone, and it will break if overloaded.
- b. This machine can cut angle plates.

(11) Drilling machine for woodworking

This machine is a machine tool with drills for wood and performs drilling work by feeding the drill mounted on a spindle. The method of operation is the same as that for machine (4).

(12) Contour machine

This machine can cut curves by means of a band saw. The saw blades are available for wood (rough pitch) and for metal and acrylic (fine pitch).

- a. Before using this machine, select the width and pitch of the saw blade based on the material to be processed and its thickness.
- b. To start the machine, turn the switch on.
- c. Notify the staff member in charge immediately if anything unusual occurs during the cutting operation (broken saw blade, blade falling off the pulley, or chipped/bent blade).
- d. Do not hold small workpieces directly with your hand. Use additional woodpieces to secure the item that needs to be cut.

(13) Slide type circular saw (Makita LS0716FL)

The use of this machine is prohibited except in the presence of a staff member.

(14) 3D modeler (technical staff instructional equipment): Individual license required.

The 3D modeler is a machine that calculates the path and depth of the blade that cuts the material from 3D CAD data and operates the end mill to cut the material in three dimensions.

- a. This machine can be operated only by users who have attended the instructional

course on the use of this machine.

- b. When using this machine, place a rag under the blade tool when installing or removing it to prevent the blade from falling and damaging the tool.
- c. The programming code used should be the same on both the equipment and software side (MDX-500).
- d. Be sure to match the material to be machined with the material selection in the CAM software and use the recommended values for machining conditions.
- e. The tool to be used must match the tool selected in the CAM software.

(15) Laser processing machine (technical staff instructional equipment): individual license required

This machine cuts materials by focusing a CO₂ laser on a workpiece and engraves figures and letters. A wide variety of materials can be processed, including cloth, acrylic, leather, stone, cork, and rubber, making the laser useful for many purposes. However, the use of vinyl chloride-based materials and wood that contains adhesives, such as plywood, is not possible due to the risk of toxic gas emissions.

- a. The laser machine can be operated only by users who have attended the instructional course on the use of this machine.
- b. This machine cannot process metals.
- c. The maximum processing thickness for this machine is 5 mm for acrylic and wood.
- d. Processing of materials that generate toxic gases, such as vinyl chloride and Teflon materials, is not possible with this machine. It is also impossible to process materials containing adhesives, such as plywood, laminated wood, and MDF.
- e. This machine must be ventilated inside the working space during processing.
- f. During the operation of this machine, do not leave the machine unattended due to the possibility of material ignition and fire.
- g. Before processing paper (cutting paper) with this machine, consult the technical staff in charge.

(16) Panel saw (technical staff instructional equipment): The use of the panel saw is prohibited except in the presence of staff.

This machine cuts large sizes of wood plate and Styrofoam.

(17) Bench-type circular saw for woodworking (Hitachi C10FE model)

Use of this saw is prohibited except in the presence of a staff member.

(18) Electric small hand-pushed planer (Ryobi HL-6A)

Use of the planer by students is prohibited.

(19) Various electric power tools (disk sanders, hand drills, jigsaws, and electric engravers)

Various power tools are intended for general use and do not require specialized knowledge or skills. However, the manuals should be read and understood before use. Users should seek guidance from technical staff if they have any questions.

(20) Compressor

The compressor is used to compress air and inject it through nozzles to remove chips and other debris.

The compressor use procedure is as follows:

Before use: 1. Close the drain cock. 2. Turn on the limiter switch.

After use: 1. Turn off the limiter switch. 2. Open the drain cock.

Users should exercise extreme caution when using the equipment. If you have any doubts, do not operate any equipment on your own and consult the staff.