IDP SideWinder
Operations and Maintenance Manual

October 21, 2021

U.S. Ice Drilling Program
University of Wisconsin-Madison Space Science & Engineering Center

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1.0 PURPOSE

The objective of this document is to provide the operator with a working knowledge of the SideWinder kit assembly and operation. Step-by-step instructions are included for those with no experience with this accessory to a hand-coring drill. Those who have experience are encouraged to scan the Tips, Notes, Cautions, Warnings and Appendices.

2.0 SCOPE

This document applies to:

2.1 SideWinder kit

2.2 IDDO 3-inch Hand Auger kit

2.3 IDDO 4-inch Hand Auger kit

2.4 Kovacs Hand Auger kit

3.0 REFERENCES

3.1 8618-0004 IDDO Hand Auger Kit Operations and Maintenance Manual

4.0 DEFINITIONS

4.1 IDDO – Ice Drilling Design and Operations, predecessor to IDP

4.2 IDP – U.S. Ice Drilling Program

4.3 Operator – Any person involved in the assembly and use of the drills or equipment described in this document.

4.4 QAS – Quality and Safety group.

4.5 SSEC – University of Wisconsin-Space Science & Engineering Center.

5.0 RESPONSIBILITIES

5.1 IDP Management is responsible for ensuring that operators of the SideWinder are provided with accurate, up-to-date operating procedures. IDP also maintains and issues the SideWinder kits for use by science groups.

5.2 IDP Engineering is responsible for the creation and updating of this manual.

5.3 SideWinder Kit Operators are responsible for ensuring these procedures are followed and any safety warnings contained herein are heeded.

5.4 SSEC QAS is responsible for ensuring that the proper procedures of document creation, review, approval, maintenance and updating are followed.

6.0 SAFETY

6.1 Only personnel who have read this manual, and the relevant referenced manuals, in their entirety should operate the SideWinder system. All operators should read and understand the following safety precautions.

6.2 Situational Safety

6.2.1 The SideWinder system can be operated by one person, but it is required that two people are always present during operations.

6.3 Milwaukee Drill Safety

6.3.1 Operators will stay alert, watch what they are doing, and use common sense when operating a power tool. They will not use a power tool while tired or under the influence of drugs, alcohol, or medication. A moment of inattention while operating power tools may result in serious personal injury.

6.3.2 Prevent unintentional starting. Ensure the switch is in the off-position before connecting to a power source, picking up, or carrying the tool.

6.3.3 Remove any adjusting key or wrench before turning the power tool on. A wrench or a key left attached to a rotating part of the power tool may result in personal injury.

6.3.4 Keep proper footing and balance at all times. Only operate the drill from a stable and secure surface.

6.3.5 Use the auxiliary handle for proper control of the drill.

6.3.6 The Milwaukee drill can output a significant amount of torque that is only held in check by the operator. If the cutter head suddenly binds downhole, the drill will jerk on the surface. Operators will always maintain proper arm and wrist alignment while operating the drill so they can safely and securely brace against any potential jerks.

6.3.7 Always operate with the drill trigger in the operator's right hand. This ensures that if the drill jerks, the on-off trigger will be pulled away from the operator's body instead of pressed into it.

6.3.8 Do not overreach. Do not operate the drill above shoulder level. It is difficult to brace the drill in this position, which puts the operator at risk of a head injury.

6.4 Personal Protective Equipment (PPE)

6.4.1 PPE – Workers shall wear appropriate hand, eye, and ear protection during drilling operations.

6.5 Mechanical Safety

6.5.1 Pinch Points – There are several areas on the equipment where a finger, hand, arm, or clothing could be pinched. Operators should identify all pinch points prior to operation and should be mindful of all such points during operation. Pinch points include the cutter head, extension stem connections, winch cradle, and power drill.

6.5.2 Rotating Components – Sheaves, barrels, drills, ropes, and drums may be rotating and exposed to the operator on the surface. Keep hands, limbs, loose clothing, and hair away from any rotating components during operations.

6.5.3 Cold Hazard – Metal components may be extremely cold after being in the borehole. Always wear appropriate gloves when handling.

6.5.4 Slippery Surfaces – Rig footing and surrounding ice may become slippery when wet with fluids or meltwater. Use caution whenever walking around the operational area.

6.5.5 Overhead Masses – Equipment may be above head level. Be mindful of hazards and always work as a team when using the system.

6.6 Electrical Safety

6.6.1 Voltage – Extreme care shall be taken when assembling, disassembling, and servicing electrical equipment. Always disconnect power before servicing equipment.

6.6.2 Grounding – Because the drill sits upon a large thickness of ice, a common earth ground cannot be established. Workers shall ensure that all drilling equipment is bonded together to a common ground back to the generator.

6.7 Chemical Safety

6.7.1 Use care and observe all safety warnings when handling Ethanol and/or other chemicals.

6.8 Environmental Safety

6.8.1 Cold – This system will be deployed to extremely cold climates. Operators shall wear outerwear suitable to protect themselves from the cold, and should monitor their own and fellow workers' activities for overexposure to cold.

7.0 INTRODUCTION

7.1 What is the SideWinder? The SideWinder kit is a motorized accessory designed to power the IDDO hand auger kits, but can be adapted to any hand coring drill kit.

7.2 How does it work? The SideWinder kit provides power for rotating as well as lifting and lowering the drill string, greatly decreasing effort and time for collecting ice cores. Its power comes from a hand-held electric drill. Lifting is enabled by a rope on a winder that is attached to the electric drill (see Figure 2). During lifting and lowering of the drill string, the winder sits in a cradle. During drilling, the cradle leans back out of the way and the winder connects to the drill string (see Figure 3). In summary, the electric drill is used both for rotating the drill string, as well as raising and lowering the drill string.

7.3 What is the time advantage? The SideWinder kit allows one person to drill about 20 meters with a hand coring kit in approximately six hours, including setup and teardown. It has been used to drill to depths of over 30 meters. It could go deeper, but the increase in time-spent handling the stem with each successive run, as well as the overall cargo weight of the additional extensions, usually become the limiting factors of the depth to which a group is willing to drill.

7.4 What extra equipment other than the SideWinder is needed? Most of the SideWinder kit comes in a tall plastic box (see Appendix A for contents of the tall Hardigg box). Beyond that, a plywood platform is also needed, as well as a generator and extra gas as needed for the number of holes desired (5 gallons should easily drill two 20-meter holes).

7.5 How much does everything weigh? The SideWinder, with all needed supporting equipment, adds about 230 pounds to a hand ice coring system, Figure 1. However, it will save the weight of extra bodies, since one person can drill alone using this system.

SideWinder Cargo Weights:

2kW generator *, **	50 lbs (Honda 2000i)
5-gallon plastic jerry can of gasoline***	45 lbs
SideWinder kit in plastic Hardigg box	100 lbs
SideWinder plywood platform	15 lbs
Tools	20 lbs
TOTAL	**230 lbs**

* Plan use of 80% of a generator's rating for workload: The 3/4-inch drill maximum power is 1200W; the 1/2-inch drill uses about 800W
** Be sure to subtract 3% of the generator's rating per 1000 feet of elevation gain due to the thinner atmosphere.
*** One 5 gal jerry can of gas will drill about two, 20 m-deep holes

Figure 1: Total cargo weights of the SideWinder. This can vary, for instance, one may use a smaller electric drill (the SideWinder Lite—see Appendix E) without the variable transformer, which would subtract about 15 lbs; gasoline quantities can also vary between projects.

8.0 INSPECTION

8.1 Before leaving for the field, inspect the SideWinder kit to make sure all the parts, tools and spares are included and in good condition (Appendix A lists the contents of the Hardigg box).

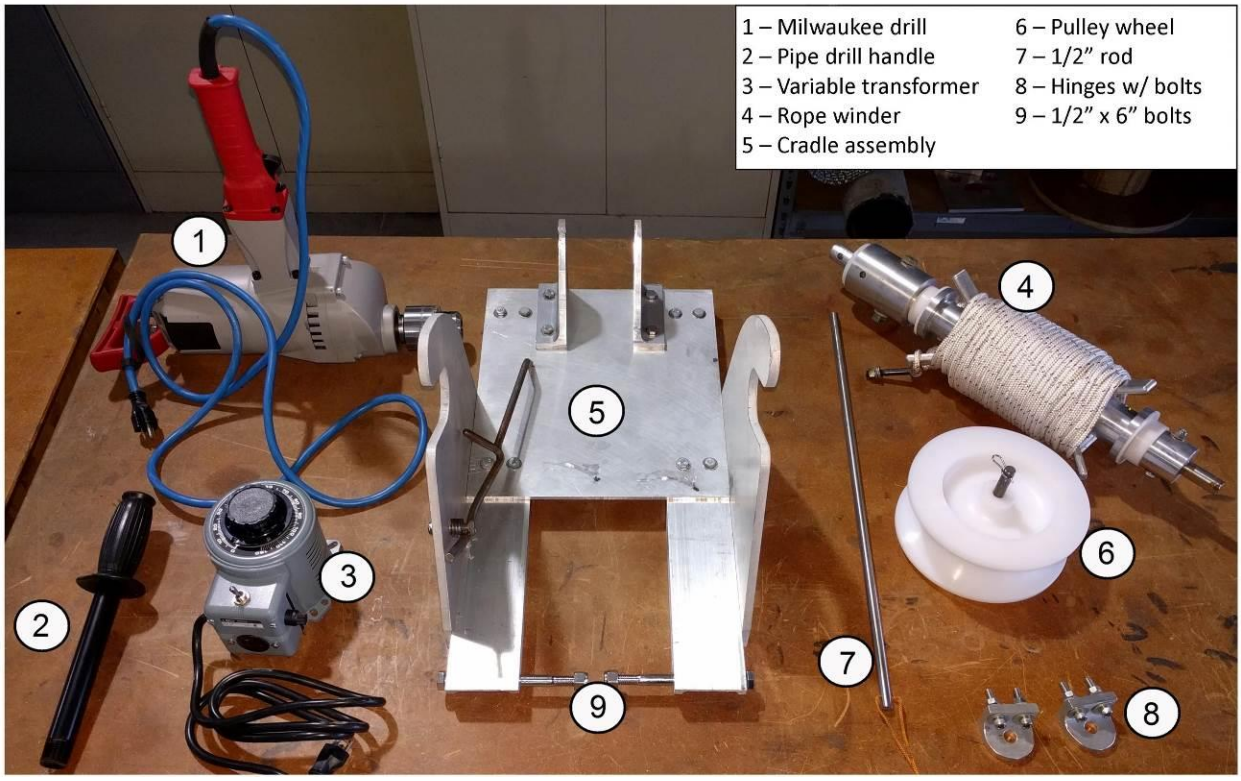


Figure 2: Main SideWinder components

9.0 ASSEMBLY PRIOR TO GOING TO THE FIELD

9.1 Construct a plywood platform from a ½-inch sheet of plywood according to the plans (shown in Appendix C) if one was not included in the kit.

10.0 SETTING UP THE SIDEWINDER IN THE FIELD

Tip! The first thing to do may be to make a wind break. Do this by placing approximately eight bamboo poles in the snow in an arc pattern. Then lay a plastic tarp against them and secure the tarp to the poles using bungees or rope (arrange the platform so that the cradle will be leaning toward the tarp when in the drilling configuration). With strong winds, you may need to anchor the bamboo poles with upwind guy lines.

10.1 Attach the hinges to the plywood platform.

10.2 Lay the plywood platform on a level area of the snow. If the surface layer is loose, it may be best to dig down to a denser layer first.

10.3 Pin the cradle assembly to the hinges on the platform with the hinge pins (long 1/2-inch bolts). Don't worry about tightening the nuts down all the way.

10.4 Swing the cradle assembly back out of the way of the hole.

10.5 Place the winder in the drill chuck and tighten.

10.6 Plug the drill into the short extension cord (this step is unnecessary if the electric drill's stock cord has been replaced by a long, blue cord); enough cord length is needed for when a drilling run begins high up.

10.7 Plug the electric drill into the variable transformer.

10.8 Set the transformer to 80%. This is the typical speed setting but can be adjusted by the operator.

10.9 Plug the transformer into the generator with a long extension cord. Carry the generator downwind as far away as the cord will allow to keep the noise and exhaust away from the operators and to prevent contamination.

Tip! Bring a piece of plywood upon which to set the generator so that it doesn't melt down into the snow. Alternatively, the generator can be placed on top of its own box if this can be done without melting the box.

Tip! Orient the generator with the exhaust port downwind. If the generator is intaking its own exhaust, it may stop running. Also, use a windbreak to prevent snow from blowing into the generator.

Tip! Never set the Milwaukee drill directly onto the snow. This can allow liquid into the drill body and fry electronics. Also, try to use windbreaks to prevent snow from blowing into the drill.

11.0 OPERATIONS

11.1 First Run

11.1.1 If the snow is soft and drilling is easily performed by hand, begin the hole by using the coring barrel alone. One can use the ½-inch diameter bar provided in the SideWinder kit as a T-handle. Use the horizon as a guide to vertical. If the snow is dense, or ice is present, one can place the drive adapter (the big plastic piece that plugs the top of the coring barrel) into the barrel and pin the end of the winder directly to it and use the electric drill. The chips will churn to the surface and can be brushed away, allowing the coring barrel to be filled to the very top with core.

11.1.2 Lift the barrel slowly at first to feel the coring head grab the core. This should happen within 5 cm (2 inches) or so of upward movement.

11.1.3 Remove the core by laying the core barrel on a flat surface. Remove the drive adapter from the top, and then push the core out from the bottom of the drill using a core pusher.

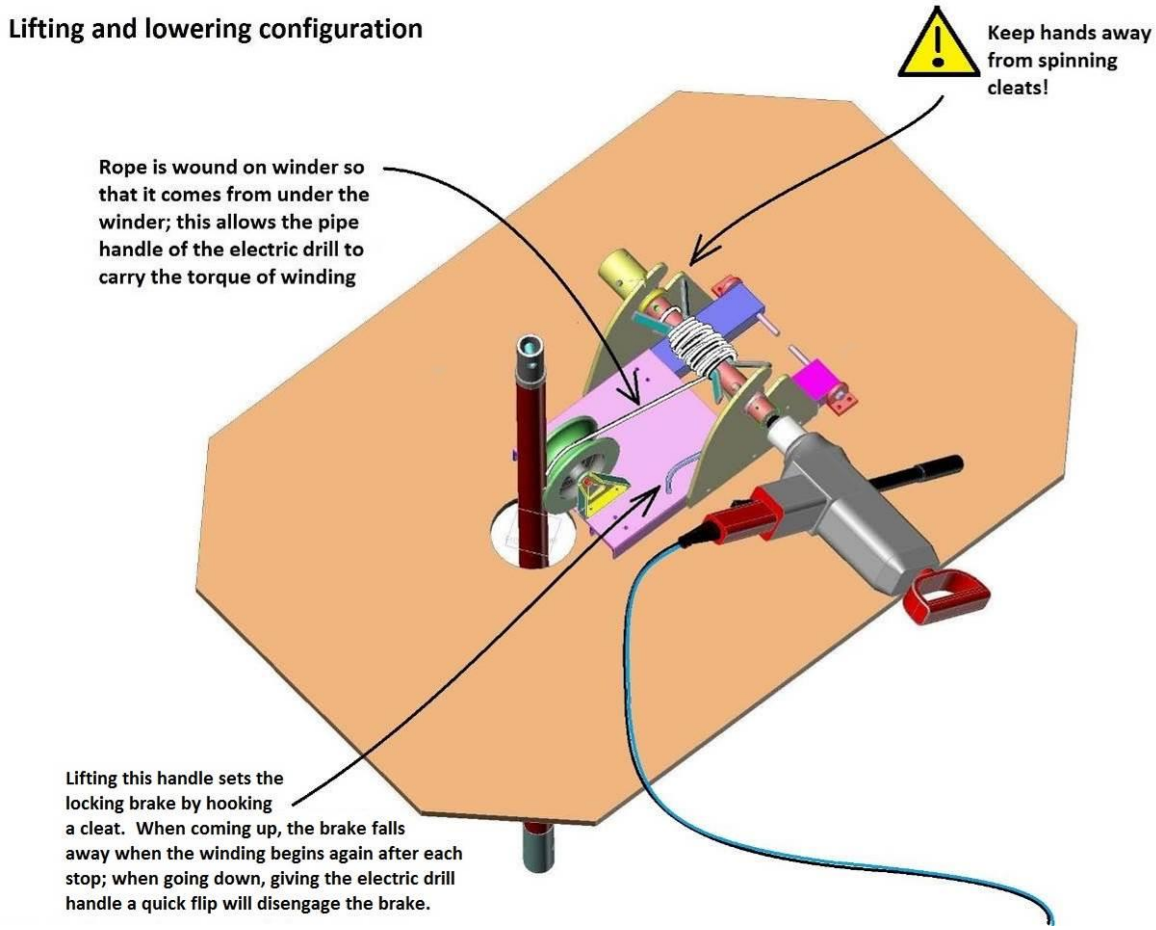


Figure 3: The SideWinder in its lifting and lowering configuration. The top of the drill string is shown protruding from the 'borehole'.

11.2 Second Run

11.2.1 Before every run, make sure to clean the snow and ice off of the cutters, core dogs, and collet. This can be done with rags, brushes, or dental picks. What works best will vary from site to site.

11.2.2 After removing the core, place the drive adapter into the coring barrel and secure with the pin and then place the barrel back into the borehole. Add a 1-meter extension to the drill string as it sits on the bottom of the borehole.

11.2.3 Pin the first short torsion extension stem (hereafter called an 'extension') to the top of the barrel. Normally, this is about a 1-meter addition to the overall length of the drill string, since from here on one will be able to drill only about half the length of the coring barrel.

11.2.4 Lift the electric drill motor/winder onto the protruding extension, insert the drive pin and begin drilling.

11.2.5 Leave the rope secured onto the winder for the first few runs since it is much quicker and easier to lift the drill string by hand.

Warning: Exercise caution around the spinning cleats on the winder while drilling so they do not catch your clothing or body parts. Always be mindful that if anything goes amiss, your first reaction should be to release the trigger to stop the electric drill.

Drilling configuration

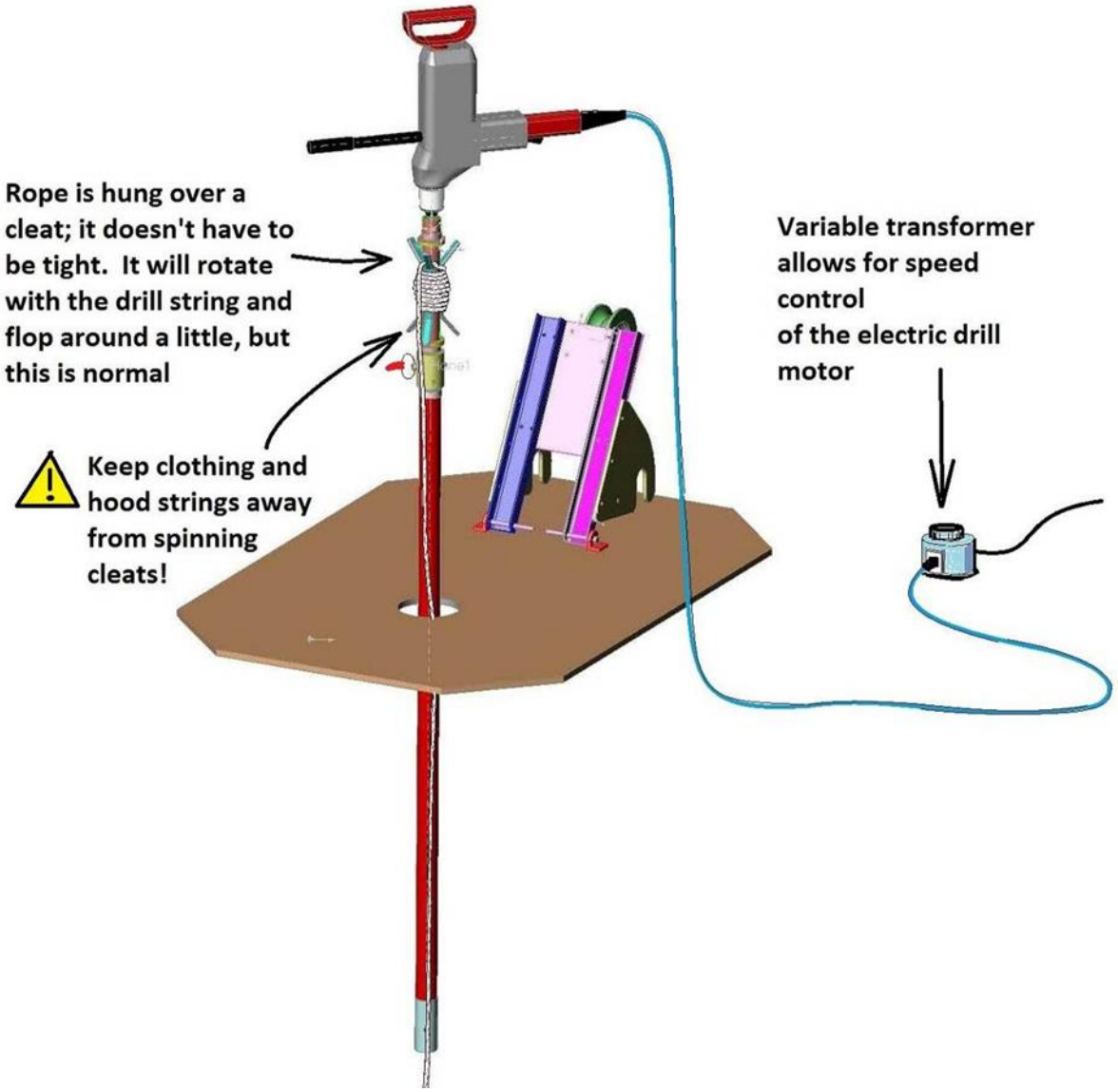


Figure 4: The SideWinder in the drilling configuration, showing the electric drill plugged into the variable transformer.

11.2.6 Drill approximately one meter of core. In softer snow, the snow cuttings, or chips, will be less than half of the core barrel volume and one can drill a bit over one meter. When chips are seen churning onto the top of the coring barrel, the barrel is full. Use the length of this core as a guide to how much can be drilled in one run. As the snow becomes denser, the ratio of core to chips by volume will decrease, that is, less core length will be drilled per run.

11.2.7 When the run is complete, unpin the electric drill/winder and set it aside. Try not to set it directly in the snow.

11.2.8 Break the core free by inserting the ½-inch bar through the protruding extension end and manually jerking upwards (it may be easier to break the core while the electric drill/winder are still attached).

Note: In softer snow, the core will break relatively easily. More dense snow will become harder to break. In addition, the free chips on the flights will add resistance to breaking free. Lift as hard and fast as you can, since impact force is best for breaking ice in tension. You should feel the core break after two or three jerks.

Note: It is often easier to break the core free when only one person is jerking upward since the motion must be one rapid, continuous movement. When having multiple people involved, everyone must be in sync to maximize the impact. Avoid a steady pulling motion, as this only serves to compact the snow in the flights and will wedge the barrel firmly into the borehole.

11.2.9 Lift the drill string out by hand, lay it on the snow surface, remove the pin and pull the barrel free from the adapter.

11.2.10 Remove the core.

11.2.11 Replace the adapter and re-insert the pin

11.3 Subsequent runs down to about 5 or 6 meters

Warning: Remember to re-insert the drive adapter pin so that the barrel does not drop to the bottom of the hole. It is something easily overlooked.

11.3.1 Lower the drill string into the hole and attach the necessary number of extensions.

11.3.2 Repeat the second run procedure (0).

11.4 Lifting the drill string using the rope with the electric drill/winder

11.4.1 After drilling about 5 or 6 m of core, it becomes advantageous to raise the drill string with the electric drill/winder rather than by hand. This is about the limit to the length of the drill string that can be handled before one must break the drill string, because it is simply too unwieldy, especially when there is any wind.

11.4.2 Lifting the drill string using the electric motor/winder means the rope will need to be attached, Figure 4. This is done on the surface with the drill string lying on the snow surface. First, remove the rope pin from its storage place in the winder. Unwind a couple of meters of rope from the cleated winder.

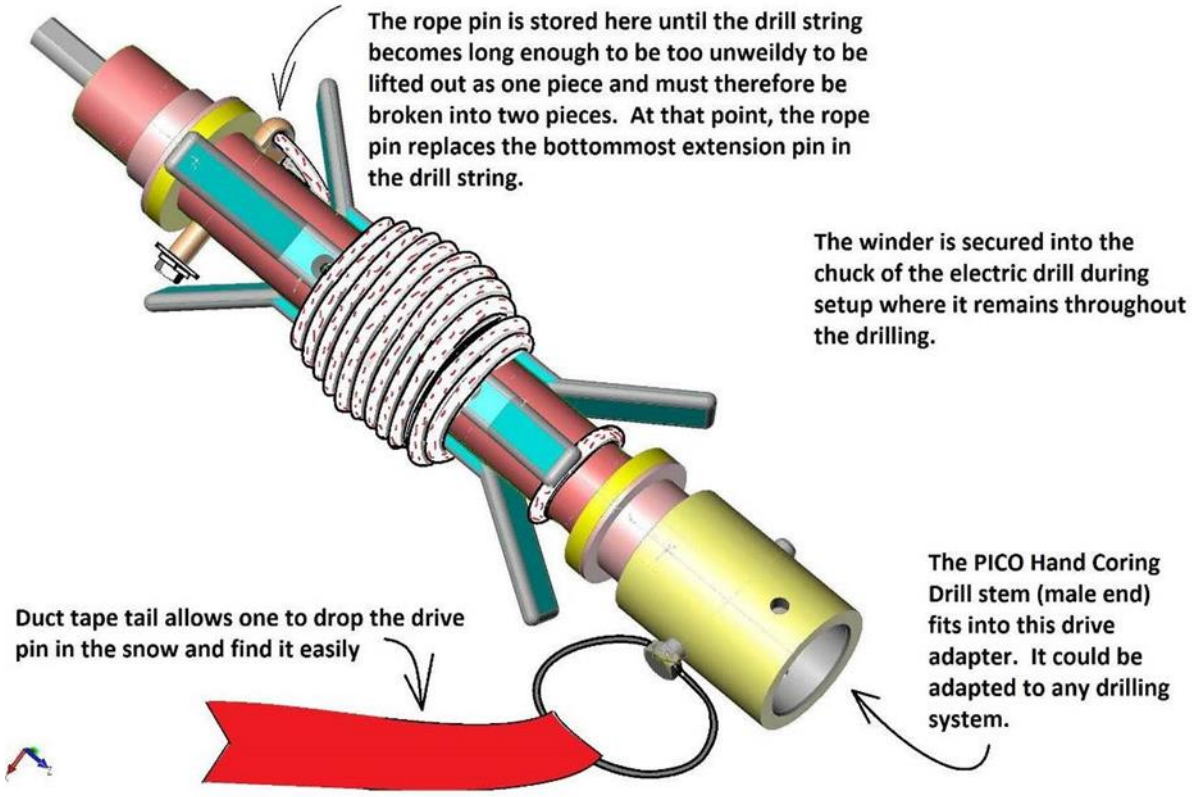


Figure 5: The winder, showing the rope pin in the stored position when it is not connected to the drill string, and the drive pin where it fits when connecting to the top of the drill string.

11.4.3 Remove the pin at the bottom most extension, the one that attaches the extensions to the drive adapter, the piece that caps the coring barrel. Replace it with the rope pin (use a short extension for this connection for ease of handling); the rope pin will stay in place throughout the drilling.

11.4.4 Secure the rope pin in place with the provided bolt.

11.4.5 Pin the drive adapter to the core barrel.

11.4.6 Lower the barrel (with adapter and extension) into the borehole suspended by the rope until the top of the barrel is just below the surface.

Figure 6: Engaging or disengaging the winder means that the weight of the drill string will need to be transferred to the big ½-inch rod. The ½-inch diameter screwdriver shaft, or a ½-inch rod, is inserted through the loop where the rope is attached to the rope pin. This relieves the rope tension so that: 1) Excess rope can be spooled out to have enough slack to lift the barrel from the hole when coming out of the borehole; or, 2) excess rope can be spooled up so that the rod can be removed --then the winder is ready to lower the drill string when going back into the hole.

11.4.7 Lay the bar on the platform across the hole (see Figure 6).

11.4.8 Drop the cradle into place and lay the winder in it.

11.4.9 Wind up the excess rope using the drill. The rope does not need to be taut.

11.4.10 Remove the bar so that the barrel is suspended by the winder.

11.4.11 Attach extension tubes and lower the drill string with the motor until the bottom of the hole is reached.

11.4.12 Add one more extension if needed (this can be done when the drill string sits on the bottom, as well).

11.4.13 Remove the drill motor from the cradle and swing the cradle out of the way.

11.4.14 Pin the electric drill to the end of the extensions.

11.4.15 Drill approximately one meter in depth.

11.4.16 Unpin the motor from the drill string and lower the cradle into place.

11.4.17 Place the motor into the cradle.

11.4.18 Break the core free as described previously (11.2.8).

11.4.19 Raise the drill string using the electric drill.

11.4.20 Break apart the extension string every 4 meters, as longer lengths become too unwieldy and will damage the extension joints.

11.4.21 Continue winding the rope until the loop in the rope is above the surface.

11.4.22 Place the bar through the loop and remove tension from the cleated winder so that the barrel is suspended by the bar (see Figure 6).

11.4.23 Spool out several meters of rope to accommodate lifting the barrel from the hole without interference.

11.4.24 Remove the electric drill and winder from the cradle and swing the cradle out of the way.

11.4.25 Lift the barrel out by hand.

11.4.26 Remove the drive adapter so that the core can be pushed out.

11.5 Subsequent Runs after about 6 meters

11.5.1 Repeat the previous procedure from 11.4.5 to 11.4.26.

11.5.2 Remember to break the extension string into 4-meter segments when both lowering and raising the drill string.

Note: If the SideWinder is being used to depths greater than 30 meters, an optional slowing brake (see Appendix D) can be equipped on the system. This serves to slow the descent of the system when the downhole weight exceeds the resistance of the drill motor.

Note: Troubleshooting guide can be found in Appendix F.

12.0 DISASSEMBLY AND PACKING

12.1 Remove the electric drill and cleated winder from the cradle and disconnect the two.

12.2 Disconnect the variable transformer and extension cords.

12.3 Unpin all of the pinned connections on the drill string.

12.4 Rewrap the rope.

12.5 Unbolt the cradle assembly from the plywood platform.

12.6 Remove the hinges from the platform.

12.7 Wipe debris, snow and ice chips off all parts.

12.7.1 If possible, bring all components indoors to thoroughly dry and clean before packing.

12.8 Repack all hand auger parts into the appropriate bags.

12.9 Repack all SideWinder parts into the Hardigg case.

13.0 APPENDIX A: SIDEWINDER KIT INVENTORY

13.1 Upon arrival of any parts in Madison, IDP staff will:

13.1.1 Clean, test, and store all components.

13.1.1.1 Any parts that are out of spec or broken will be removed from the general inventory until they are repaired or replaced.

13.2 Prior to any parts leaving Madison, IDP staff will:

13.2.1 Pack the kit per the PI's field request.

13.2.2 Fill out a Fit Checklist (13.5) and an Inventory Checklist (13.6), including a paper copy in the kit.

13.2.3 If sending part designs that have not been field tested, proven backup methods will be included as well.

13.3 Upon arrival of any parts in the field, field personnel will:

13.3.1 Verify that all components arrived undamaged.

13.4 Prior to any parts leaving the field, field personnel will:

13.4.1 Clean and dry all components as best as possible.

13.4.2 Use the Inventory Checklist (13.6) to verify that the correct components are being returned.

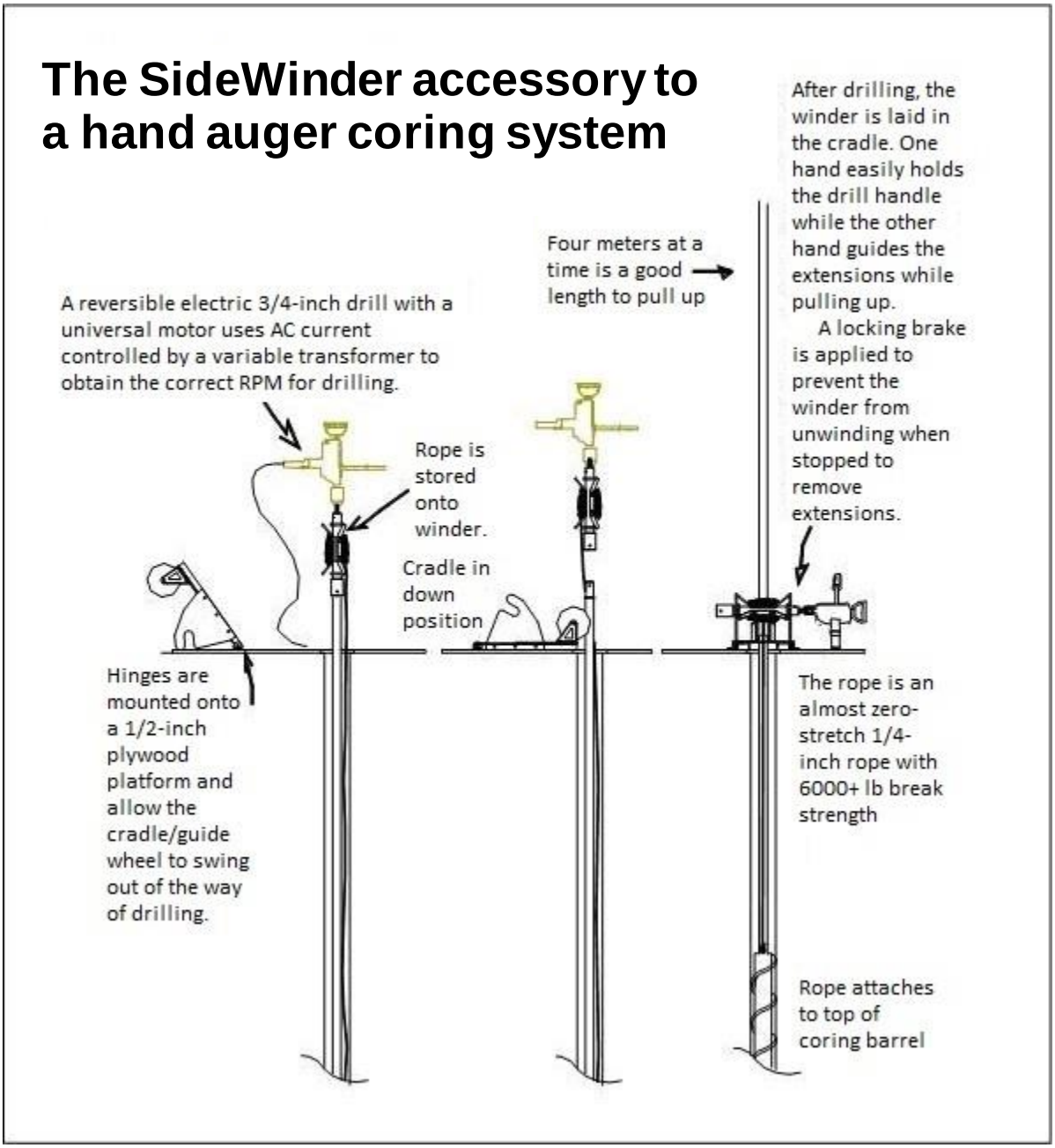
13.5 IDP Staff Fit Checklist

Season:	**User:**
Where Used:	**Sidewinder ID#**_____
Content:	
Done?	**Task**
	Fit pipe handle to Milwaukee drill
	Fit Milwaukee drill to rope winder
	Fit Milwaukee drill to drive adapter(s)
	Fit drive adapter(s) to all extensions
	Fit all extensions to rope winder
	Fit all extensions to rope attachment adapter
	Fit rope adapter to barrel adapter
	Check alignment of hinges, plywood base, and cradle assembly
	Fit extension support to plywood base
	Fit pulley wheel to cradle assembly
	Fit rope winder to cradle assembly
	Check brake engagement with rope winder
	Check electrical function through extension cord, variable transformer, and Milwaukee drill

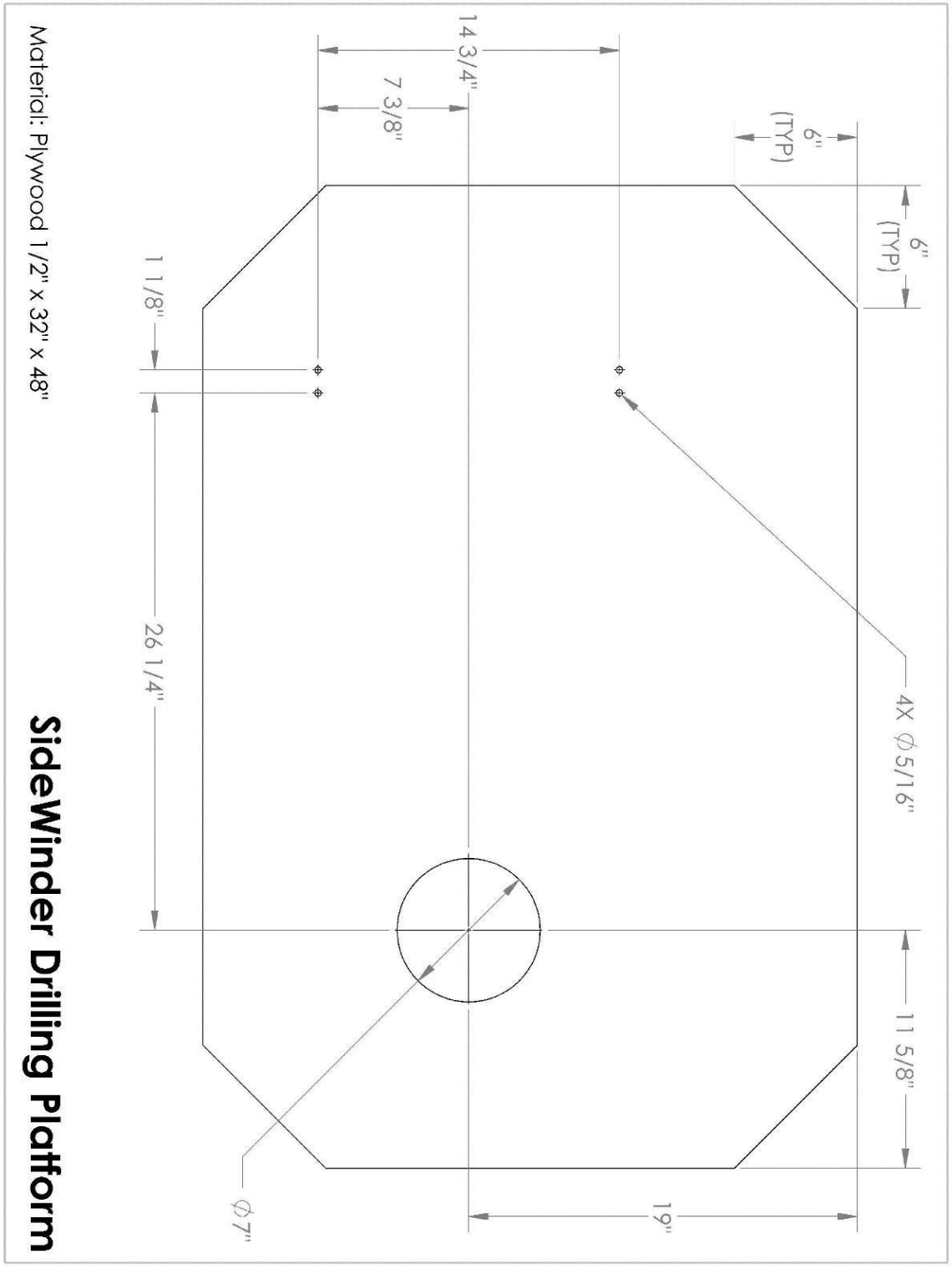
13.6 Inventory Checklist

Season:		**User:**		
Where Used:		**Sidewinder ID#_____**		
Content:				
	Item	**Standard Qty**	**Qty Packed**	**Notes**
0	**Hardigg Case**	**1 Each**		
1	**Milwaukee Super Hole Shooter Drill**	**1 Each**		
2	**Extension Drill Handle**	**1 Each**		
3	**Variable Transformer, 12+ Amp**	**1 Each**		
4	**Cleated Rope Winder**	**1 Each**		
5	**Winch Cradle Assembly**	**1 Each**		
6	**Pulley Wheel with Pin**	**1 Each**		
7	**Braking Bar or Screwdriver**	**1 Each**		
8	**Hinges with Bolts**	**2 Each**		
9	**½" x 6" Hex Bolt**	**2 Each**		
10	**90' of Kevlar Rope**	**1 Each**		
11	**Extra Fuses 15A 250V**	**2 Each**		
12	**Extension Cord**	**1 Each**		
13	**Extra drill Switch & Motor Brushes**	**1 Each**		
14	**Extra eyebolt**	**1 Each**		
15	**Sidewinder Manual**	**1 Each**		
Note: Download Manual from http://icedrill.org/documents/view.shtml?id=143				
18	**Direct Drive Adapter – IDDO**	**1 Each**		
19	**Cleat Adapter – IDDO**	**1 Each**		
20	**Rope Adapter – IDDO**	**1 Each**		
21	**Plywood Base**	**1 Each**		

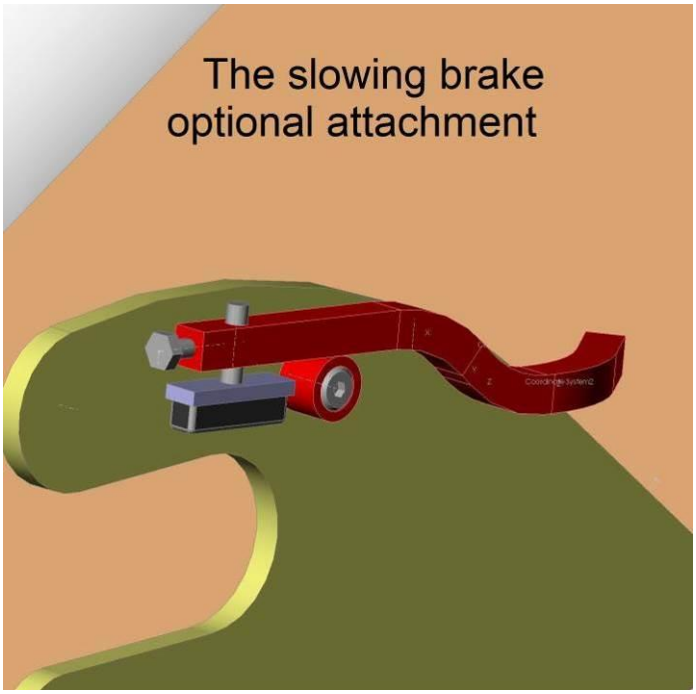
14.0 APPENDIX B: SIDEWINDER KIT SUMMARY SLIDE

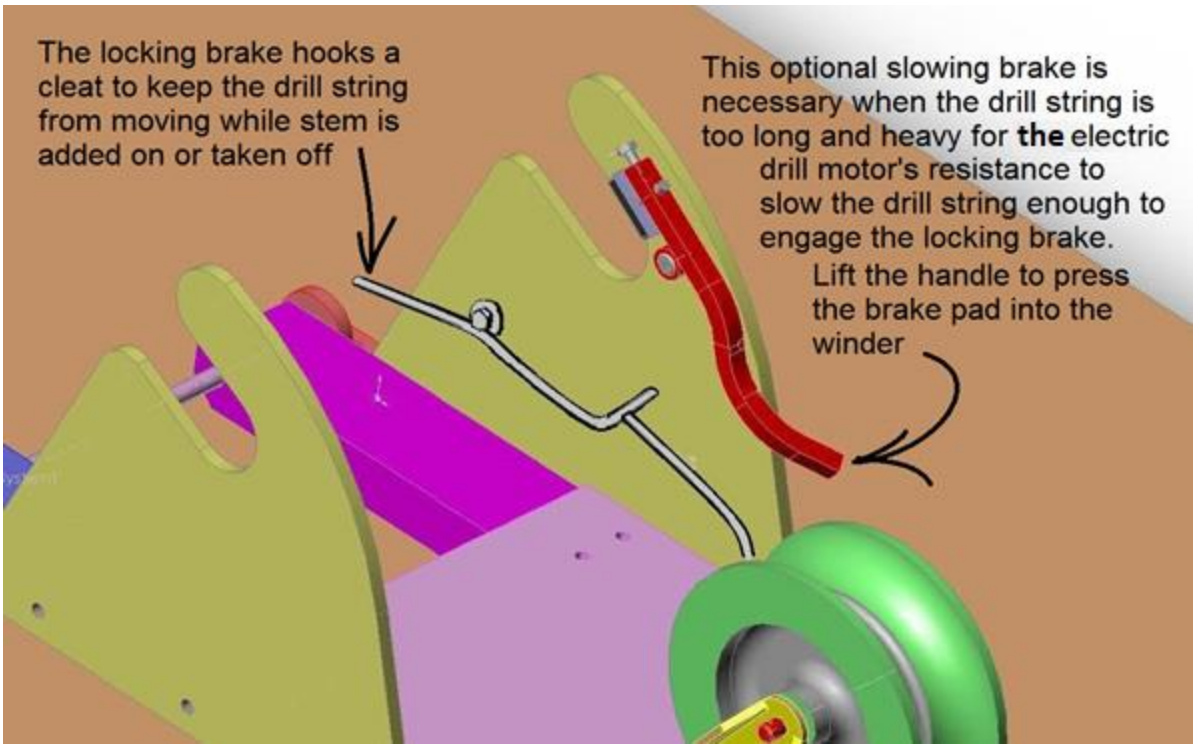


15.0 APPENDIX C: PLYWOOD PLATFORM DIMENSIONS



16.0 APPENDIX D: SLOWING BRAKE





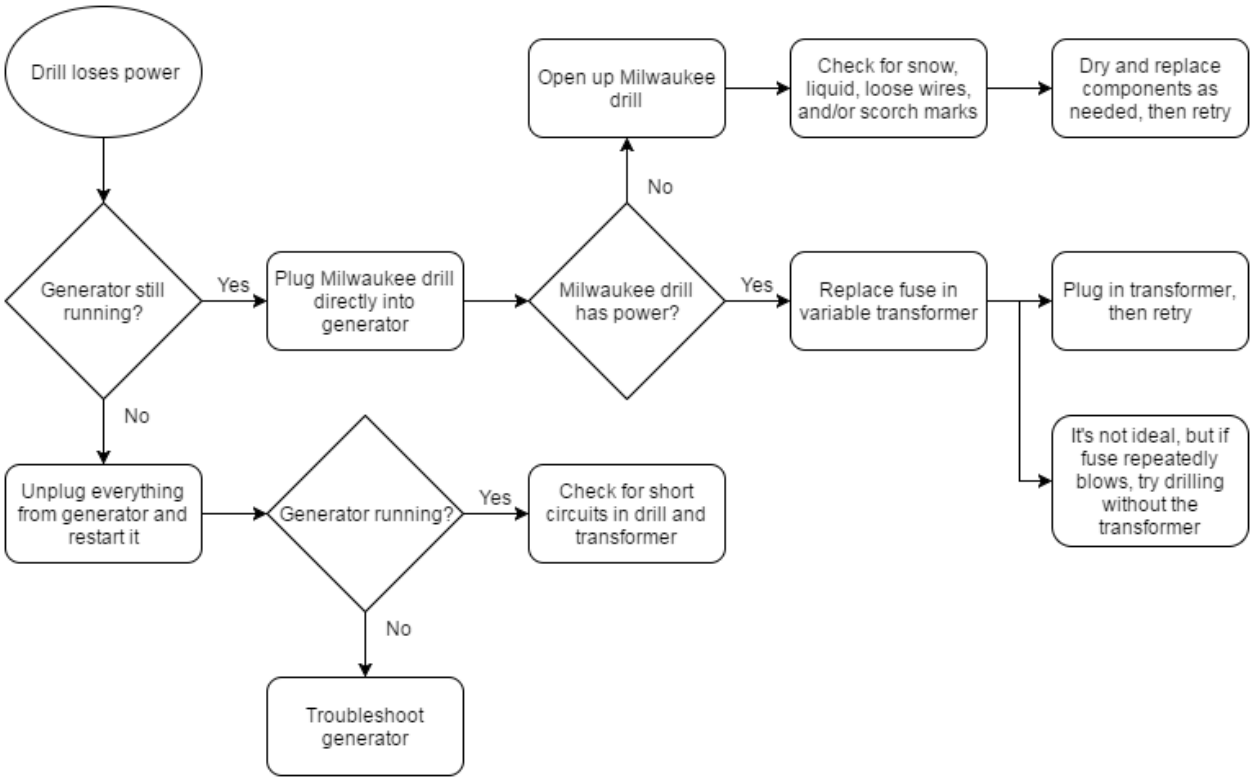
In the past, it was often a bit nerve-wracking for the operator when the heavy drill string would disappear into the hole and would accelerate downward when suddenly the locking brake would engage and the entire platform would 'jump'. The slowing brake was added as an option to mitigate that force of impact, providing a way to slow the drill string to a stop before engaging the locking brake.

17.0 APPENDIX E: SIDEWINDER *LITE*

When drilling to only 15 meters with a small diameter coring barrel, the ½-hp electric drill will suffice. This saves about 20 pounds in system weight, partly because it is much lighter than the big drill, but also because one doesn't need the corresponding variable controller that accompanies the big drill. In addition, it is much more manageable to lift during operation. Note: the winding tube must have the correct chuck grip: ¾-inch diameter for the big drill and ½-inch diameter for the smaller drill.

18.0 APPENDIX F: TROUBLESHOOTING

- Loss of drill power



- Loss of drill penetration
    - See Operations and Maintenance Manual for the specific hand auger
- Items dropped in the borehole
    - See Operations and Maintenance Manual for the specific hand auger