General Safety Practices

Safety

This symbol warns of possible personal injury.

The safety rules and regulations in this section are representative of some, but not all, rules and regulations. The Occupational Safety and Health Act (“OSHA”) is paraphrased without representation that the OSHA rules and regulations have been reproduced verbatim. Please refer to Section 1910 of the Federal Register and subsequent revisions for a complete list of OSHA rules and regulations. Regulations vary from country to country, outside of the U.S.A., operate your Zamboni Ice Resurfacer in accordance with local regulations.

Important Safety Notice

Periodic and proper operation, lubrication and maintenance is important for the safety and reliability of your Zamboni machine. The ice resurfacer operation manual outlines recommended procedures, some of which require the use of special tools or work methods.

Improper operation, lubrication and maintenance of this machine is dangerous and could result in injury or death.

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS BEFORE OPERATING, OR PERFORMING LUBRICATION AND MAINTENANCE ON THIS MACHINE.

Basic safety precautions are outlined in the SAFETY bulletin and in the description of operations where hazards exist. Warning labels have also been put on the machine to provide instructions and to identify specific hazards which could cause bodily injury or death to you or other persons.

It is the responsibility of the owner to perform a job safety analysis of all hazards associated with the total environment in which the Zamboni will operate and to train all personnel annually.
The warnings in the manual and on the machine are identified by the symbol:

**DANGER !**

*Operations that may cause product damage are identified on the product and this publication. Zamboni cannot anticipate every possible circumstance that might involve potential hazard.*

The warnings in this manual and on the machine are therefore not all inclusive. If a procedure, tool or work method not specifically recommended by Zamboni is used, a competent person must be consulted to assure the safety of you and others and that the machine will not be damaged or made unsafe by the procedures you choose. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedure you choose. When in doubt, call our factory for free consultation and advice.

**DANGER !**

*Do not operate or perform maintenance on this machine unless you have read and understand the instructions in THIS BULLETIN AND THE OPERATION MANUAL. Improper machine operation and maintenance is dangerous and could result in injury or death. Contact Zamboni for a free replacement manual. Proper operation and maintenance is your responsibility.*

Accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. A person must be alerted to potential hazards. This person should also have the necessary training, skills and tools to perform safely.

The specifications are subject to change at any time. These changes may affect the service given to the product. Please obtain the most current information from your local distributor or the Zamboni factory before starting any job.

For a list of the most current publication, please contact Frank J. Zamboni & Co., Inc., 15714 Colorado Avenue, Paramount, CA 90723 U.S.A., (562) 633-0751.
Warning Signs and Labels

There are several specific safety signs on your Zamboni machine. Make sure that you can read and understand all of the safety signs. Clean or replace them if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasoline, etc.

You must replace a label if it is damaged, missing or cannot be read. If a label is on a part that is replaced, make sure a new label is installed on the replaced part. Contact Frank J. Zamboni Co., Inc. for new labels free of charge.

DANGER!

Only trained and authorized personnel may operate this machine. For safe operation, read and follow the manual furnished with this machine and observe the following warnings:

- Keep all guards in place. Do not operate the Zamboni machine if any guard is damaged or missing.
- Check all controls and warning devices for proper operation.
- Put directional control or shift lever in neutral before “ON-OFF” switch is turned on.
- Start, turn and brake smoothly. Slow down for turns, slippery or uneven surfaces. Use extreme caution when turning or on inclines.
- Watch out for pedestrians and obstructions, check overhead clearances.
- Do not permit riders on the Zamboni machine at any time.
- Do not allow anyone to stand or pass under the elevated portion of any machine.
- Be sure operating surface can safely support machine.
- Observe safety rules when handling fuel on engine powered machines and when changing or charging batteries for electric machines.
- Never cover, hide or remove any safety label.
Crushing or Cutting Prevention

- Support equipment and attachments properly when working beneath them.
- Do not depend on hydraulic cylinders to hold up. Any attachment can fail if a control is moved or if a hydraulic line breaks.
- Never attempt adjustments while the machine is moving or is running unless otherwise specified.
- Where there are mechanical linkages, the clearance in the linkage area will increase or decrease with movement of the assembly.
- Stay clear of all rotating and moving parts.
- Keep objects away from moving fan blades. They will throw or cut any object or tool that falls or is pushed into them.
- Retainer pins, when struck with force, can fly out and injure nearby persons. Make sure the area is clear of people when driving retainer pins.
- Wear protective glasses when striking a retainer pin to avoid injury to your eyes.
- Chips or other debris can fly off objects when struck. Make sure no one can be injured by flying debris before striking any object.
- Keep all guards in place and good repair.

Fire or Explosion Prevention

Fuels (Gasoline, Propane - LPG, Compressed Natural Gas - CNG)

DANGER!

Gasoline, LPG, CNG and their vapors are extremely flammable. LPG and CNG vapors reduce oxygen available for breathing and may cause suffocation. Gasoline vapors are extremely flammable and cause flash fires.

- Never smoke when filling, installing or changing the fuel tanks on the machine.
• Keep all sources of open flame, spark or other ignition such as stoves, furnaces, water heaters or any appliance using a pilot light away from fuel storage, fuel use and refueling areas. Under well ventilated conditions, a minimum distance of 20 feet from all ignition sources is recommended.

• Do not operate the machine if an odor of gasoline or LPG or CNG is present or if other explosive conditions exist.

• Refuel outdoors or in a well ventilated area.

• DO NOT refuel when the engine is running or hot. Allow engine and engine exhaust system and catalytic convertor (if equipped) to cool for a minimum of five minutes before refueling.

• Never fill the gasoline tank completely full or to a point where the gasoline is overflowing. Always leave a small portion of the gas tank and the entire fill tube empty. This will allow for the expansion and movement of the gasoline and will minimize sloshing and potentially spilling the gasoline when the machine moves.

• If gasoline is spilled, avoid creating any source of ignition until the gasoline has been completely removed.

• LPG is heavier than air and spreads rapidly. Stop all leaks quickly. Shut off the source of gas.

• If a fire starts, evacuate the area and notify the fire department.

• For a fire in the engine compartment, shut off engine. Shut off the gas flow at the tank valves for LPG and CNG powered vehicles before trying to extinguish

• Always have a properly maintained fire extinguisher located in the Zamboni room.

• Fire extinguishing media must be dry chemical, foam, or CO₂ for use on large fires.

**Propane (LPG)**

• Avoid skin contact with liquid because of possibility of freeze burn. Use propane resistant gloves when working with the propane tank connections. Always use full face mask and wear a long sleeve shirt or jacket.
Propane Tank Storage and Handling

- The storage and handling of LP gas and tanks should be in accordance with the NFPA 58 Standard for the Storage and Handling of Liquefied Petroleum Gases, 1995 Edition.

- The machine should be refueled in accordance with the NFPA 58 Standard for the Storage and Handling of Liquefied Petroleum Gases, 1995 Edition.

- Only properly trained and designated persons should charge or exchange the LP gas tanks.

- The engine should be stopped and no persons should be on the Zamboni machine during refueling.

- Always install tanks and make tank connections outdoors or in a well ventilated area away from heat, ignition sources and open flames. NO SMOKING ALLOWED during these operations.

- Store tanks in an authorized location (outside, detached storage is required) with adequate ventilation.

- Store tanks in an upright position, away from heat and ignition sources.

- Reasonable care should be exercised in handling the LP gas containers to avoid damage. Do not drop, throw, roll or drag LP gas containers or any associated parts of the containers or fuel system.

- The careless handling of LP gas containers can result in a serious accident. Extreme care should be exercised when transporting containers so that they are not accidently dropped or physically damaged. When it is necessary to move more than one container at one time, a proper carrying device should be provided and used.

- Physical damage such as dents, scrapes or gouges may materially weaken the structure of the tank and render it unsafe for use.

- All LP gas containers should be regularly inspected before recharging and examined again before reuse, for the following defects or damage:
  - Leaks, dents, scrapes, gouges or corrosion of the pressure vessel, with emphasis on the bottom of the cylinders;
  - Damage to the various valves and liquid level gauge;
  - Debris in the relief valve;
  - Indication of leakage at valves and or threaded connection;
• Deterioration, damage or loss of flexible seals in the fill or servicing connection;

• Do not overfill LP gas containers.
• Keep container valve closed and plugged when not in use.
• Never use a match or open flame to check for leaks, use a soap solution.
• Always close the LPG tank service valve when the Zamboni machine is parked for the night or for any extended length of time.

CNG Fuel System
The installation of distribution, storage and dispensing (charging) systems must be done in accordance with the NFPA 52 Compressed Natural Gas (CNG) Vehicular Fuel Systems, 1995 Edition and any other applicable regulations. Your local gas utility company must be advised of your installation.

The machine's CNG cylinders must be charged in accordance with the NFPA 52 Compressed Natural Gas (CNG) Vehicular Fuel Systems, 1995 Edition. Only properly trained and designated persons should charge the CNG fuel cylinders on the machine.

• Never smoke when charging the CNG fuel cylinders on the machine.
• Keep all sources of open flame, spark or other ignition such as stoves, furnaces, water heaters or any appliance using a pilot light away from fuel storage, fuel use and refueling areas. Under well ventilated conditions, a minimum distance of 20 feet from all possible ignition sources is recommended.
• Never charge the cylinders in excess of their maximum allowable service pressure at normal temperature. DOT and TC containers shall be charged in accordance with DOT and TC regulations.

Oils

• Hydraulic oil and it's vapors are flammable and will ignite if they contact a hot surface such as an exhaust pipe or manifold. A flash fire can occur.
• Hot oil and components can cause personal injury. Do not allow hot oil or components to contact the skin.
• At operating temperature, the hydraulic tank is hot and can be under pressure.
• Remove the hydraulic tank filler cap only after the machine has been stopped and the filler cap is cool enough to remove with your bare hand.

• Remove the hydraulic tank filler cap slowly to relieve pressure.

Batteries

• Battery fumes may cause fire or explosion. Battery acid can cause burns.

• Only trained and designated personnel should recharge or exchange batteries.

• Service, exchange and handle batteries only in authorized areas where proper safety and ventilation facilities are provided (i.e. eye wash stand, showers, etc.).

• Do not smoke, or expose battery to sparks or flame when checking, charging or servicing battery. Keep chains and metallic tools away from the top of the battery.

• Highly explosive gases are present and are especially hazardous toward the end of the charging period as the battery approaches a full charge condition. DO NOT OVERCHARGE THE BATTERIES.

• Cover the top of the battery with plywood or other insulating material before removing it from the machine.

• Do not add acid to a “wet” battery, add distilled water only.

• When preparing a dry charged battery for service, follow the battery manufacturer’s instructions.

Lubricants

Most lubricants are flammable.

• Do not smoke in areas where batteries are charged, or where flammable materials are stored.

• Clean and tighten all electrical connections. Check daily for loose or frayed electrical wires. Have all loose or frayed electrical wires tightened, repaired or replaced before operating the Zamboni Ice Resurfacer.

• Keep all lubricants stored in properly marked containers and away from unauthorized persons.
• Store all oily rags or other flammable material in an approved container, in a safe place.

• Do not weld or flame cut on pipes or tubes that contain flammable fluids. Clean them thoroughly with non-flammable solvent before welding or flame cutting on them.

• Remove all flammable materials such as oil and other debris before they accumulate on the Zamboni machine.

• Do not expose the Ice Resurfacer to flames, burning, etc., if at all possible.

• Have a fire extinguisher available and know how to use it. Inspect and have it serviced as recommended on its instruction plate.

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**Lines, Tubes and Hoses**

• Do not bend or strike high pressure lines. Do not install bent or damaged lines, tubes or hoses.

• Repair any loose or damaged oil lines, tubes and hoses. Leaks can cause fires. Contact Zamboni or your Zamboni dealer for repair or replacement.

• Check lines, tubes and hoses carefully. Do not use your bare hand to check for leaks. Use a board or cardboard to check for leaks. Tighten all connections to the recommended torque. Replace if any of the following conditions are found:
  
  • End fittings damaged or leaking;
  
  • Outer covering chafed or cut and wire reinforcing exposed;
  
  • Outer covering ballooning locally;
  
  • Evidence of kinking or crushing of the flexible part of hose;
  
  • Armoring embedded in the outer cover;
  
  • End fittings displaced;

• Make sure that all clamps, guards and heat shields are installed correctly to prevent vibration, rubbing against other parts and excessive heat during operation.
Safe Operation

Mounting and Dismounting

- Mount and dismount the Ice Resurfacer only where steps and/or handholds are provided.
- Use both hands and face the Zamboni machine when mounting and dismounting. Use extra care when wet or slippery conditions exist.
- Never get on or off a moving Zamboni machine. Never jump off the machine.
- Do not try to climb on or off the Ice Resurfacer when carrying tools or supplies.

Before Operating the Zamboni

- Operate the machine only from the operator’s station.
- Adjust the seat so that full pedal travel can be obtained with the operator’s back against the seat back.
- The Zamboni machine is equipped with a lighting system, make sure all lights are working properly.
- Make sure no one is working on, underneath or close to the Ice Resurfacer before turning on the key or beginning to move the machine. Make sure the area is free of personnel.
- Do not move the machine or move any of the controls if there is a “DO NOT OPERATE” or similar warning tag attached to the start switch or controls.
- Move the transmission control lever to NEUTRAL.
- Clear all personnel from the machine and the area.
- Clear all obstacles from the path of the Ice Resurfacer. Beware of hazards such as curbs, blocks, posts, wire, cans, etc.
- Make sure the horn and all other warning devices are working properly.
- Check for proper operation of all controls.
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Operation

- Obey all traffic rules and warning signs.
- Always observe floor load limits and overhead clearances.
- When turning the Ice Resurfacer, slow down to safe speed.

Parking

- Park the Zamboni machine in authorized areas only.
- Move the hydrostatic transmission control lever to NEUTRAL.
- Turn the key switch OFF and remove the key.
- If possible, park the machine on a flat and level surface. If the machine is parked on any kind of grade, the wheels must be blocked with wheel chocks to prevent the vehicle from rolling away after it has been parked.
- Store in well ventilated area.

Engine Emission Systems - Inspection and Maintenance

DANGEROUS!

Internal combustion engines produce exhaust emissions that contain dangerous gases, including carbon monoxide (CO) and nitrogen dioxide (NO₂). These gases can cause serious injury or death.

The rink MUST be adequately ventilated during every operation of the Ice Resurfacer. Also the resurfacer must be kept properly maintained and serviced at all times and the engine timing should always be properly set. Each person who operates and maintains the resurfacer should be so instructed.

Please keep in mind that adequate ventilation, monitoring the facility’s indoor air quality (for CO and NO₂ levels) and the condition of the machine is, at all times, the complete responsibility of the rink.
The safe and correct operation and maintenance of the resurfacer, the engine and the engine exhaust system includes:

- Measuring the facility's indoor air quality (for CO and NO₂ levels), daily;
- Measuring engine emission levels;
- Adjusting engine components (when applicable) to ensure correct operation and optimum engine emission levels;
- Inspecting, adjusting (when applicable), maintaining and replacing engine and exhaust system components when required.

If you do not have the tools, education or expertise to inspect, maintain, repair or replace these items, contact a reputable, licensed mechanic for assistance.

### Optional Emission System Components

Machines may be equipped with the following optional emission systems components: catalytic converter (two way and three way), engine controller and oxygen sensor.

**Catalytic Converter**

The purpose of the catalytic converter is reduce the tail pipe emissions of the vehicle. The pyrometer mounted on the dash indicates the operating temperature of the converter. However, correct operation of the catalytic converter must be verified by measuring the engine emission levels before and after the catalytic converter by using an exhaust gas analyzer (4 or 5 gas).

The performance of the catalytic convertor must be measured every 300 hours.

**Engine Controller**

The purpose of the engine controller is to try to control the engine’s air-fuel ratio to a predetermined level thus producing optimum engine performance.

The correct operation of the engine controller is verified using a “Mixture monitor” tool (ZPN 7K-40410).

**Oxygen Sensor**

The oxygen sensor is a critical component used by the engine controller. Correct oxygen sensor operation should be verified at each engine service or tune-up (every 300 hours). The oxygen sensor must be replaced every 1000 hours of operation.
**Engine Emission Inspection**

The engine emission checks must take place:

- Upon catalytic converter installation;
- Every tune-up or 300 hours of operation (or sooner if required by state or local regulations or indicated by machine duty cycle or performance);

Record the engine emission levels.

As a guideline reference, the post-cat emissions should show a reduction of no less than 75% in the carbon monoxide (CO) level. Typically the reduction in CO is much greater, around 90%. If the reduction in CO is less than 75% then the engine or the exhaust system components (which includes the catalytic converter) must be inspected, adjusted, repaired or replaced.

**WARNING!**

*These engine emission checks are NOT substitutes for the daily emission monitoring of facility indoor air quality. In addition, the guideline reference for emission reductions should NOT be a substitute for any applicable government guidelines, standards or regulations.*