Field Gear

Shelters

Before field teams deploy to the field, they should become experienced in erecting the tents they are issued. The tents should be set up in McMurdo and their condition double-checked.

Tents should have a solid anchor for every guy line, and these should be checked daily to ensure they are tensioned. Loose guy lines make the tent more prone to wind damage, and they make catastrophic failures in a storm more likely. Hard knots should be avoided. Instead, use taut-line hitches or trucker's hitches for guy lines, as they are easy to undo. Field team members should practice and become familiar with these knots before deploying.

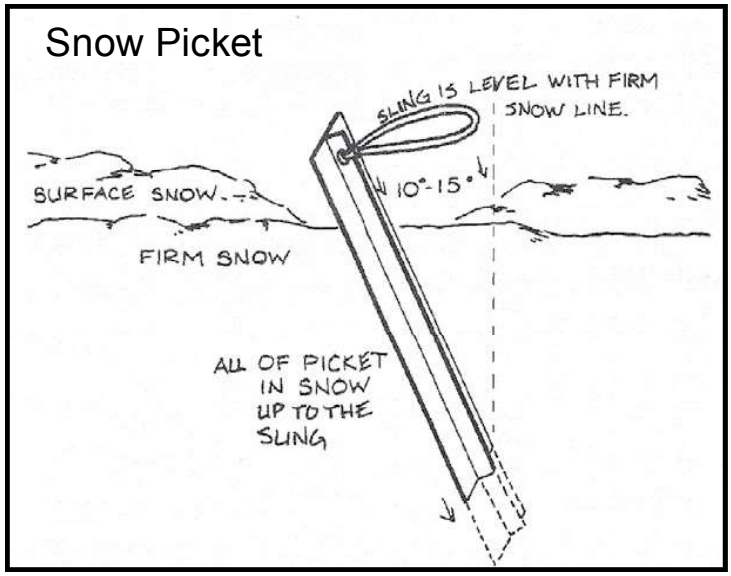
Anchoring Tents at Deep-Field Snow Camps

Establishing Wind Direction

The most important factor in the set-up process is securely anchoring the tent so it can withstand high winds. Field teams should first determine the prevailing wind direction by observing patterns in the snow. Long rows of drifts (sastrugi) in, for example, a north-south orientation will indicate that the prevailing wind is either from the north or south. Look for etching at the ends. If the prevailing wind is from the south, the snow at the southern end of the sastrugi will be etched. Orient the tent with the main door opening downwind but at a 45-degree angle to the prevailing wind. This will help prevent drifting that blocks the door.

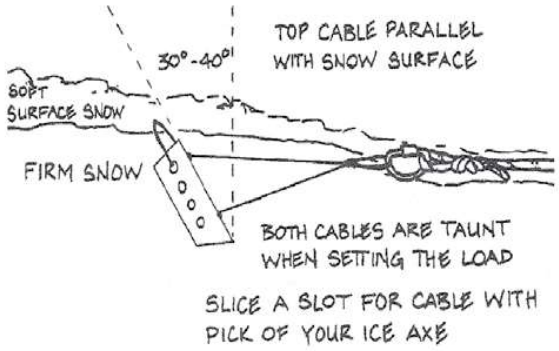
Anchoring in Hard Substrate

The best method for anchoring a tent is determined by the substrate. If the snow or ground is hard-packed, hammer long stakes or sections of bamboo ("pickets") at a 15-degree angle away from the tent, and attach guy lines to these.

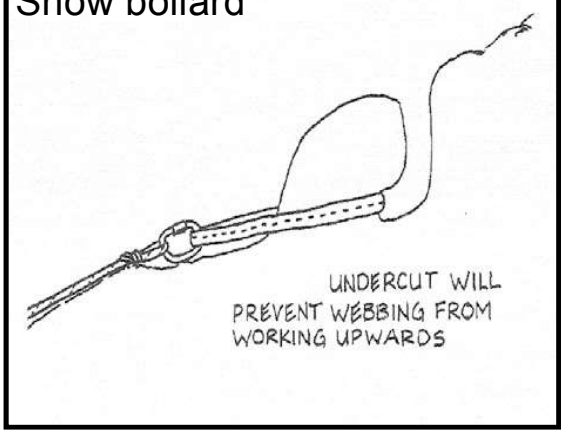


Snow flukes and snow bollards represent additional ways to anchor tents, camp items, or other objects in hard snow areas (see illustrations on following page).

Snow fluke



Snow bollard

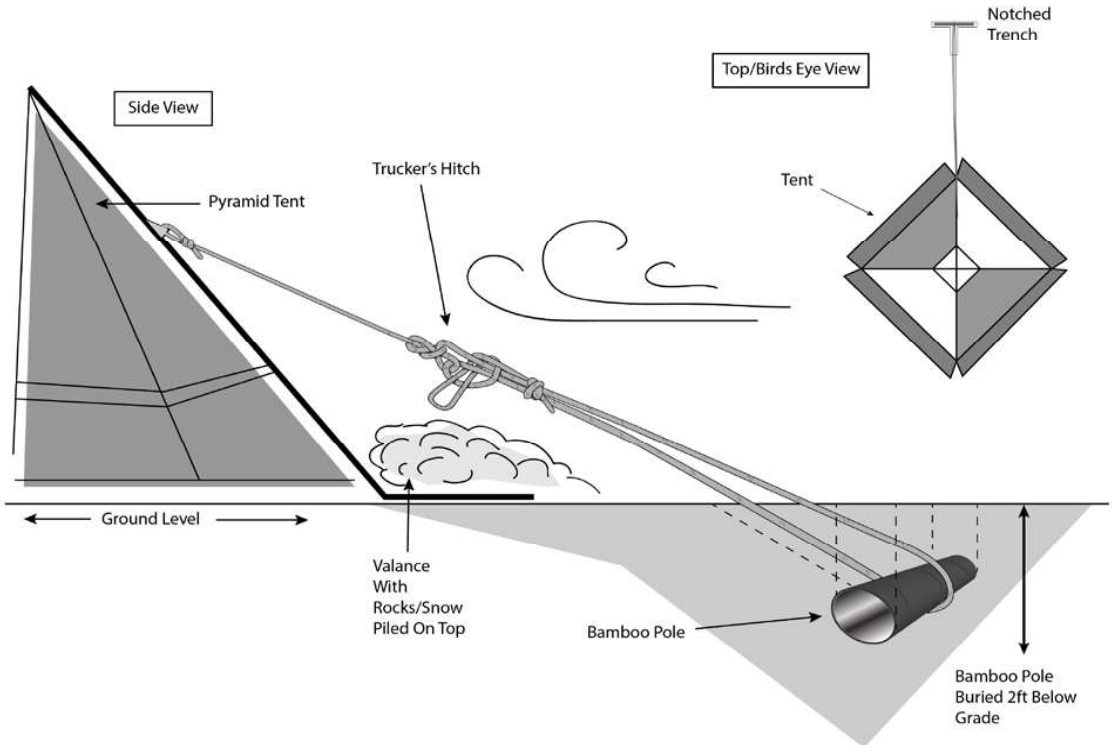


Anchoring in Soft Substrate

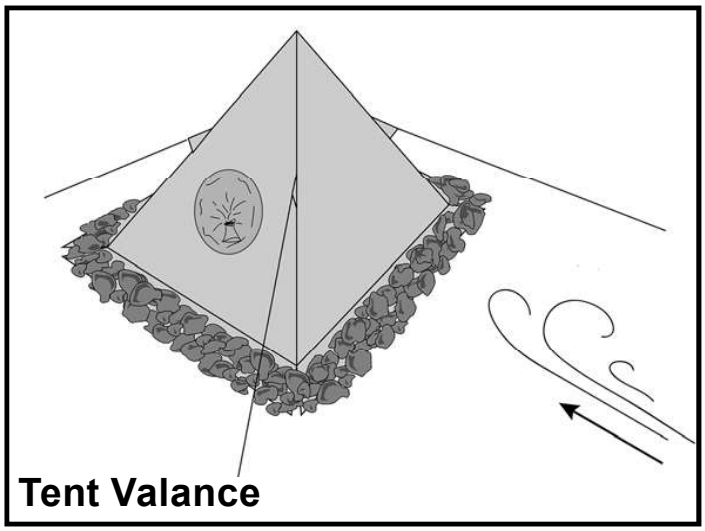
If the snow, sand, or soil are soft, bury a long stake or piece of bamboo ("deadman") in a slot perpendicular to the angle of pull, with a guy line attached at the mid-point. The guy line runs in a straight line from the deadman to the tent, via a slot notched in the ground or snow. The deadman should not be buried too close to the tent or it will be pulled upward when the line is tensioned. In very soft snow, the deadman anchor should be buried two feet deep or more.

Note: If anchoring on rocky land, especially in a volcanic area with sharp rocks, be aware that the guy line exiting the ground from the deadman could abrade in windy conditions. Monitor it frequently

Deadman anchor



and replace it if necessary. Alternatively, fabricate a make-shift sheath around the line from rock sample bags or whatever else may be on hand. Placing a length of bamboo between the guy line and ground may also help keep the line off sharp rocks.



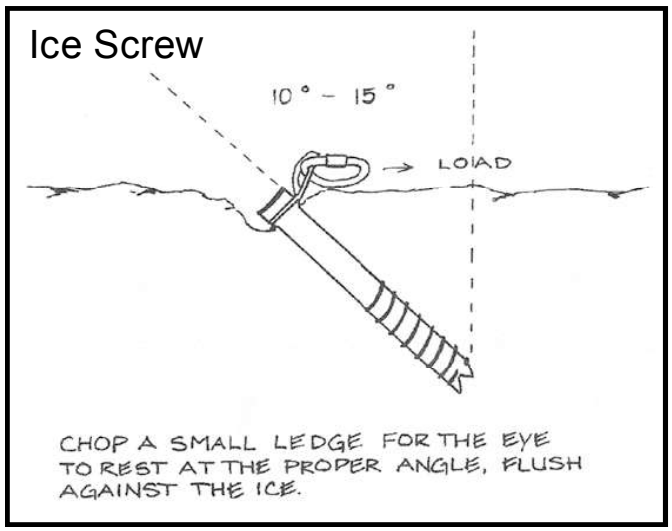
Tent Valance

Tent Valance

All issued tents have a valance or "skirt" on either the tent fly or body. These should be fanned out flat and weighted down with snow or rocks to help keep the tent anchored in windy conditions. This also prevents wind from going underneath the valance and lifting up and damaging the tent. It also helps keep the tent warmer. Be careful not to pile rocks onto the wall of the tent, as this could abrade and tear the fabric in high winds.

Snow Walls

Snow walls, which are constructed with blocks cut from the snow, shelter tents from wind. If it is a windy day or if the camp is at a windy location, field teams may need to construct walls before attempting to set up a tent. Ideally, blocks are cut with a saw in hard-packed snow, but a shovel or ice ax may work. Since snow conditions can change over a small area, probe the snow to see if there is an area harder than others. If only soft snow conditions exist, the snow can be packed down with boots to see if it hardens (sinters) after an hour or more.

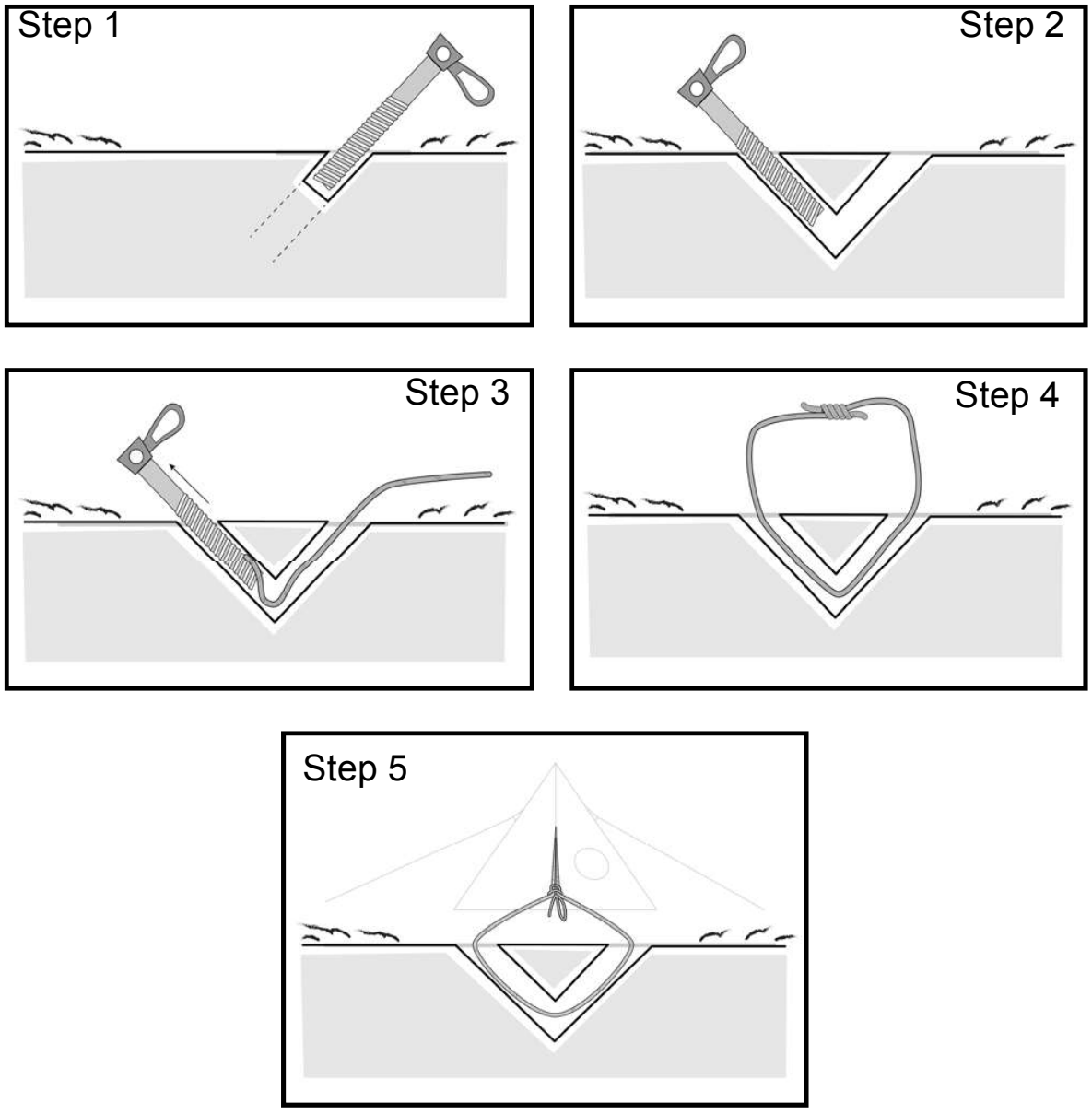


Anchoring Tents on Sea Ice and Blue-Ice Glaciers

If the snow on the ice is deep enough, anchor the tent as described above. Otherwise, clear off any snow and anchor the tent to the ice with ice screws. Team members may also drill V-threads (two holes

that intersect to form a V-shaped channel), use an ice screw or ice drill to feed a guy line through the channel, and attach the line to the tent.

V-Thread Anchor



Anchoring Tents in the McMurdo Dry Valleys

It is important that field teams adhere to environmental regulations and consider helicopter restrictions for site selection and camp set-up in the Dry Valleys. Team members should consult with the environmental department before departing for the field. Most commonly visited Dry Valley areas have pre-determined camping locations.

Large boulders can provide a wind break, and large rocks or stacks of rocks can be tied off as anchors. If the field team is using metal stakes for anchors, it may take several minutes to sledge

hammer each one into the frozen soil. If the team intends to move camp, members should take extra anchors, as it may be difficult to remove some from the frozen soil.

Emergency Shelters

If a tent is lost, the first and most important order of business is to arrange for protection from the wind, as this will increase the odds of survival.

The quickest emergency shelter to construct in snow is a trench. Dig a three-foot-deep, shoulder-width trench in the snow, making it long enough for a person to lie down, with extra room for gear. Cover the trench with a tarp, and anchor the tarp with snow blocks, bamboo stakes, shovels, sleds, or other equipment. Snow blocks or slabs may also be used to cover the trench opening. A trench can accommodate two people if the bottom is excavated to form a bell shape. However, the surface opening should remain shoulder wide.

Other emergency snow shelters are snow mounds (Quinzhee huts), snow caves, and igloos. Keep in mind that ventilation is critical if a stove is to be operated in any snow shelter.

On sea ice or on a blue-ice glacier, a wind break can be created by re-positioning snowmobiles and sleds.

Stoves and Heaters

The Berg Field Center (BFC) issues propane and white-gas cooking stoves to field parties. The Facilities department maintains the heaters in semi-permanent field camps and sea-ice huts. This guide provides information on stove and heater safety, basic operation, and troubleshooting. Contact Facilities or BFC personnel for assistance or further guidance.

Stove Safety

Liquid-fuel stoves are potentially hazardous due to the flammability of the fuels and the toxicity of the carbon monoxide they produce. Therefore, it is important for field personnel using a stove to follow these safety measures:

- Test all stoves before field deployment.
- Do not use stoves without adequate ventilation.
- Do not release fuel-tank pressure near an open flame.
- Use extreme caution when refueling. Skin contact with supercooled fuel can cause instant frostbite.

- Check for leaks before every use.
- Release pressure in the fuel tank before packing and storing.
- Pack stoves and fuel away from food.
- Do not cook in mountain tents, except in emergencies.
- Preheat the stove outside the tent.
- Insulate base of stove so it won't melt through tent floor.

Residues of evaporated gasoline are combustible. Designate a pair of gloves for fueling operations and don't use them near stoves. Should a person's clothing become ignited, stop, drop, and roll to extinguish flames.

Carbon Monoxide Risks

Carbon monoxide (CO) is a colorless, odorless, tasteless, and toxic gas produced by the incomplete combustion of carbon compounds, including the fossil fuels used in heaters and stoves. Dangerous amounts of CO can accumulate when fuel does not burn properly and/or when an area is poorly ventilated. Both of these situations can occur when someone is cooking in or heating a tent.

CO displaces oxygen in the bloodstream, starving the heart, brain, and other vital organs. People are even more susceptible to CO poisoning at altitude.

Carbon Monoxide is Dangerous

There have been several cases of CO poisoning in Antarctic field camps from improper stove use. This is completely avoidable. The best way to prevent CO poisoning is to ensure that any structure in which cooking is taking place is well ventilated. Because CO has no color, taste, or smell, it is better to be safe than sorry. In short:

- ALWAYS ventilate the tent.
- NEVER cook in or heat a tent without leaving a door or window cracked.
- Be especially vigilant if sleeping in a heated structure.
- VENTILATE, VENTILATE, VENTILATE!

Also, field teams must use a CO detector (issued from the BFC) when cooking, but the detector should not be attached directly to the stove. The detectors are not fool-proof, so all team members should remain vigilant of CO risks and symptoms. For information on the signs, symptoms, and treatment of CO poisoning, consult the First Aid section of this manual or contact the medical department.

MSR® WhisperLite™ Stove

Assembling the Stove

1. Fill the MSR® fuel bottle to within two inches of cap.
2. Screw the pump snugly into the fuel bottle.
3. Pump the plunger 15 to 20 times for a full bottle. Additional strokes will be necessary if the bottle is not full.
4. Insert the fuel line through the hole in the heat reflector.
5. Rotate the stove legs into the slots in the flame reflector.
6. Insert the end of the fuel line into the fuel-tube bushing on the pump. Lubricate the end of the fuel line with lip balm, and be extremely gentle when inserting.
7. Snap the catch arm securely into the slot on the pump body.

Operating the Stove

Priming:

1. To preheat the stove, the priming flame must contact the generator tube.
2. Open the control valve until fuel flows through the jet and fills the priming cup ½ full.
3. Close the control valve.
4. Light the priming cup or wick.
5. Place a windscreen around the stove.

Lighting:

1. As the priming flame diminishes, slowly open the control valve.
2. If the stove goes out, wait for the stove to cool and re-prime it.
3. If the stove burns with a yellow, erratic flame but the priming cup is still burning, turn the control valve off and prime longer.

Cooking:

- The stove should burn with a steady blue flame.
- To simmer, operate the stove with low pressure in the fuel bottle.
- Note that there is a delay between control valve turns and changes in flame intensity.

Shutting Off the Stove:

1. Turn the control valve off.
2. Wait for the stove to cool before disassembling.
3. To depressurize the fuel bottle, move away from heat,

sparks, or flame. Turn the stove assembly upside down and open the control valve. Pressure will be eliminated through the jet.

Safety Tips

- Do not use these stoves in mountain tents.
- Ensure the stove assembly has no fuel leaks.
- Securely lock the catch and ensure the stove is properly assembled.
- Clear the area of flammables and spilled fuel.
- Do not open the control valve more than three full turns.

MSR® WhisperLite™ Stove Troubleshooting		
Problem	**Possible Cause**	**Remedy**
Fuel leaks at control valve	Control valve O-ring torn or damaged	Replace O-ring*.
	Control valve threads are damaged or stripped from over-tightening	Replace with new pump.
Fuel leaks at pump/fuel bottle connection	Incorrect fuel bottle in use	Use only MSR® fuel bottle.
	Bottle threads are damaged or bottle is dented	Replace bottle.
	Fuel bottle O-ring is torn or damaged	Replace O-ring*.
Fuel leaks at fuel line/pump connection	Fuel tube O-ring is torn or damaged	Replace O-ring*.
	Fuel tube bushing is damaged or missing	Replace bushing*.
Fuel leaks at fuel line	Fuel line is damaged	Replace fuel line or entire stove.
Fuel leaks at shaker jet	Shaker jet is loose	Tighten with jet and cable tool*.
	Shaker jet is damaged	Replace shaker jet*.
Fuel leaks through the shaker jet when control valve is off	The pump is damaged from over tightening the control valve	Replace pump.
Burner cap turns bright red and a dull roar is audible	The flame is burning under the burner cap instead of through the flame rings	Clean the jet, ensure the correct jet is installed, and ensure flame rings are clean and installed correctly.
Pump not pressurizing	Dry leather pump cup	Lubricate or replace pump cup.
	Dirt in check-valve assembly	Clean check-valve assembly.

Erratic yellow flame	Insufficient priming	Shut off the stove, let it cool down, and re-prime it.
	Fuel bottle is over-pressurized	Reduce bottle pressure.
	Improper fuel used	Replace fuel.
	Old or poor quality fuel	Replace fuel.
	Improper jet installed	Replace jet.
	Incorrect flame ring installation under burner cap	Re-install flame rings. Correct order is wavy, flat, wavy, flat, wavy, flat, wavy.
	Weather conditions are cooling the generator tube	Use windscreen and heat reflector.
	Lack of oxygen at high altitudes	Reduce fuel bottle pressure and open windscreen.
Reduced performance; diminishing flame, slow boil	Insufficient pressure in fuel bottle	Pump plunger as required to increase pressure.
	Obstructions in jet and/or fuel line	Remove obstructions.
	Incorrect jet installed for fuel type	Install correct jet.
* Stove and pump replacement parts available in the repair kit.		

Coleman® Gas Stove

Operating the Stove

Filling the Tank:

1. Close the valve and unscrew the tank cap. Do this carefully if the tank has pressure inside.
2. Use a fuel funnel (with filter) to fill the tank. Use white gas only.
3. Wipe off any spilled fuel and replace the cap.

Caution: Never open the tank around an open flame! Never remove the cap while the stove is running!

Pressurizing the Tank:

1. Close the cap and ensure the generator valve is closed.
2. Turn the pump plunger handle to the left to open.
3. Place a thumb over the small hole in the handle and pump 35 to 50 times.
4. Turn the plunger handle to the right to tighten.
5. Put the stove handle into the opening on the side, insert the generator into the mixing chamber, and place the tank in hanger brackets.

Lighting the Stove:

1. Close the auxiliary burner valve.
2. Turn the fuel-valve lever to the “up” position.
3. Hold a match above the main burner and open the fuel-flow valve wide.
4. Let the stove burn for one minute with fuel-valve lever up.
5. When the flame is blue, turn the valve lever down.

Note: Add more pressure if needed, but hold the tank firmly. If the flame does not burn fully, open and close the valve to clean the tip. After the main burner is lit, the auxiliary burner can be lit by opening the valve on the left side of the stove. If there are problems, refer to the “Troubleshooting Guide” included with the stove.

Shutting Off the Stove:

1. Put the fuel-valve lever in the “up” position and let the stove burn for one minute to reduce carbon deposits.
2. Turn off the valve. The flame will burn for a few minutes until the gas in the generator is gone. When the flame is out, let the stove cool before packing it away.

Coleman® Gas Stove Tips

Most problems associated with Coleman® stoves occur in extremely cold temperatures. This stove was not designed for use in sub-zero temperatures, and measures must be taken to enhance its performance:

- Use white gas only. Always use clean, filtered gas.
- Do not overfill the tank, as this impedes performance.
- The pump mechanism becomes impaired as temperatures drop. Keep the pump plunger oiled. Also, the rubber or leather pump cup sometimes dries out. It is essential to keep it oiled and pliable.
- In temperatures below -6°C, the stove generator must be preheated to ensure the fuel vaporizes. Apply priming paste along the generator and above the burner. Light it with a match. Allow at least three minutes of burning to ensure the stove is sufficiently preheated. When the flame burns down, make sure the lever is up and open the valve. The burner should light from the paste.
- Keep the stove and tank clean. Grease deposits can flame up. Line the inside of the stove with foil for easy cleaning.

Note: Place the stove where it can be thrown out of the tent in an emergency. Keep a small fire extinguisher nearby.

Coleman® Gas Stove Troubleshooting

If the fuel does not vaporize, liquid gas collects in the manifold assembly and a strong, blue flame cannot be achieved. The stove will sputter and spark, and the flame will be orange and sooty. If this occurs, shut the stove down and allow it to cool completely. Remove the tank assembly and clean fuel from the manifold and burners with absorbent pads provided in the spill kit (the small, black nylon bag). Replace the tank assembly and repeat the lighting process.

To access the control valve assembly (behind the knobs and under the burners) for troubleshooting:

1. Unscrew the burners
2. Turn the stove over and unscrew the nuts on the bottom. It should be possible to push the burner assembly up and release the retaining ring that holds the burner to the metal tray. Alternatively, spread the retaining rings to release the burner assembly.
3. Remove the metal tray for access to the burner and control valve assemblies.

Coleman® Gas Stove Troubleshooting

Problem	Possible Cause	Remedy
No pressure	Cracks, dryness, creases, or tears in pump	Remove and inspect pump; replace if necessary and oil.
	Leaking tank lid gasket	Check gasket; replace if necessary.
	A flooded pump cylinder indicates a faulty pump valve	Replace pump valve.
	Broken seal at valve assembly and tank junction	Tighten by one rotation, if possible; replace seal if necessary.
	Loose generator	Tighten.
Loses pressure too fast	The tank will lose pressure the longer it sits without periodic pumping	If pressure is lost soon after pumping, check all joints and gaskets.
	Leaky cap and gasket	Replace if necessary.
Yellow flame	Bad or dirty generator	Clean or replace.
	Manifold assembly is flooded	Turn stove off, cool, remove tank assembly, and wipe out excess fuel.
	Bad fuel	Drain and replace with new fuel.

Orange flame (on older stove with flame rings)	Corrosion on flame rings	Remove flame rings as on a white gas stove. Lightly use steel wool or a nylon brush to remove corrosion from each ring and improve flame quality.
Flame at generator/manifold assembly	Tip of generator is loose	Tighten.
Weak flame	Generator too cold	Preheat generator.
	Bad or dirty generator	Clean or replace generator.
	Pressure too low	Increase pressure.
	Manifold assembly is flooded	Turn stove off, cool, remove tank assembly, and wipe out excess fuel.
	Contaminated fuel	Replace fuel.
	Control valve nut too loose	Remove the metal tray (see above). There is a small nut where the copper tube meets the control valve assembly. Try tightening (or first loosening then re-tightening) this nut. This often works on new stoves that burn poorly.
Flaring	Loose gas tip	Tighten gas tip (at end of generator).
	Flooded burner	Shut down stove and dry it out
	Excessive pressure in tank	Reduce pressure.
	Insufficient priming	Shut down stove and re-prime.
	Premature switch to “on” position of fuel flow switch	Refrain from opening fuel flow switch too early.
	Contaminated fuel	Replace fuel.
	Grease in stove	Clean grease out of stove. Line the bottom of the stove with foil and change when dirty.
Poor gas flow to burner	Clogged generator	Clean or replace generator.
	Cleaning needle is non-functional or bent	Check the needle and replace if necessary.

Coleman® Propane Stove

Note: Propane cylinders should only be stored outside of a tent. Use a long propane hose though an opening in the tent door or window to connect the cylinder to the stove.

Setting up the Stove

1. Press on latch to open the lid.
2. Position the wind baffles.
3. Insert wire clips into slots.
4. Close both burner valves firmly.
5. Remove the regulator from storage under the grate.
6. Attach the regulator, hand tight, to hose or propane bottle.
7. Inspect the gasket on the stove connection before attaching the regulator.
8. Screw the regulator hand-tight onto the stove.

Operating the Stove

Lighting Electronic Ignition Stoves

1. Open the burner valve and rotate the igniter knob several times until the burner lights.
2. Use a match to light the burner if the igniter fails.

Lighting Standard Ignition Stoves

1. Hold a lighted match near the burner and open the valve.
2. Adjust the flame with burner valves.

Shutting the Stove Off

1. Close the burner valves firmly.

Storing the Stove

1. Remove the propane cylinder or hose.
2. Unscrew the regulator from the stove and store it under the cooking grate.

Preway® Diesel (AN-8) Heater

These heaters are installed in huts in the McMurdo Dry Valleys.

Lighting the Heater

1. Make sure the Preway® is level. This is very important! If it is not level, it will not burn correctly.
2. Make sure the outside fuel valve at the tank is open and the breather tube is open to prevent “air lock.” If there is no breather tube, loosen the upper bung cap.
3. Open the valve behind the Preway®.
4. Take a small piece of toilet paper, wrap it around the end of a wire, and place a small amount of burn paste on it.
5. Push the safety lever down on the carburetor.

6. Open the valve knob on the carburetor to “3” (the halfway position).
7. Allow a small amount of fuel (about two tablespoons) to puddle in the bottom of the burn chamber.
8. Shut off the valve knob on the carburetor.
9. Light the fuel in the burn chamber with the tissue on a wire, removing it once the fuel is lit.
10. Allow the fuel to burn until the flame is nearly out. This preheats the chamber.
11. Open the valve knob on the carburetor to “3” again and push down the safety lever.
12. Adjust heat as desired. Typically these heaters burn poorly and will soot excessively on either “1” (too low) or “6” (too high), reducing performance and requiring frequent cleaning. Stick with settings “2” through “5.” For reference, a properly burning heater doesn’t require cleaning more than once every couple of months.

Shutting Off the Heater

Close all valves and lift the safety lever on the carburetor.

Things Not To Do with a Preway®:

- Do not leave burned tissue in the chamber, and do not throw any other combustibles in the burn chamber. Yes, they will burn (partially), but the heater will soon stop working and be full of partially burnt ashes. The Preway® is not an incinerator.
- At start-up, do not turn the stove up to a high number immediately. Let the heater warm up first on “3” or it will make frightening “woofing” sounds.
- Don’t leave the burn chamber door open longer than necessary when the heater is burning. It interferes with proper drafting by letting too much air in.
- NEVER wire down the safety lever on the carburetor. If it needs to be “held down” for operation, there is an internal problem that needs to be addressed. Wiring down the lever poses two risks: 1) flooding the heater with too much fuel (creating a mess), or 2) flooding the structure with the full contents of the fuel barrel (even bigger mess).

Kuma® Stoves, ARCTIC Heater

Kuma Stoves will replace the old Preway heaters and are installed in sea-ice huts, some Dry Valleys huts, and at deep-field fixed camps.

Caution: The handles on the side of the heater are surprisingly hot.

Do not touch or hang towels or clothing over the handles.

Please read instructions completely before lighting the stove.

Starting the Heater

1. Be sure that the burn chamber is clean before lighting.
2. Open stove door and remove stainless steel mesh cylinder and burn ring from the burn pot.
3. Turn on all supply valves (tank and in-line valves).
4. If there are any leaks in the system, turn off all valves immediately.
5. Turn control knob on carburetor to setting 1.
6. Move ON/OFF lever on carburetor to the correct position to start the flow of fuel oil into the burn pot. Depending on what model of carburetor is on your particular stove, it may need to be pressed down for ON, or be pulled up for ON. The correct orientation will be indicated on each carburetor near the ON/OFF lever.
7. When enough fuel has entered the burn pot to fill the center groove (~ 4 tablespoons), turn the control knob AND the carburetor lever OFF.
8. Replace burn ring into the burn pot so the cupped part of the ring is face-up (as if it would hold water). The stove will not burn properly if the ring is face down.
9. Squeeze a small amount of burn paste (about the size of a marble) onto the end of the metal wire, light the paste, and place the fireball into the puddle of oil in the burn pot. Using the wire, spread the fireball around the fuel puddle.
10. Replace the stainless mesh cylinder and close the door tightly (turn door handle until it is snug). Do not overtighten!
11. Wait for the fuel in the burn pot to catch fire. After the flame begins to die down (it could take several minutes), turn the carburetor ON again (ON/OFF lever) and turn the control knob to setting 1.
12. The flame should gradually get larger and within a few minutes the stove should begin burning a blue flame.
13. Run the stove for at least 15 minutes on low (setting 1) to allow chimney and stove to heat up before adjusting the temperature. Failure to allow proper heating time will cause the system to soot up.
14. After fifteen minutes, turn control knob (1 to 6) to achieve desired heat level. Repeat: Make sure the flue and stove are warmed up before making any carburetor adjustments.

Adjustments should be of no more than one-quarter turn, and each should be allowed to stabilize for five minutes before making any further adjustments.

Warning: Do not light a flooded or hot stove!

Warning: Do not throw foreign objects in burn chamber! No paper, wrappers, matches, or used tissues!

Note: Tissue paper can be used to light fuel if you run out of burn paste, but do not leave burned tissue paper in burn pot.

Shutting Off the Kuma Heater

1. Trip the float switch on the carburetor and turn the dial on the carburetor to 0 or "off" (clockwise).
2. The ball valve near the fuel filter can also be turned off to stop the flow of fuel to the heater. Do not adjust the "firematic" valve that is between the fuel filter and the stove (the only round handle on the fuel line that resembles a spigot).

Empire® Vented Propane Heater

These heaters are installed in sea-ice huts.

Starting the Heater

1. Turn on propane at the tank by turning the knob all the way to the left.
2. Open the combustion air vents on the wall.
3. Open the valve behind the stove (the handle in line with the tube to the stove).
4. Set the heat dial (numbered 1-7) to "1."
5. Remove the front panel of the stove by lifting the bottom out and then up.
6. Remove the pilot-light sight glass.
7. Push and hold down the control knob; turn from "off" past "ign" to "pilot."
8. Light the pilot with a match; don't bother with the piezo igniter.
9. Hold the control knob down in "pilot" position for one minute after lighting.
10. Let the control knob pop up and move it to the "on" position.
11. Replace the sight glass and front panel of stove.
12. Adjust heat dial as desired.

Shutting Off the Heater

1. Set heat dial to “1” and control knob to “pilot.”
2. Close combustion air vents.

Note: The pilot light should be left on at all times unless the tank is being changed or the hut is being moved. Be sure and turn off the propane at the tank if moving the hut.

Sleds

The Berg Field Center (BFC) issues several types of sleds that can be towed behind a snowmobile or pulled with a rope by someone skiing or walking. Each field team should consult with BFC staff to determine which sled type matches the team’s requirements.

Loading and Securing Cargo

Following are illustrations showing how to distribute the cargo load on a Nansen sled. The same principles apply to the other sleds.

Load the heaviest items on the bottom. Place small items in sled bags. The survival bag should be placed at the top of the load, along with anything the team members might need during the day. Rock boxes (18” L x 12” H x 12” D wooden boxes) make convenient containers for fieldwork and can be loaded with both samples and gear. Rock-box platforms are available if the team anticipates hauling a large number of boxes.

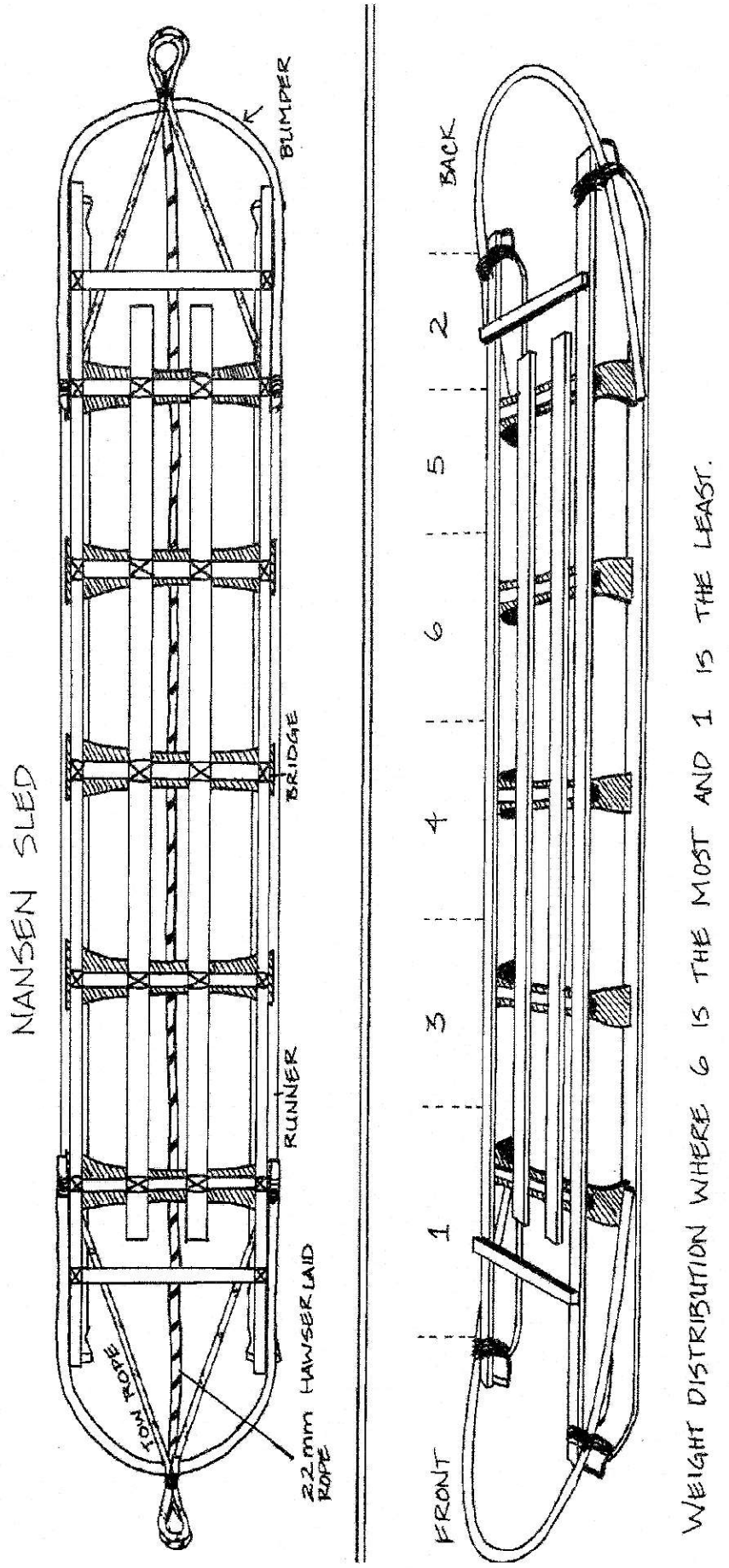
It is best to transport fuel drums on drum cradles for stability.

- Nansen sleds can haul two drums side to side.
- Siglin® ultra high molecular weight (UHMW) sleds can also accommodate two drums side to side.
- Komatik sleds can carry up to five drums side by side.

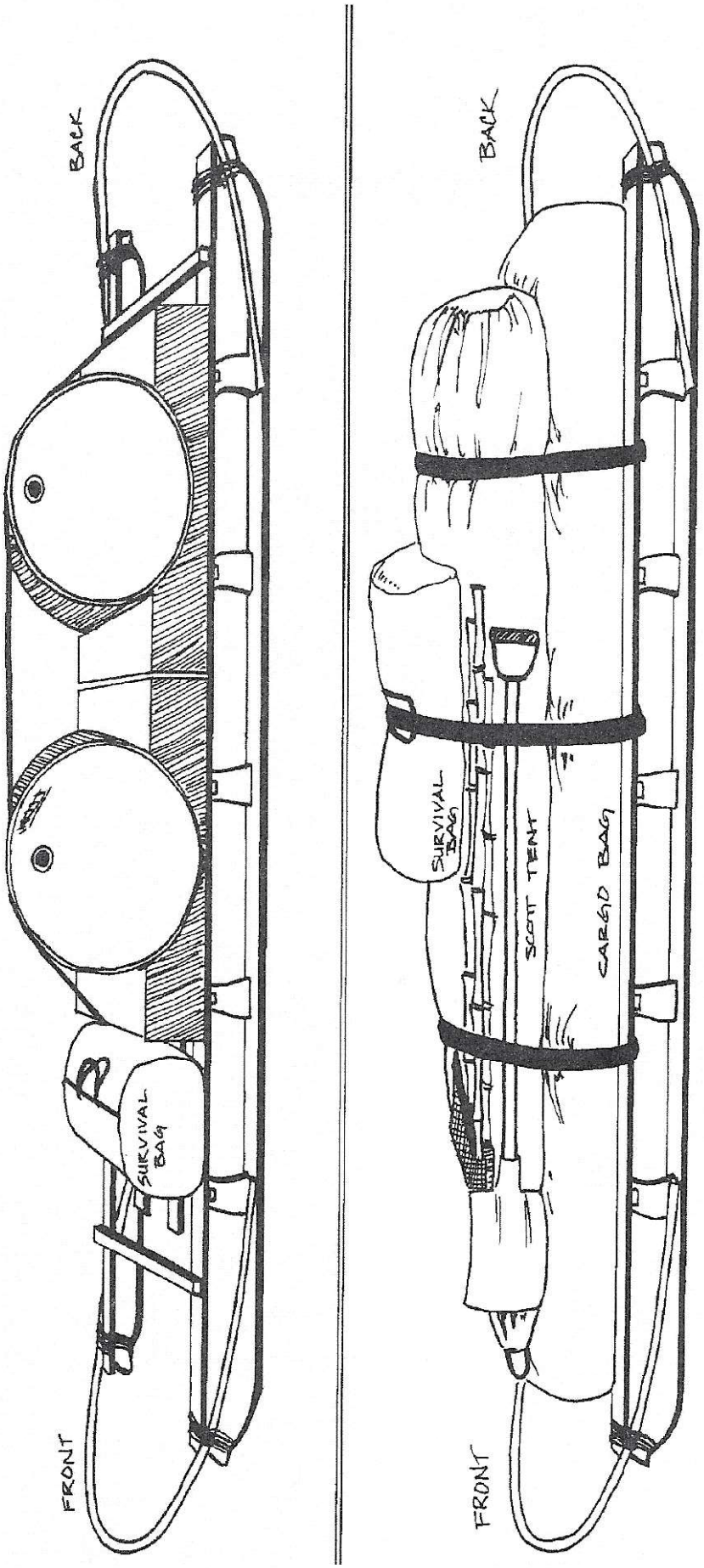
Secure the finished load tightly with cord, cargo straps, or bungee cords. Banana sleds have fabric cargo covers attached along the sides. The fabric folds over the cargo and is tied down. Siglin UHMW sleds have side ropes for lashing down gear.

Avoid using hard knots when rigging loads for travel. Use taut-line hitches or trucker’s hitches instead, as they are easy to undo if it becomes necessary to re-tension a cord. Be sure to check all lashings periodically and every time the team stops for any reason. Also inspect the snowmobile, tow plate, ropes, and sled at the same time for any developing structural issues. Re-tighten the lashings if they have become loose. It is prudent to bring extra lashing supplies into the field.

Nansen sled weight distribution example



Nansen sled load example



Pulling Sleds with a Snowmobile

With ideal surface conditions, a tail wind, and light loads, a snowmobile may achieve seven miles per gallon (mpg). Soft snow conditions, heavy loads, and strong head winds significantly reduce fuel efficiency. Mileage can drop to as low as two to three mpg. In good conditions, a snowmobile may be able to pull up to 2,000 pounds. Soft snow and a head wind will reduce that substantially. It is important for field teams to keep these things in mind when planning loads and fuel consumption.

Snowmobile operators pulling a sled should adhere to the following rules:

- Attach sleds equipped with rigid tongues directly to snowmobiles. Other sleds attach with a tow rope.
- Before driving, rock sleds back and forth to break the runners and bottom free of the ice.
- Drive slowly. Driving fast over uneven terrain may cause a sled to tip over, which can damage not only the sled and cargo, but the snowmobile as well.
- Drive even more slowly if pulling passengers.
- Maintain situational awareness and regularly look back to ensure everything is riding securely, especially passengers.
- Stop gradually so the sled doesn't run into the back of the snowmobile.

Snowmobiles

The Mechanical Equipment Center (MEC) provides training in the operation and maintenance of snowmobiles, generators, and other equipment to science team members before they deploy to the field. General operation and troubleshooting guidance is provided here as a reference. Contact the MEC for assistance or further guidance, if required.

Operational Guidelines

- All riders and passengers must wear a helmet! This includes people pulled on a sled behind a snowmobile.
- Each operator is responsible for checking the machine before each use.
- Ensure the correct fuel is used. Snowmobiles have two-stroke engines that require gasoline (mogas) pre-mixed with lubricating oil. The mixture ratio is 50:1 (12 ounces of oil per five gallons of mogas).

- To avoid over-working the electric starter, the pull starter should be used when the engine is cold.
- A snowmobile's center of gravity is just in front and toward the bottom of the fuel tank. Operators must shift body weight for turning and as needed for the load, the terrain, and the snow and ice conditions.
- Be mindful of track tension. In general, if the track is slapping against the frame tunnel while the snowmobile is in motion, it is too loose. Adjustments to both tension and alignment are made via long bolts at the end of the suspension.
- Watch for loose trailing straps and ropes, as these can get tangled in the tracks and around axles.
- Never shift the transmission unless the snowmobile is stopped. Shift gently. If gears will not engage, turn off the engine, shift gears, and restart. Abusive shifting can cause drive-train problems that are not repairable in the field.
- Park snowmobiles so they face into the prevailing wind, and always cover them. This reduces the likelihood of snow fouling the points and accumulating under the cowling.

Preventative Maintenance

Daily

- Check operation of the snowmobile.
- Check the suspension, particularly when operating on ice. Look for broken suspension components.

Weekly

- Check for loose mounting bolts on bogie wheels, skis (particularly the two bolts through the springs), rear suspension, and steering. A small suspension problem can rapidly become serious (e.g., slashed tracks, broken bogie mounts).

Loading, Towing, and Driving

Loading

- Maintain a low center of gravity.
- Place survival packs on the front to help maintain ski contact on hills.
- Keep straps tied down; ensure there are no loose ends.
- Place frequently used items where they are easy to access.

Towing a Sled

- Sleds may be towed with rigid tongues or ropes, depending on the circumstances. Rigid tongues are preferable.

- Check the hitch mechanisms on both snowmobile and sled for proper operation.
- Cover the load to protect it from track spray, if necessary.
- Check load tie-downs for tightness and security shortly into each trip.
- Check both the sled and the load frequently.

Driving

- Whenever possible, drive on a proven trail or a hard surface.
- If driving in powdery snow and the snowmobile begins to bog down, head in the straightest line possible for firmer or packed snow; sharp turns will compound the problem. Maintain the throttle.
- If the machine slows and reaching firmer snow appears impossible: STOP! DO NOT CONTINUE SPINNING THE TRACK!
  – Tip the snowmobile on its side (in both directions, if necessary), clear snow from the track, and pack the snow under the track.
  – Dig a ramp out of the hole and attempt to ease the machine out of the hole, with other people pushing. Or use a tow rope and have another snowmobile pull the stuck one out.

  Caution: If a stuck machine does not come out quickly when towing it, stop towing and dig more. Continual towing wears drive belts prematurely and can cause them to break. It can also damage engine parts.

Troubleshooting

Fuel Flow Problems

Symptoms: The engine cranks but it won't run; no fuel is present in the line from the pump to the carburetor; the engine may run briefly after priming.

Diagnosis and Cure:

1. Check the fuel level in the tank.
2. Pry the fuel line off the carburetor, pressurize the fuel tank (i.e., seal and blow into the vent line) to see if fuel flows out the end of fuel line. Crank the engine to see if fuel pulses out the end of fuel line.
3. If fuel flows adequately and pumps adequately, the problem may have been small ice crystals in the fuel pump valves. Pressurizing the tank dislodged them, solving the problem. Replace the line and continue operation.

4. If fuel flows when the tank is pressurized but does not pump, the problem is in the fuel pump. First, disconnect the vacuum pulsation line from the center of the fuel pump to the engine crankcase. Blow through the line. If it is blocked, clean ice out of the line with wire. Check the nipples on the pump and crankcase for obstructions. If the vacuum line is operational but fuel still does not pump, replace the pump or remove it and thaw it.
5. If fuel will neither flow nor pump, then either the line or the fuel filter is clogged. Clean the line or replace the filter.
6. If the tank is under vacuum pressure when the cap is open, check the vent line for obstructions or pinches. Occasionally the vent hose will rub on the exhaust and melt. Make sure the tank is venting properly.
7. If all of the above is tried and still no fuel flows, check the line for cracks or holes. Look for any obvious fuel deposits (i.e., discolored snow) in the engine compartment. Repair or replace the line.

Starter/Cranking Problems

Symptoms: Engine cranks slowly or not at all when key is turned.

Diagnosis and Cure:

1. Usually this problem indicates a dead battery. If that is the case, the engine must be pull-started. Once the engine is running, the battery should begin to recharge, unless it is shorted or the rectifier is faulty. The battery can also be charged with an AC charger, if one is available.
2. If the battery is fine, check the in-line fuse (30 amp) in the red wire near the starter or see if the red-green wire has slipped off the terminal on the starter solenoid. Finally, the starter itself may be faulty.

Spark Problems

Symptoms: The engine cranks but it won't start. Fuel is present in the line between the fuel tank and carburetor.

Diagnosis and Cure:

1. Remove both spark plugs. Push the spare plugs into the wire caps, ground the metal plug bodies to the metal engine housing, and crank the engine. If a spark can be seen at the electrodes of the spare plugs, the problem may be that the installed plugs were fouled with excessive fuel, ice, or a piece of carbon. Install the new plugs or clean and reinstall the old ones. Note: When the engine is cold, it may be hard to see the spark in direct sunlight.

2. If a spark is not present, the problem is in the electrical system. First, check the kill switches and all electrical connectors. If they are in the correct position and operational, the solution to the problem depends on the engine type.
    a. 503/550: These models have an electronic ignition, so the problem is probably the igniter box. Replace the igniter box.
    b. Other engines: The problem may be a bad coil or a shorted wire.

Power Problems

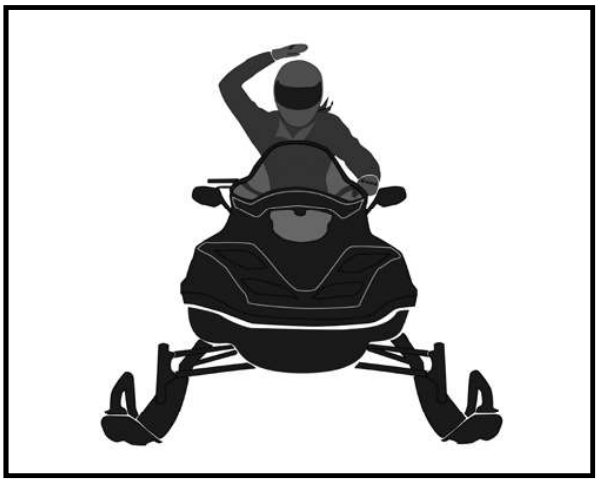
Symptoms: The snowmobile runs but it lacks power.

Diagnosis and Cure:

- If engine seems to be running fine, but the snowmobile has trouble with uphill starts, the problem may be with the clutch-driven pulley. Remove the cowling and see where the belt is riding on the pulley. It should be along the outer edge of the driven pulley when the snowmobile is at rest. If the belt is instead slotted down between the driven-pulley halves, check for ice in the drive and driven pulley. Shift the transmission into neutral and rev the engine slowly until the belt works its way to the outer edge.
- If the engine has very low power or dies when revved, remove the carburetor and check for ice. If ice is present, thaw out the carburetor and reinstall it. If the engine is weak and runs rough, but the carburetor is ice free, the problem may be a bad spark in one cylinder. Follow the procedures outlined in Spark Problems.
- The problem may be altitude. If hill-climbing performance is weak and the problem isn't the belt or an iced-up carburetor, check the spark plug color. Chocolate brown is correct; gray or white too lean; and black signifies a mixture that is too rich. For altitudes up to 4,000 feet, decrease jet size by one increment from the standard setting (i.e., 290 to 280). From 4,000 feet to 8,000 feet, decrease it by two increments. From 8,000 feet to 11,000 feet, decrease it by four. Remember to enrich the mix when returning to lower altitudes.

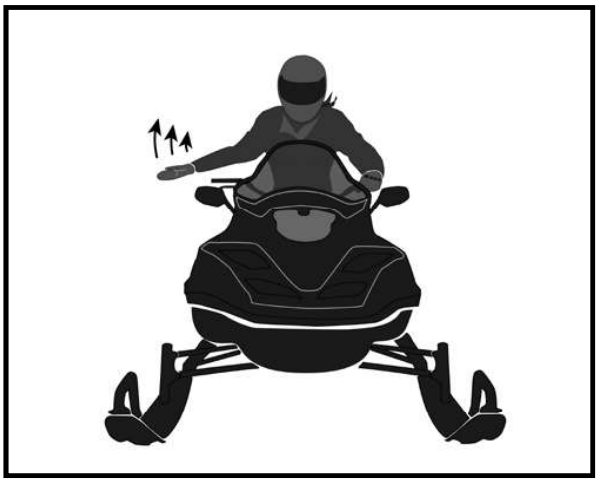
Driver Communication

Hand signs for group travel on snowmobiles



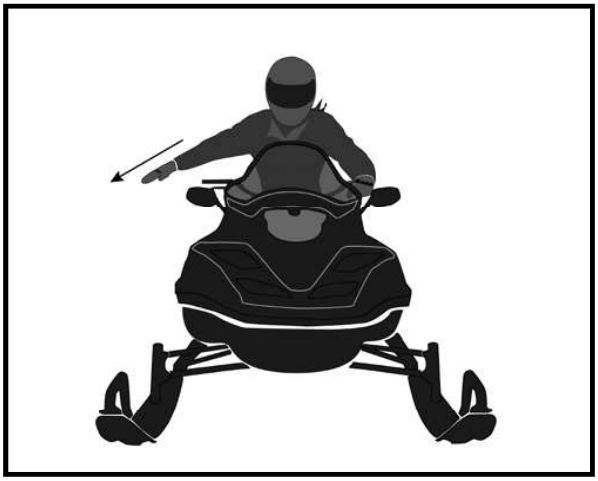
Hand on head: “OK, ready to depart.”

Fist in air, elbow at right angle: “Stop” or “Stopping.”



Arm outstretched, palm up, pushing up: “Speed up” or “Speeding up.”

Arm outstretched, palm down, patting down: “Slow down” or “Slowing down”



Arm outstretched, pointing: “Watch out for crevasses and other hazards.”

Honda Generator

Generator Safety

- Place the generator on a firm, level surface. If the generator is tilted or turned over, fuel may spill or the generator may become contaminated with soil or water.
- To prevent a fire hazard and provide adequate ventilation, keep the generator at least three feet away from tents or other equipment during operation. Do not place flammable objects close to the generator.
- Know how to stop the generator quickly. Know how to operate all the controls.
- Do not let the generator get wet, and do not operate it with wet hands. The generator is a potential source of electrical shock if misused.
- Gasoline is extremely flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks where gasoline is stored or where the generator is refueled. Refuel it in a well-ventilated area, with the engine stopped.
- The engine muffler becomes hot during operation and remains hot for a while after stopping the engine. Do not touch the muffler or engine until the generator has cooled down. Let the engine cool before storing the generator indoors.

Pre-Operation Check

1. Check and add fuel (mogas), if necessary.
2. Check and add engine oil (0W30), if necessary. Check the oil level every time fuel is added.
3. Check the air cleaner element to ensure it is clean and free of ice and snow. It should feel oily.

Starting the Engine

1. Make sure the AC circuit breaker is in the “off” position. It may be hard to start the generator if a load is connected.
2. Turn the fuel valve to the “on” position.
3. Pull the choke rod or lever to the closed position. **Note:** Do not use the choke if the engine is warm.
4. If the generator is so equipped, make sure the auto-throttle switch is off.
5. Move the engine switch to the “on” position.
6. Pull the starter grip slowly until resistance is felt, then pull briskly. **Note:** Do not allow the starter grip to snap back. Return it slowly by hand.

7. Once the generator has started, push the choke rod or twist the choke lever to the open position as the engine warms up.
8. Allow the engine to warm up for three to five minutes; do not apply a load during this time.
9. Once the generator is warm, turn on a breaker or plug in a load.

Stopping the Engine

1. Turn off the breaker or unplug the load.
2. Allow the generator to run unloaded for two minutes to cool down.
3. Turn off the engine switch.
4. Turn off the fuel supply.

Troubleshooting

Symptom: The engine will not start.

Diagnosis and Cure:

1. Check that the engine switch is on.
2. Check to see if the oil-alert lamp flashes when the starter is pulled. If it does, add oil.
3. Ensure all loads are disconnected from the AC receptacles.
4. Check to see if there is a spark at the spark plug. Ground the side of the electrode to the engine and pull the recoil starter to see if a spark jumps the gap. If there is no spark, replace the spark plug.
5. Check to see if gasoline is reaching the carburetor. Place a suitable container under the carburetor and loosen the drain screw. Fuel should flow freely. If it does not, check the fuel valve on the tank.

Symptom: The engine starts but stops immediately.

Diagnosis and Cure:

1. Check the oil level. If it is low, fill the oil reservoir to the top of the dipstick.
2. Restart the engine.

Symptom: There is no electricity at the receptacles.

Diagnosis and Cure:

1. Check to see if the AC circuit breaker is on.
2. Check the appliance or equipment plugged into the generator for defects.

SunBox Power Systems

The SunBox Power System is a portable, self-contained solar power supply that can be disconnected and disassembled quickly for transportation. The unit is composed of three components: a weatherproof box, a solar panel stand, and an output cable. The input and output cables connect to the battery box via sturdy, screw-on, weatherproof connectors. The system is fully grounded, and all wiring and electrical components are rated to -40° C. Maximum output is 300 watts AC or 80 watts DC.

Directions:

1. Open the box and inspect the unit for damage or loose wires. Correct as necessary.
2. Decide on the configuration of the solar panels. They can be mounted on top of the box with four 1/4 X 20 bolts, they can stand independently and be tied down, or they can be spread out to face the sun for maximum input. However they are configured, ensure the panels are secure in case of wind gusts.
3. Connect the three-pin solar plug to the three-pin receptacle.
4. Connect the five-pin extension cord to the five-pin receptacle.
5. Turn the 40-amp breaker to “on” and turn the switch on the far side of the inverter to “on.” AC power will now be available.

When battery power is low, the AC and DC outputs will disconnect. The power will not return until battery voltage reaches 12.2 volts DC. Disconnect loads and let the system recharge. Recharge time from 80% discharge is approximately three days in the sun. Keep in mind there is rarely full sun in Antarctica for three days in a row.