

# CHAPTER ONE

## GENERAL INFORMATION

Snowmobiling has in recent years become one of the most popular outdoor winter recreational pastimes. It provides an opportunity for an entire family to experience the splendor of winter and enjoy a season previously regarded by many as miserable.

Snowmobiles also provide an invaluable service in the form of rescue and utility vehicles in areas that would otherwise be inaccessible.

As with all sophisticated pieces of machinery, snowmobiles require specific periodic maintenance and repair to ensure their reliability and usefulness.

### MANUAL ORGANIZATION

This manual provides periodic maintenance, tune-up, and general repair procedures for Ski-Doo snowmobiles manufactured since 1970.

This chapter provides general information and hints to make all snowmobile work easier and more rewarding. Additional sections cover snowmobile operation, safety, and survival techniques.

Chapter Two provides all tune-up and periodic maintenance required to keep your snowmobile in top running condition.

Chapter Three provides numerous methods and suggestions for finding and fixing troubles

fast. The chapter also describes how a 2-cycle engine works, to help you analyze troubles logically. Troubleshooting procedures discuss typical symptoms and logical methods to pinpoint the trouble.

Subsequent chapters describe specific systems such as engine, fuel system, and electrical system. Each provides disassembly, repair, and reassembly procedures in easy to follow, step-by-step form. If a repair is impractical for the owner/mechanic, it is so indicated. Usually, such repairs are quicker and more economically done by a Ski-Doo dealer or other competent snowmobile repair shop.

Some of the procedures in this manual specify special tools. In all cases, the tool is illustrated in actual use or alone.

The terms **NOTE**, **CAUTION**, and **WARNING** have specific meaning in this book. A **NOTE** provides additional information to make a step or procedure easier or clearer. Disregarding a **NOTE** could cause inconvenience, but would not cause damage or personal injury.

A **CAUTION** emphasizes areas where equipment damage could result. Disregarding a **CAUTION** could cause permanent mechanical damage; however, personal injury is unlikely.

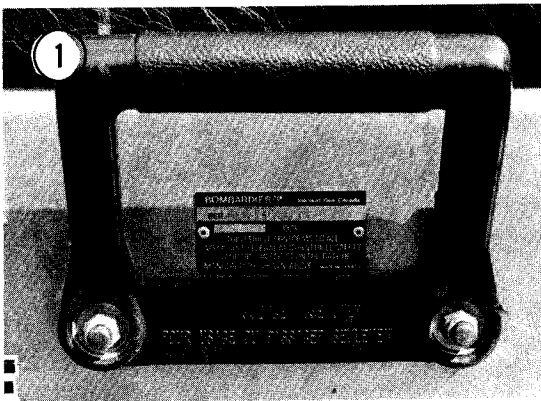
A **WARNING** emphasizes areas where personal injury or death could result from negligence.

Mechanical damage may also occur. **WARNINGS** are to be taken seriously. In some cases, serious injury or death has been caused by mechanics disregarding similar warnings.

### MACHINE IDENTIFICATION AND PARTS REPLACEMENT

Each snowmobile has a serial number applicable to the machine and a model and serial number for the engine.

**Figure 1** shows the location of the machine serial number on the right side of the tunnel. **Figure 2** shows the location of engine model and serial numbers.



Write down all serial and model numbers applicable to your machine and carry the numbers with you. When you order parts from a dealer, always order by year and engine and machine numbers. If possible, compare old parts to the new ones before purchasing them. If parts are not alike, have the parts manager explain the difference.

## OPERATION

### Fuel Mixing

#### WARNING

*Serious fire hazards always exist around gasoline. Do not allow any smoking in areas where fuel is mixed or when refueling your snowmobile.*

*Always use fresh fuel. Gasoline loses its potency after sitting for a period of time. Old fuel can cause engine failure and leave you stranded in severe weather.*

Proper fuel mixing is very important for the life and efficiency of the engine. All engine lubrication is provided by the oil mixed with the gasoline. Always mix fuel in exact proportions. A "too lean" mixture can cause serious and expensive damage. A "too rich" mixture can cause poor performance and fouled spark plugs which can make an engine difficult or impossible to start.

Use a gasoline with an octane rating of 90 or higher. Use premium grade gasoline in all high performance racing machines. Mix gasoline in a separate tank, not the snowmobile fuel tank. Use a tank with a larger volume than necessary to allow room for the fuel to agitate and mix completely.

Use Ski-Doo Snowmobile oil and mix with fresh gasoline in a 20:1 ratio for 1970-1973 models, 40:1 for 1974 models and 50:1 for all later models.

1. Pour required amount of oil into a *clean* container.
2. Add  $\frac{1}{2}$  the necessary gasoline and mix thoroughly.
3. Add remainder of gasoline and mix entire contents thoroughly.
4. Always use a funnel equipped with a fine screen while adding fuel to the snowmobile.

### Pre-start Inspection

1. Familiarize yourself with your machine, the owner's manual, and all decals on the snowmobile.
2. Clean the windshield with a clean, damp cloth. *Do not* use gasoline, solvents, or abrasive cleaners.

3. Check all ski and steering components for wear and loose parts. Correct as necessary.
4. Check track tension.
5. Check operation of throttle and brake controls and ensure that they are free and properly adjusted.
6. Check fuel level.

**WARNING**

*Before starting engine, be sure no bystanders are in front of, or behind, the snowmobile or a sudden lurch may cause serious injuries.*

7. Start engine and test operation of emergency kill switch. Check that all lights are working.

**Emergency Starting**

Always carry a small tool kit with you. Carry an extra starting rope for emergency starting or use the recoil starter rope.

1. Remove hood.
2. Remove recoil starter.
3. Wind rope around starter pulley and pull to crank engine.

**Emergency Stopping**

To stop the engine in case of an emergency, switch emergency kill switch to STOP or OFF position.

**Towing**

When preparing for a long trip, pack extra equipment in a sled, do not try to haul it on the snowmobile. A sled is also ideal for transporting small children.

**WARNING**

*Never tow a sled with ropes or pull straps, always use a solid tow bar. Use of ropes or flexible straps could result in a tailgate accident, when the snowmobile is stopped, with subsequent serious injury.*

If it is necessary to tow a disabled snowmobile, securely fasten the disabled machine's skis to the hitch of the tow machine. Remove the drive belt from the disabled machine before towing.

**Clearing the Track**

If the snowmobile has been operated in deep or slushy snow, it is necessary to clear the track after stopping or the track may freeze, making starting the next time difficult.

**WARNING**

*Always be sure no one is behind the machine when clearing the track. Ice and rocks thrown from the track can cause serious injury.*

Tip the snowmobile on its side until the track clears the ground *completely*. Run the track at a moderate speed until all the ice and snow is thrown clear.

**CAUTION**

*If track does freeze, it must be broken loose manually. Attempting to force a frozen track with the engine running will burn and damage the drive belt.*

**Proper Clothing**

Warm and comfortable clothing are a must to provide protection from frostbite. Even mild temperatures can be very uncomfortable and dangerous when combined with a strong wind or when traveling at high speed. See **Table 1** for wind chill factors. Always dress according to what the wind chill factor is, not the temperature. Check with an authorized dealer for suggested types of snowmobile clothing.

**WARNING**

*To provide additional warmth as well as protection against head injury, always wear an approved helmet when snowmobiling.*

**SERVICE HINTS**

All procedures described in this book can be performed by anyone reasonably handy with tools. Special tools are required for some procedures; their operation is described and illustrated. These may be purchased at Ski-Doo dealers. If you are on good terms with the dealer's service department, you may be able to borrow from them, however, it should be borne in mind that many of these tools will pay for

Table 1 WIND CHILL FACTORS

Estimated Wind Speed in MPH	Actual Thermometer Reading (° F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Temperature (° F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-21	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-36	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-124
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
*	Little Danger (for properly clothed person)			Increasing Danger				Great Danger				
	• Danger from freezing of exposed flesh •											
*Wind speeds greater than 40 mph have little additional effect.												

themselves after the first or second use. If special tools are required, make arrangements to get them before starting. It is frustrating and sometimes expensive to get under way and then find that you are unable to finish up.

Service will be far easier if the machine is clean before beginning work. There are special cleaners for washing the engine and related parts. Just brush or spray on the cleaning solution, let it stand, then rinse it away with a garden hose. Clean all oily or greasy parts with cleaning solvent as they are removed.

#### WARNING

*Never use gasoline as a cleaning agent, as it presents an extreme fire hazard. Be sure to work in a well-ventilated area when using cleaning solvent. Keep a fire extinguisher handy, just in case.*

Observing the following practices will save time, effort, and frustration as well as prevent possible expensive damage:

1. Tag all similar internal parts for location and mark all mating parts for position. Small parts such as bolts can be identified by placing them in plastic sandwich bags and sealing and labeling the bags with masking tape.

2. Frozen or very tight bolts and screws can often be loosened by soaking them with penetrating oil such as WD-40®, then sharply striking the bolt head a few times with a hammer and punch (or screwdriver for screws). A hammer driven impact tool can also be very effective. However, ensure tool is seated squarely on the bolt or nut before striking. Avoid heat unless absolutely necessary, since it may melt, warp, or remove the temper from many parts.

3. Avoid flames or sparks when working near flammable liquids such as gasoline.

4. No parts, except those assembled with a press fit, require unusual force during assembly. If a part is hard to remove or install, find out why before proceeding.

5. Cover all openings after removing parts to keep dirt, small tools, etc., from falling in.

6. Clean all parts as you go along and keep them separated into subassemblies. The use of trays, jars, or cans will make reassembly that much easier.

7. Make diagrams whenever similar-appearing parts are found. You may *think* you can remember where everything came from — but mistakes are costly. There is also the possibility you

may be sidetracked and not return to work for days or even weeks — in which interval carefully laid out parts may have become disturbed.

8. Wiring should be tagged with masking tape and marked as each wire is removed. Again, do not rely on memory alone.

9. When reassembling parts, be sure all shims and washers are replaced exactly as they came out. Whenever a rotating part butts against a stationary part, look for a shim or washer. Use new gaskets if there is any doubt about the condition of old ones. Generally, you should apply gasket cement to only one mating surface so the parts may be easily disassembled in the future. A thin coat of oil on gaskets helps them seal effectively.

10. Heavy grease can be used to hold small parts in place if they tend to fall out during assembly. However, keep grease and oil away from electrical and brake components.

11. High spots may be sanded off a piston with sandpaper, but emery cloth and oil do a much more professional job.

12. Carburetors are best cleaned by disassembling them and soaking the parts in a commercial carburetor cleaner. Never soak gaskets and rubber parts in these cleaners. Never use wire to clean out jets and air passages; they are easily damaged. Use compressed air to blow out the carburetor only if the float has been removed first.

13. Take your time and do the job right. Do not forget that a newly rebuilt snowmobile engine must be broken in the same as a new one. Keep rpm's within the limits given in your owner's manual when you get back on the snow.

14. Work safely in a good work area with adequate lighting and allow sufficient time for a repair task.

15. When assembling 2 parts, start all fasteners, then tighten evenly.

16. Before undertaking a job, read the entire section in this manual which pertains to it. Study the illustrations and text until you have a good idea of what is involved. Many procedures are complicated and errors can be disastrous. When you thoroughly understand what is to be done, follow the prescribed procedure step-by-step.

## TOOLS

Every snowmobiler should carry a small tool kit to help make minor adjustments as well as perform emergency repairs.

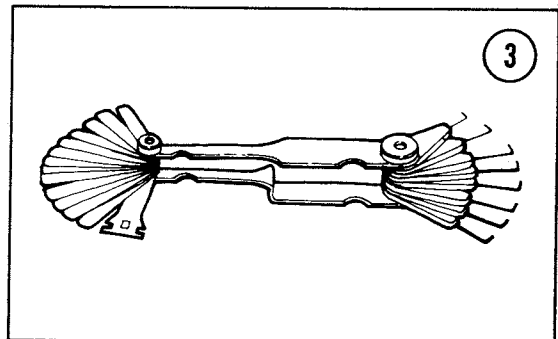
A normal assortment of ordinary hand tools is required to perform the repair tasks outlined in this manual. The following list represents the minimum requirement:

- a. American and metric combination wrenches
- b. American and metric socket wrenches
- c. Assorted screwdrivers
- d. Pliers
- e. Feeler gauges
- f. Spark plug wrench
- g. Small hammer
- h. Plastic or rubber mallet
- i. Parts cleaning brush

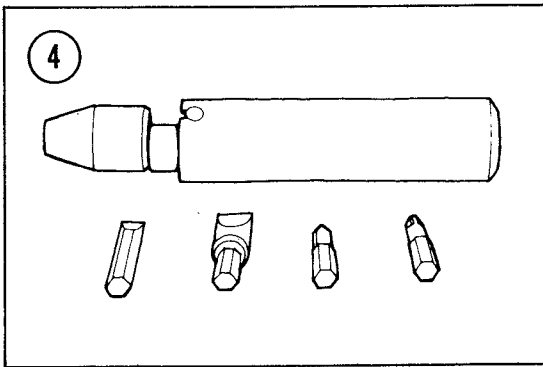
When purchasing tools, always get quality tools. They cost more initially but in most cases will last a lifetime. Remember, the initial expense of new tools is easily offset by the money saved on a few repair jobs.

Tune-up and troubleshooting require a few special tools. All of the following special tools are used in this manual, however all tools are not necessary for all machines. Read the procedures applicable to your machine to determine what your special tool requirements are.

1. *Ignition gauge (Figure 3)*. This tool combines round wire spark plug gap gauges with narrow breaker point feeler gauges. The device costs about \$3 at auto accessory stores.

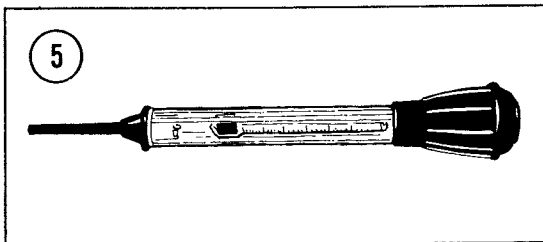


2. *Impact driver (Figure 4)*. This tool might have been designed with the snowmobiler in mind. It makes removal of screws easy, and



eliminates damaged screw slots. Good ones run about \$12 at larger hardware stores.

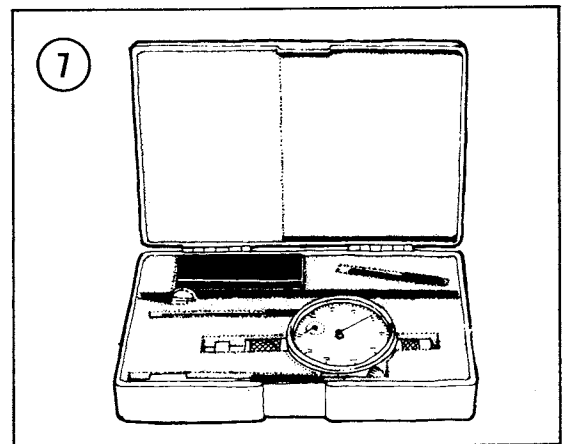
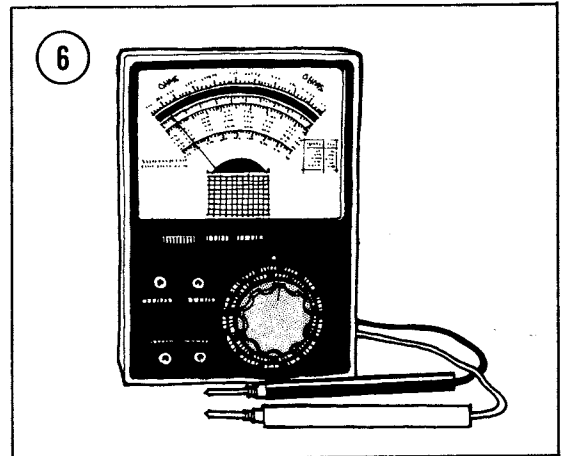
3. *Hydrometer* (Figure 5). This instrument measures state of charge of the battery, and tells much about battery condition. Such an instrument is available at any auto parts store and through most larger mail order outlets. Satisfactory ones cost as little as \$3.



4. *Multimeter or VOM* (Figure 6). This instrument is invaluable for electrical system troubleshooting and service. A few of its functions may be duplicated by locally fabricated substitutes, but for the serious hobbyist, it is a must. Its uses are described in the applicable sections of this book. Prices start at around \$10 at electronics hobbyists stores and mail order outlets.

5. *Timing gauge* (Figure 7). This device is used to precisely locate the position of the piston before top dead center to achieve the most accurate ignition timing. The instrument is screwed into the spark plug hole and indicates inches and/or millimeters. The tool shown costs about \$20 and is available from most dealers and mail order houses. Less expensive tools, which use a vernier scale instead of a dial indicator, are also available.

6. *Air flow meter or carburetor synchronizer* (Figure 8). This device is used on engines with

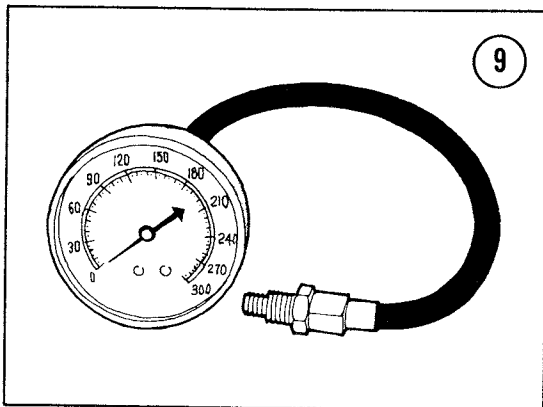
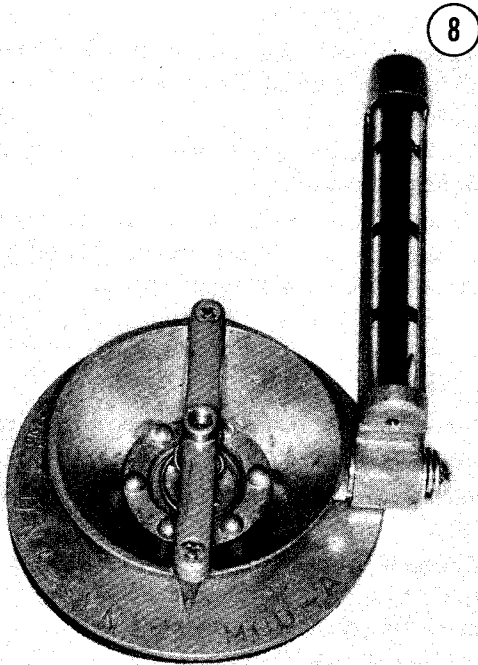


multiple carburetors to fine tune the synchronization and idle speed. The tool shown costs about \$10-15 at most dealers, auto parts stores, and mail order houses.

7. *Compression gauge* (Figure 9). The compression gauge measures the compression pressure built up in each cylinder. The results, when properly interpreted, indicate general piston, cylinder, ring, and head gasket condition. Gauges are available with, or without, the flexible hose. Prices start around \$5 at most auto parts stores and mail order outlets.

### EXPENDABLE SUPPLIES

Certain expendable supplies are also required. These include grease, oil, gasket cement, wiping rags, cleaning solvent, and distilled water. Solvent is available at many service stations. Distilled water, required for the battery,



is available at every supermarket. An increasing number of mechanics clean oily parts with a solution of common household detergent or laundry powder.

### WORKING SAFELY

Professional mechanics can work for years without sustaining serious injury. If you observe a few rules of common sense and safety, you can enjoy many safe hours servicing your

own machine. You can also hurt yourself or damage the machine if you ignore these rules.

1. Never use gasoline as a cleaning solvent.
2. Never smoke or use a torch in the area of flammable liquids, such as cleaning solvent in open containers.
3. Never smoke or use a torch in an area where batteries are charging. Highly explosive hydrogen gas is formed during the charging process.
4. If welding or brazing is required on the machine, remove the fuel tank to a safe distance, at least 50 feet away.
5. Be sure to use properly sized wrenches for nut turning.
6. If a nut is tight, think for a moment what would happen to your hand should the wrench slip. Be guided accordingly.
7. Keep your work area clean and uncluttered.
8. Wear safety goggles in all operations involving drilling, grinding, or use of a chisel.
9. Never use worn tools.
10. Keep a fire extinguisher handy. Be sure it is rated for gasoline and electrical fires.

### SNOWMOBILE CODE OF ETHICS

When snowmobiling, always observe the following code of ethics as provided by the International Snowmobile Industry Association.

1. I will be a good sportsman. I recognize that people judge all snowmobile owners by my actions. I will use my influence with other snowmobile owners to promote sportsmanlike conduct.
2. I will not litter trails or camping areas. I will not pollute streams or lakes.
3. I will not damage living trees, shrubs, or other natural features.
4. I will respect other people's property and rights.
5. I will lend a helping hand when I see someone in distress.
6. I will make myself and my vehicle available to assist search and rescue parties.
7. I will not interfere with or harass hikers, skiers, snowshoers, ice fishermen, or other winter sportsmen. I will respect their rights to enjoy our recreation facilities.

8. I will know and obey all federal, state, and local rules regulating the operation of snowmobiles in areas where I use my vehicle. I will inform public officials when using public lands.
9. I will not harass wildlife. I will avoid areas posted for the protection or feeding of wildlife.
10. I will stay on marked trails or marked roads open to snowmobiles. I will avoid country travel unless specifically authorized.
13. Never attempt to repair your machine while the engine is running.
14. Check all machine components and hardware frequently, especially skis and steering.
15. Never lift rear of machine to clear the track. Tip machine on its side and be sure no one is behind machine.
16. Winch snowmobile onto a tilt-bed trailer, never drive it on. Secure machine firmly to trailer and ensure trailer lights operate.

## SNOWMOBILE SAFETY

### General Tips

1. Read your owner's manual and know your machine.
2. Check throttle and brake controls before starting the engine. Frozen controls can cause serious injury.
3. Know how to make an emergency stop.
4. Know all state, provincial, federal, and local laws concerning snowmobiling. Respect private property.
5. Never add fuel while smoking or when engine is running. Always use fresh, properly mixed fuel. Improper fuel mixtures can cause engine failure, and can leave you stranded in severe weather.
6. Wear adequate clothing to avoid frostbite. Never wear any loose scarves or belts that could catch in moving parts or on tree limbs.
7. Wear eye and head protection. Wear tinted goggles or face shields to guard against snowblindness. Never wear yellow eye protection.
8. Never allow anyone to operate the snowmobile without proper instruction.
9. Use the "buddy system" for long trips. A snowmobile travels farther in 30 minutes than you can walk in a day.
10. Take along sufficient tools and spare parts for emergency field repairs.
11. Use a sled with a stiff tow bar for carrying extra supplies. Do not overload your snowmobile.
12. Carry emergency survival supplies when going on long trips. Notify friends and relatives of your destination and expected arrival time.
3. Cross highways (where permitted) at a 90 degree angle after looking in both directions. Post traffic guards if crossing in groups.
4. Do not ride snowmobile on or near railroad tracks. The snowmobile engine can drown out the sound of an approaching train. It is difficult to maneuver the snowmobile from between the tracks.
5. Do not ride snowmobile on ski slope areas with skiers.
6. Always check the thickness of the ice before riding on frozen lakes or rivers. Do not panic if you go through ice; conserve energy.
7. Keep headlight and taillight areas free of snow and never ride at night without lights.
8. Do not ride snowmobile without shields, guards, and protective hoods.
9. Do not attempt to open new trails at night. Follow established trails or unseen barbed wire or guy wires may cause serious injury or death.
10. Always steer with both hands.
11. Be aware of terrain and avoid operating snowmobile at excessive speed.
12. Do not panic if throttle sticks. Pull "tether" string or push emergency stop switch.
13. Drive more slowly when carrying a passenger, especially a child.
14. Always allow adequate stopping distance based on ground cover conditions. Ice requires a greater stopping distance to avoid skidding. Apply brakes gradually on ice.

### Operating Tips

15. Do not speed through wooded areas. Hidden obstructions, hanging limbs, unseen ditches, and even wild animals can cause accidents.
16. Do not tailgate. Rear end collisions can cause injury and machine damage.
17. Do not mix alcoholic beverages with snowmobiling.
18. Keep feet on footrests at all times. Do not permit feet to hang over sides or attempt to stabilize machine with feet when making turns or in near-spill situations; broken limbs could result.
19. Do not stand on seat, stunt, or show-off.
20. Do not jump snowmobile. Injury or machine damage could result.
21. Always keep hands and feet out of the track area when engine is running. Use extra care when freeing snowmobile from deep snow.
22. Check fuel supply regularly. Do not travel further than your fuel will permit you to return.
23. Whenever you leave your machine unattended, remove the "tether" switch.

### Preparing for a Trip

1. Check all bolts and fasteners for tightness. Do not operate your snowmobile unless it is in top operating condition.
2. Check weather forecasts before starting out on a trip. Cancel your plans if a storm is possible.
3. Study maps of the area before the trip and know where help is located. Note locations of phones, resorts, shelters, towns, farms, and ranches. Know where fuel is available. If possible, use the buddy system.
4. Do not overload your snowmobile. Use a sled with a stiff tow bar to haul extra supplies.
5. Do not risk a heart attack if your snowmobile gets stuck in deep snow. Carry a small block and tackle for such situations. Never allow anyone to manually pull on the skis while you attempt to drive machine out.
6. Do not ride beyond one-half the round trip cruising range of your fuel supply. Keep in mind how far it is home.
7. Always carry emergency survival supplies when going on long trips or traveling in unknown territory. Notify friends and relatives of your destination and expected arrival time.

8. Carry adequate eating and cooking utensils (small pans, kettle, plates, cups, etc.) on longer trips. Carry matches in a waterproof container, candles for building a fire, and easy-to-pack food that will not be damaged by freezing. Carry dry food or space energy sticks for emergency rations.

9. Pack extra clothing, a tent, sleeping bag, hand axe, and compass. A first aid kit and snow shoes may also come in handy. Space age blankets (one side silverfoil) furnish warmth and can be used as heat reflectors or signaling devices for aerial search parties.

### Emergency Survival Techniques

1. Do not panic in the event of an emergency. Relax, think the situation over, then decide on a course of action. You may be within a short distance of help. If possible, repair your snowmobile so you can drive to safety. Conserve your energy and stay warm.
2. Keep hands and feet active to promote circulation and avoid frostbite while servicing your machine.
3. Mentally retrace your route. Where was the last point where help could be located? Do not attempt to walk long distances in deep snow. Make yourself comfortable until help arrives.
4. If you are properly equipped for your trip you can turn any undesirable area into a suitable campsite.
5. If necessary, build a small shelter with tree branches or evergreen boughs. Look for a cave or sheltered area against a hill or cliff. Even burrowing in the snow offers protection from the cold and wind.
6. Prepare a signal fire using evergreen boughs and snowmobile oil. If you cannot build a fire, make an S-O-S in the snow.
7. Use a policeman's whistle or beat cooking utensils to attract attention or frighten off wild animals.
8. When your camp is established, climb the nearest hill and determine your whereabouts. Observe landmarks on the way, so you can find your way back to your campsite. Do not rely on your footprints. They may be covered by blowing snow.