



Arctic Griddle AG-1000

User Manual

v1.4

April 5, 2019



Table of Contents

PLEASE READ FIRST	3
Safety Warnings	4
Specifications	6
Unpacking the Unit	7
Installation	8
Front Panel.....	10
Back Panel.....	11
Airflow Clearance, Layout, and Fans.....	12
Temperature Regulation and Sensing.....	13
Condenser/Fan Cleaning.....	15
Error and Alert Messages.....	18
Electrical Block Diagram.....	20
Refrigeration Block Diagram	21
Troubleshooting Guide	22
Document Revisions.....	24

PLEASE READ FIRST

If you read nothing else in the user manual, please read the following critical information regarding the use and maintenance of your AG-1000 unit.



When you receive your AG-1000, wait a minimum 24 hours before plugging in and running your unit for the first time. If your unit is shipped in any position other than right side up, oil and liquid refrigerant can migrate from where it should be to locations within the unit that can cause damage upon startup. Leaving your unit in the upright position for 24 hours will allow most of this to correct itself.



While the unit is a fraction of the size of other units on the market, we still recommend that the unit be lifted and transported by two individuals. This not only protects the unit from being dropped but will also save your back.



The unit must be plugged into a Ground Fault Circuit Interrupter (GFCI) protected outlet for the safety of the AG-1000 operators and your customers. Operating without a GFCI can present a shock hazard to anyone who touches the machine in the event of a malfunction.



When your unit is first powered on, or after you disable the unit while running, a 60 second countdown timer is started which is shown on the PAN TEMP LED display. This is a protective feature which prevents the unit's refrigeration compressor from cycling too quickly and damaging it.



The most important thing you can do to keep your Arctic Griddle running for a long time is to keep your unit's condenser coils very clean. If the coil unit is dirty the high temperature refrigerant coming from the compressor cannot be properly cooled. This causes the compressor to run hot which significantly shortens its lifespan. The Arctic Griddle was designed to easily facilitate the cleaning of the condenser coils so please take advantage of this. Obvious failure to keep the coils clean will void your warranty. Please see the condenser cleaning guidelines within this user manual for details.

Safety Warnings



As stated previously, the unit must be plugged into a GFCI protected outlet for the safety of the AG-1000 operators and your customers. Operating without a GFCI can present a shock hazard to anyone who touches the machine in the event of a malfunction. If the unit trips the GFCI, unplug the unit and inspect it inside and out for signs for damage. If the unit trips the GFCI randomly but shows no sign of damage, the GFCI may be sensitive and need to be replaced.



Always unplug the power cord when moving or performing maintenance on the unit. Ensure that the unit is disconnected before removing any of the external cover panels.



Do not operate your machine if the power cord is damaged or pulled out from the machine in any manner. A cable gland is in place and fully tightened to prevent the power cord from being pulled out. However, with enough force this can still be overcome. Do not undo the cable gland under any circumstances. Should the cable be pulled from the machine it is likely that the cable conductors could contact the machine frame and cause a shock hazard.



The external fuse in the back of the unit should not blow under normal operating conditions. In the event that a fuse does blow, first unplug the unit and inspect it inside and out for any signs of damage. If no sign of damage is present, replace the damaged fuse with one of the exact same rating. Do not replace with a higher current rated fuse which could pose a fire hazard. A slow blow fuse is required.



Since the height of the Arctic Griddle is just over 13 inches, it must be placed on a table or stand. The weight of the unit is 84 lbs. While this is much lighter than most of the units on the market, careful consideration must be given to where and how the Arctic Griddle is placed. It is up to the end user to ensure that the location selected for the machine can handle the weight and will be highly stable even under the somewhat heavy force required to roll ice cream.



If the shock detector attached to the shipping crate is tripped during shipping (indicated by showing red in either window of the detector), or if the unit is dropped at any point after, the unit should be inspected internally for any damage and loose wires before operating. In particular, if the unit is dropped on its side with significant force, it can break the mounts of the compressor and dislodge critical wiring, causing a potential safety hazard. In this event, unplug the unit and remove the right side panel (with the stickers). The compressor and wiring should be closely checked for any sign of damage.



The Arctic Griddle should only be lifted from the bottom of the unit using a two-person lift. Do not try to lift the unit from the top cover lip or from the sides. A single person lift, while possible, is not recommended as it can be hard on the back and is likely to result in the unit being tilted, causing oil and refrigerant to migrate to areas it does not belong within the refrigeration system.

Specifications

Minimum Recommended Pan Temperature ² @ 74°F (23° C) Toom Temperature	-30° C (short term operation) / -25° C (continuous operation)
Recommended Airflow Direction ³	Front to Back
Voltage	115 VAC / 60 Hz
Current (Running)	9 Amps Avg.
Inrush Current	90 Amps (4 cycles)
Power	775W @ -20° C Running Temp / 875W @ Start Up
Power Cord/Plug	NEMA-15 6ft long
Refrigerant	R404A
Noise Level (for standard fan set) ²	65 dbA @ 1 meter from front of unit
Size	27.25" deep, 22.25" wide, 13.4" height
Weight	84 lbs (38 kg)
Pan Size	19.7" (50 cm)
Pan Material/Thickness	304 Stainless Steel /1.5 millimeters
Safety Certifications (IN PROCESS ⁴)	UL 621, CSA 120-13
Sanitation Certifications (IN PROCESS ⁴)	NSF 7
Warranty	1 Year

¹ All specifications subject to change

² The specified operating temperatures are for the recommended standard fans. Contact us for higher power/ higher noise fan options for lower continuous temperature operation.

³ The recommended airflow is from the front of the unit to the back with 6-8 inches of clearance behind the unit. However, the airflow can be reversed if desired. Louvered/angled openings on both the front and back of the unit direct air flow down and away from operators/customers. Contact us for additional information.

⁴ Unit has passed preliminary design review with ETL/Intertek but full certification will take months longer.

Unpacking the Unit

Your new Arctic Griddle unit arrives in a quality shipping crate. To unpack your unit from the crate first remove the four screws in the top lid of the crate.

Removal of the unit from the crate requires two individuals. With the lid removed, one person should be on each end of the crate. The unit should be removed by inserting one's arms into the gap between the crate and the unit and lifting from underneath. (UNDER NO CIRCUMSTANCES SHOULD YOU TRY TO LIFT THE UNIT BY HOLDING ONTO THE TOP)

Please retain the shipping crate and foam inserts in the event the unit needs to be returned under warranty or for future servicing.

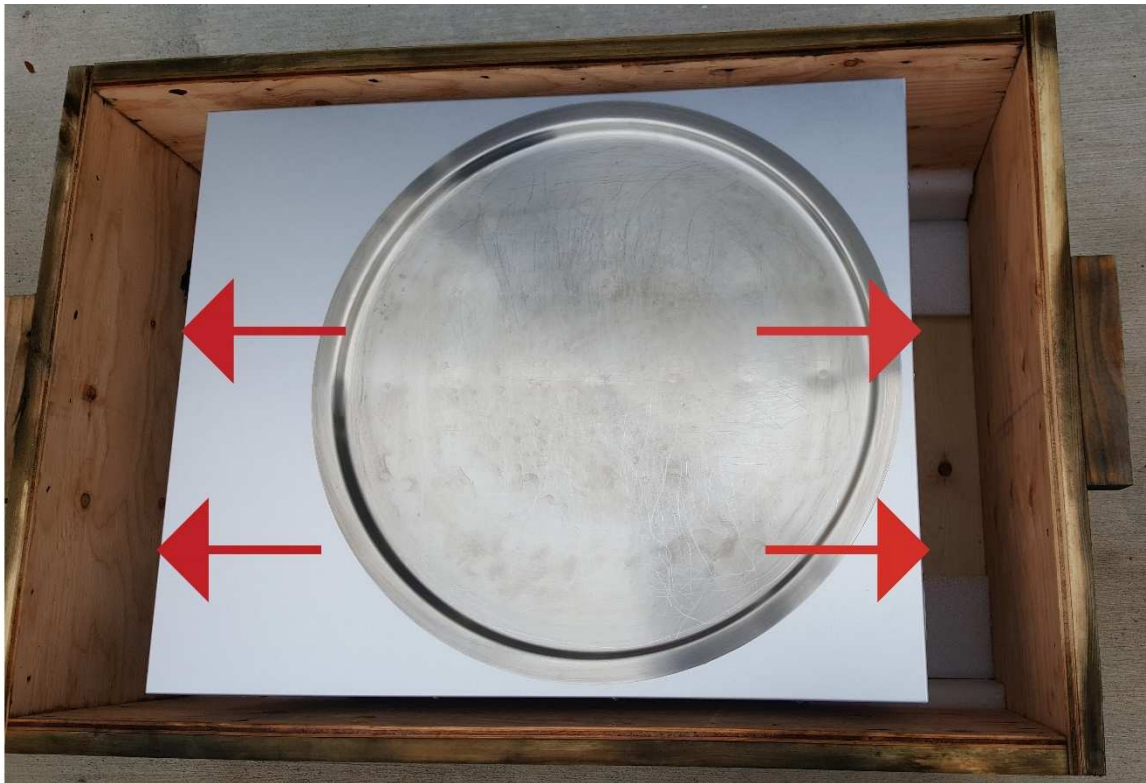


Figure 1: Unpacking your Arctic Griddle unit

Installation

Because the Arctic Griddle weighs over 80 lbs, NSF guidelines require that the unit must either be mounted on 4" legs or mounted flush to the surface it is resting on and sealed around the edges using an NSF approved silicone sealant. Mounting the Arctic Griddle on legs is not practical since the rolling process will put a lateral force on the unit that will cause it to slide and possibly become unstable. Therefore, the only recommended solution is a flush mount install with edge sealing. This sealing is required to prevent any spilled material or vermin from entering the unit from underneath where it cannot be cleaned.

If you intend to use your machine for catering or plan on moving your unit frequently, this sealing requirement can be a problem. Keep in mind it is only required to meet the NSF guidelines, if this is not of immediate concern, it need not be done. But, if not sealed, we recommend frequent moving of the unit so that the area underneath can be properly sanitized.



Figure 2: Sealing your unit to the counter or table

In order to prevent the Arctic Griddle from sliding on the table it is mounted to during the rolling process, thin neoprene strips are attached to the bottom side of the unit. These strips, along with the weight of the unit, will prevent it from slipping on most table top surfaces. If slipping does still occur, there are two additional measures that can be taken. The first is to seal the unit to the table using NSF approved silicone, as is required to meet NSF guidelines. If, however sealing the unit to the table is not desired, two bolts, installed through the table top will provide a backstop.



Figure 3:Optional table stops for your unit

The unit must be installed level to ensure proper operation. If the unit is not installed level, refrigerant within the system will tend to cool one side more than the other. However, we do recommend that the unit be installed with the slightest (1-2 degree) slant where the backend of the unit is higher than the front (the operator side). This will ensure that if any condensation forms within the unit it will drip out the front and not pool up in the backend.

Front Panel



Figure 4: Arctic Griddle Front Control Panel

- 1) Pan Temperature Display – Displays the measured current temperature in degrees Celsius. Also displays the delay timer with Lxx (where xx is seconds) following a turn off of the pan and any error codes with Exx (where xx is the code).
- 2) Setpoint Temperature – Displays the current setpoint for the pan in degrees Celsius.
- 3) Up/Down Setpoint Buttons – Controls the current setpoint temperature.
- 4) Run Button and LED – Starts and stops the pan cooling. The LED will be on when running.
- 5) Defrost Button and LED – The front panel defrost button engages the defrost solenoid, allowing hot gas from the compressor to warm the pan. A single press of the button will start the defrost process and continue to warm the pan until the temperature reaches 10 °C so that the pan can be wiped clean. Prior to the pan reaching this 10°C maximum temperature, a second press of the button at any time will end the defrost process. If the defrost button is used to help release the ice cream from the pan the defrost only needs to be on for a few seconds.

Back Panel

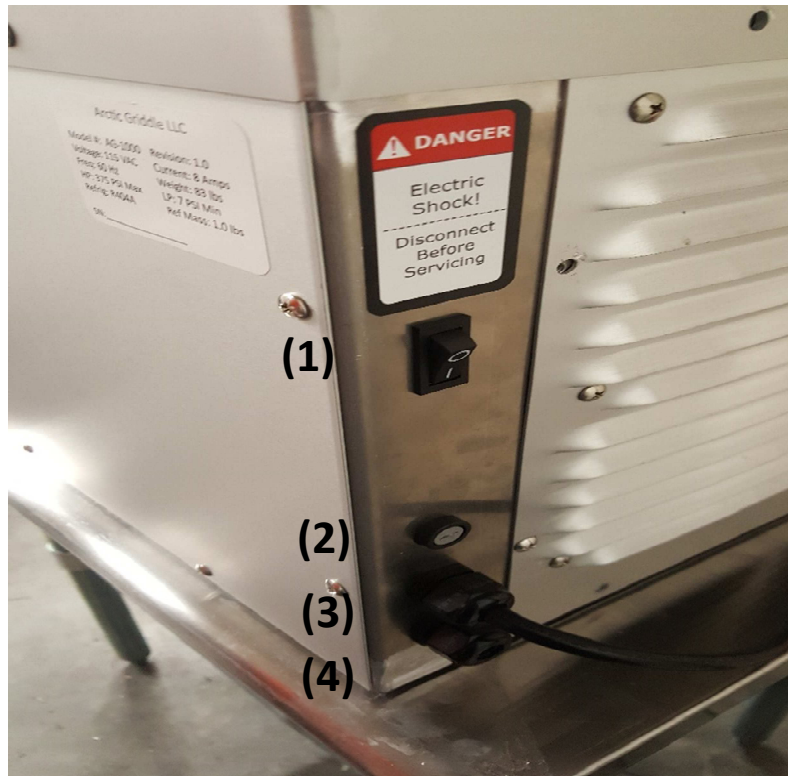


Figure 5: Arctic Griddle Back Panel

1) Power On/Off Switch – Turns power on and off to the unit. (STILL UNPLUG POWER CORD WHEN WORKING INSIDE UNIT)

2) Fuse Holder – Contains a 12 Amp slow acting $\frac{1}{4}$ " x $1\frac{1}{4}$ " fuse.

3) Power Cord – Main power cord input. The user should not try to adjust or modify this in anyway. DO NOT PULL on the power cord. The cord grip should prevent the cable from being stressed under normal conditions but excess force on the cable should be avoided since it can damage the internal wiring and create a safety hazard.

4) Optional Defrost Pedal Input – The user can install or remove an optional defrost pedal through this opening. If a defrost pedal is required please contact Arctic Griddle prior to purchasing to discuss.

Airflow Clearance, Layout, and Fans

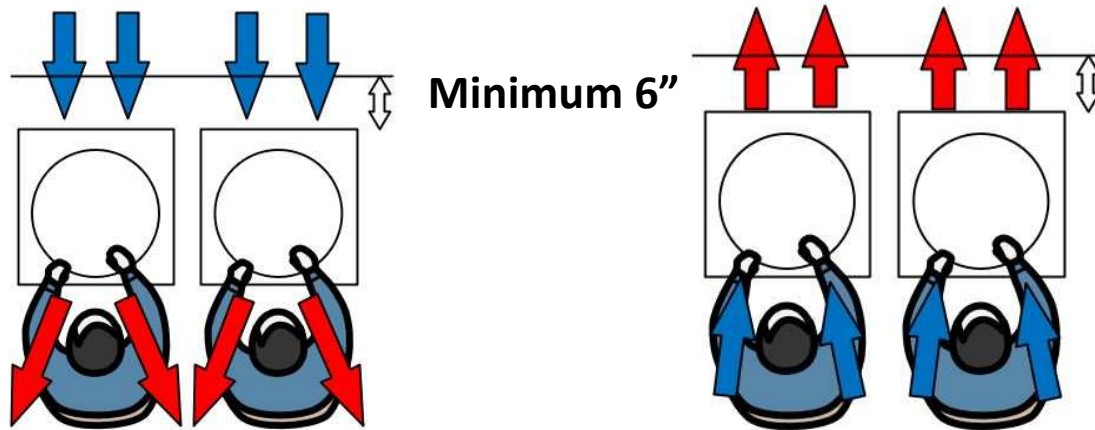


Figure 6: Airflow Direction and Required Spacings

Knowing and paying attention to the airflow of your pan is critical, especially if you plan to operate more than one unit in close proximity. The air flow of the Arctic Griddle can be either from the back to the front or from the front to the back. We recommend the unit be operated with the air flow from the front of the unit to the back because the fans operate slightly more efficiently, it can reduce condensation within the unit, and it eliminates any hot air blowing on the operator. At the back of the unit a minimum of 6" of clearance is required for the hot air to vent out. The louvered coverings on the back end direct the exhaust airflow downward so as to not blow outward towards customers. If, however, this is not desirable the fan airflow can be reversed rather easily by simply turning the fans around. In this scenario the louvers on the front of the unit will direct the airflow downward and mostly away from the operator.

For operating multiple units side by side the airflow must be in the same direction for all units. This prevents the hot air exhaust from one unit feeding into the cool air intake side of another. If operating pans with different airflow directions we recommend spacing these pans out by 2-3 ft.

The default fan configuration for the Arctic Griddle is recommended for most rolled ice cream applications. The selected fans provide an optimal amount of cooling capability while balancing fan noise. For other applications such as molecular gastronomy, biological testing, or electronic cooling a better choice of fans may be determined. Please contact us before purchasing if you plan to use the Arctic Griddle in applications other than rolled ice cream.

Temperature Regulation and Sensing

Not all rolled ice cream machines sense and regulate temperature in the same way. Knowing how the Arctic Griddle handles these two issues is important for getting the most out of your machine.

Temperature regulation in a rolled ice cream machine is handled in one of two ways. Either the compressor is shut off periodically in order to allow the temperature to rise or a solenoid is turned on allowing a portion of the refrigerant to bypass the pan coils, thereby reducing the total cooling capacity of the pan. The compressor turn on/off method is not recommended for several reasons, the most problematic is that the compressor is not designed for this and will greatly shorten its lifespan.

The Arctic Griddle uses the second approach to temperature regulation. The regulation solenoid turns on when the temperature reaches 1° C below the setpoint and turns off when 1 degree above the setpoint. With thermal momentum in the refrigeration cycle the temperature can still rise another 1 to 2 degrees after the solenoid has turned off. This is the normal mode of operation. For example, if the pan is set at -20° C, the solenoid will kick on at -21° C and shutoff at -19° C. The temperature may continue to rise until it hits -18° C before it starts coming back down. This provides a ~3° C temperature variation over the regulation cycle. This however is only valid when there isn't any ice cream mix on the pan acting as a thermal load.

How a rolled ice cream machine senses temperature during the ice cream making process is highly dependent on where the temperature sensors are placed within the system. Some machines place the temperature sensor directly on or next to the refrigeration coils. The benefit of this approach is it reads a very stable temperature regardless of what is placed on the pan. The primary downside is it doesn't tell you anything about the actual pan/ice cream temperature. It also provides less overall cooling because it will cycle on/off more often, even during the ice cream making process, which is what you don't want.

The Arctic Griddle has two temperature sensors at the locations highlighted in red in the figure below. Two sensors are used so that one can serve as a backup in the event the other is damaged. The sensors are placed in between the coils directly on the backside of the pan. The main benefit of this approach is it allows for very sensitive measurement of the pan temperature and the ice cream at the sensor locations. The perceived downside of this sensor placement is that the temperature appears to vary widely during the ice cream roll making process.

Another topic worth understanding is how the refrigerant flows through the pan top and how it influences the overall pan temperature. As shown by the blue arrows in the figure below, the cold (liquid form) of the refrigerant enters the pan top in the two copper coil tubes. As the refrigerant travels through the coils it absorbs heat and begins to change form to a gas. The gas form of the refrigerant exists the coils at the location shown by the red arrows. This is important to understand because the middle, where the refrigerant enters, will always be colder than the ends of the coils where the refrigerant exists the pan. The Arctic Griddle uses two different heat spreader materials to spread this temperature differential out and minimize any thermal gradients. However, even with this, there is an approximate 2° C temperature differential across the pan based on thermal imaging. This is still much better than the 10-15° C observed in other machines.

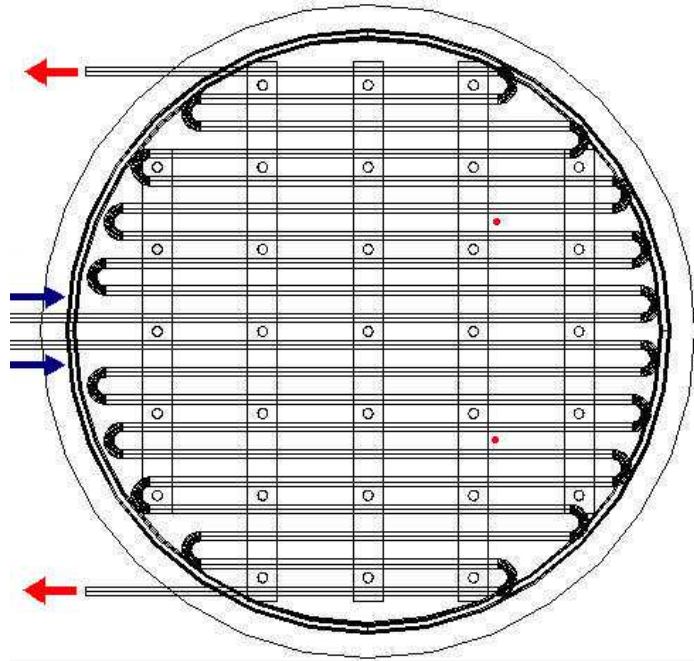


Figure 7: Pan Top Temperature Sensors and Refrigerant Flow

The placement of the sensors within the pan area also plays a factor in the temperatures sensed. If the sensors are placed in the middle of the pan they will read a few degrees colder than if placed on the outside edge of the pan. Likewise, the sensed temperature will vary more if placed in an area where the ice cream mix is poured and spread out than if in an area that has no contact with the ice cream. Because of these factors, a compromise location was decided upon to place the sensors at the positions shown so that they read midpoint temperatures which are in contact with an ice cream placement area. This allows for more accurate temperature sensing of the actual ice cream on the pan and can be an important parameter for knowing when to roll the ice cream off the pan.

Condenser/Fan Cleaning

Keeping the condenser coils clean is the most important thing you can do to keep your pan operating for a long time. If the condenser coils are dirty, the air flow through the unit will be severely restricted, preventing the system from getting the heat generated by the compressor out. This heat build-up causes the pan not to cool as efficiently and will lead to premature failure of the compressor over time.

In most rolled ice cream machines the condenser cannot be accessed for cleaning without a significant amount of effort in disassembling the unit. We designed the Arctic Griddle to make it easy to access the condenser coils for cleaning. We recommend cleaning the coils once a month when operating in a relatively clean environment. If operating in a dirty environment, such as a dusty outdoor festival, it should be cleaned more often.



Figure 8: Fan panel screw removal

The following steps should be followed to clean the outer side of the condenser coils:

- 1) **(CAUTION)** Unplug the power cord from the outlet
- 2) Place the unit so there is room to drop the back panel flat
- 3) Remove the 10 screws holding the back panel in around the edges (see photo below) and pull the back panel out and down
- 4) Clean the surface of the condenser coils with a damp rag (do not press hard enough to damage the aluminum fins of the coils)
- 5) Clean the fan blades and fan grates
- 6) Reinstall the back panel and 10 screws



Figure 9: Fan panel removal

The inside side of the condenser coils must also be cleaned. Follow the steps below to clean the inner side of the condenser coils:

- 1) **(CAUTION)** Unplug the power cord from the outlet
- 2) Place the unit so there is room to drop the left panel flat
- 3) Remove the 12 screws holding the left panel in around the edges (see photo below)
- 4) Pull the panel down and out
- 5) Clean the surface of the condenser coils with a damp rag or brush (do not press hard enough to damage the aluminum fins of the coils)
- 6) Reinstall the left panel and 12 screws



Figure 10: Left panel removal for condenser cleaning

Error and Alert Messages

Error and alert messages are displayed in the pan temp LED window of the front panel controller. Errors shutdown the unit and prevent it from operating. Alerts are cautionary in that they will send a beep and display on the LED panel but will not stop operation. Alerts should be paid attention to as they will likely lead to errors if not addressed.

When the pan is first powered on, or immediately following turning off the cooling system, the pan temp display will read an Lxx delay value where (xx) is the time in seconds. This number will count down from 60 to 0 before displaying the current pan temperature. This is not an error message, rather this is a safety feature of the unit to protect it from rapid cycling of the compressor.

The unit must be power cycled to reset any errors. However, this should only be done after resolving the problem. The alerts will not shutdown the unit but is a warning that something in the system is no longer working as designed.

The current error messages are:

Display Error	Possible Problem	Solution
E1 The high-pressure safety switch has tripped.	Lack of airflow	Clean the coils as shown in this manual and ensure at least 6" of airflow clearance between the front and back of unit
	High ambient temperature	The unit is not designed for continuous outdoor use past 90 degrees F.
	Dead fan	Remove the back panel and ensure all three fans are operational
	Restriction in refrigeration lines	Contact Arctic Griddle LLC
E2 High compressor output temperature	Lack of airflow	Clean the coils as shown in this manual and ensure at least 6" of airflow clearance between the front and back of unit
	High ambient temperature	The unit is not designed for continuous outdoor use past 90 degrees F. (or contact us for larger fans)
	Dead fan	Remove the back panel and ensure all three fans are operational
	Loss of refrigerant	Contact Arctic Griddle LLC

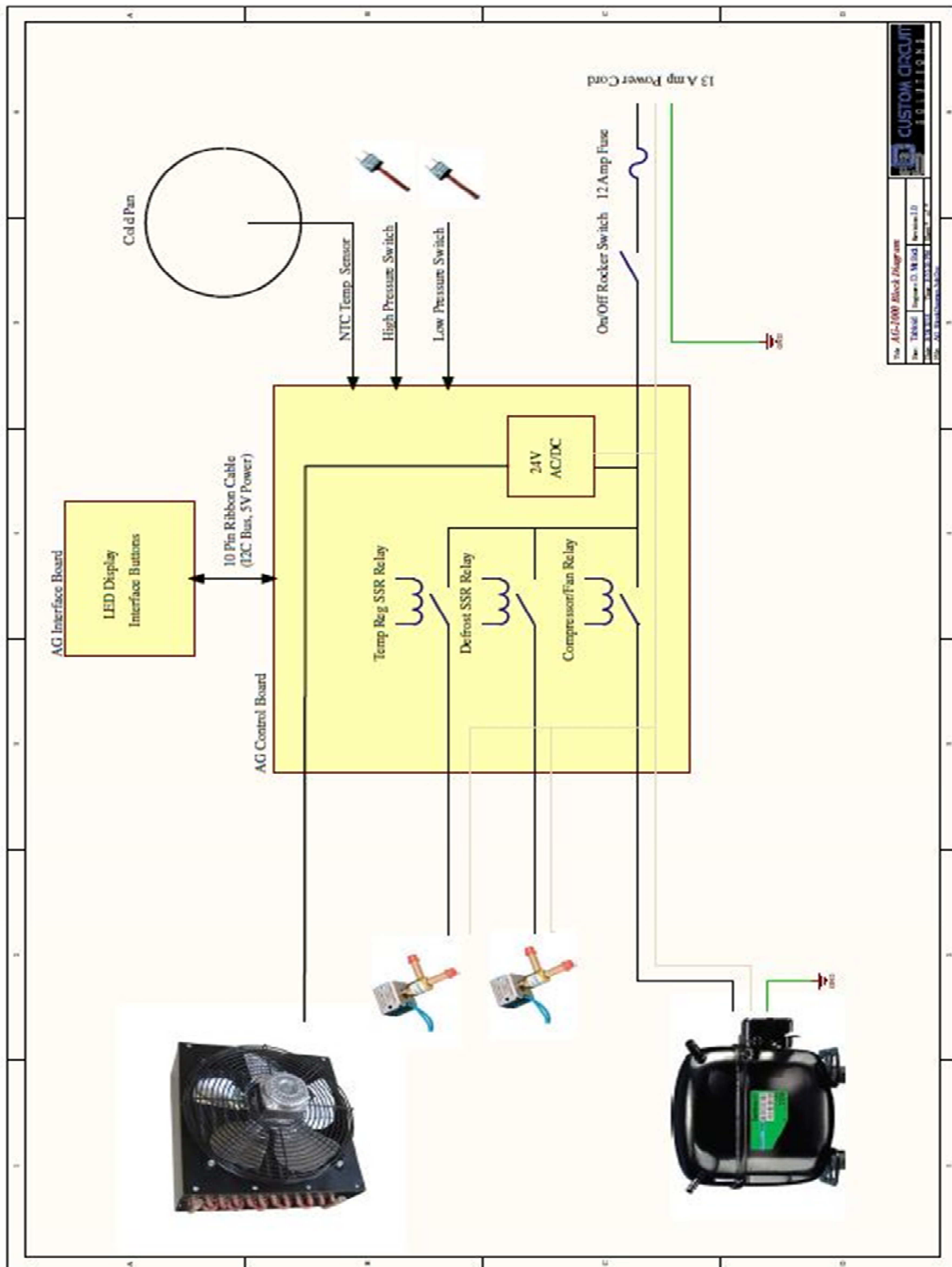
Alerts are notified by sending an audible beep while running and by the display of one of three LED dots on the pan temperature display.

Low Pressure Alert – This alert notifies the user that the low-pressure switch has been tripped. One possible cause of this is the system operating for too long with too low of an operating setpoint. Raise the setpoint temperature to above -25 deg C and see if the problem resolves itself after a power cycle of the unit. Other possible causes of this are a restriction in the refrigeration lines and the loss of refrigerant. If either of these are suspected please contact Arctic Griddle LLC.

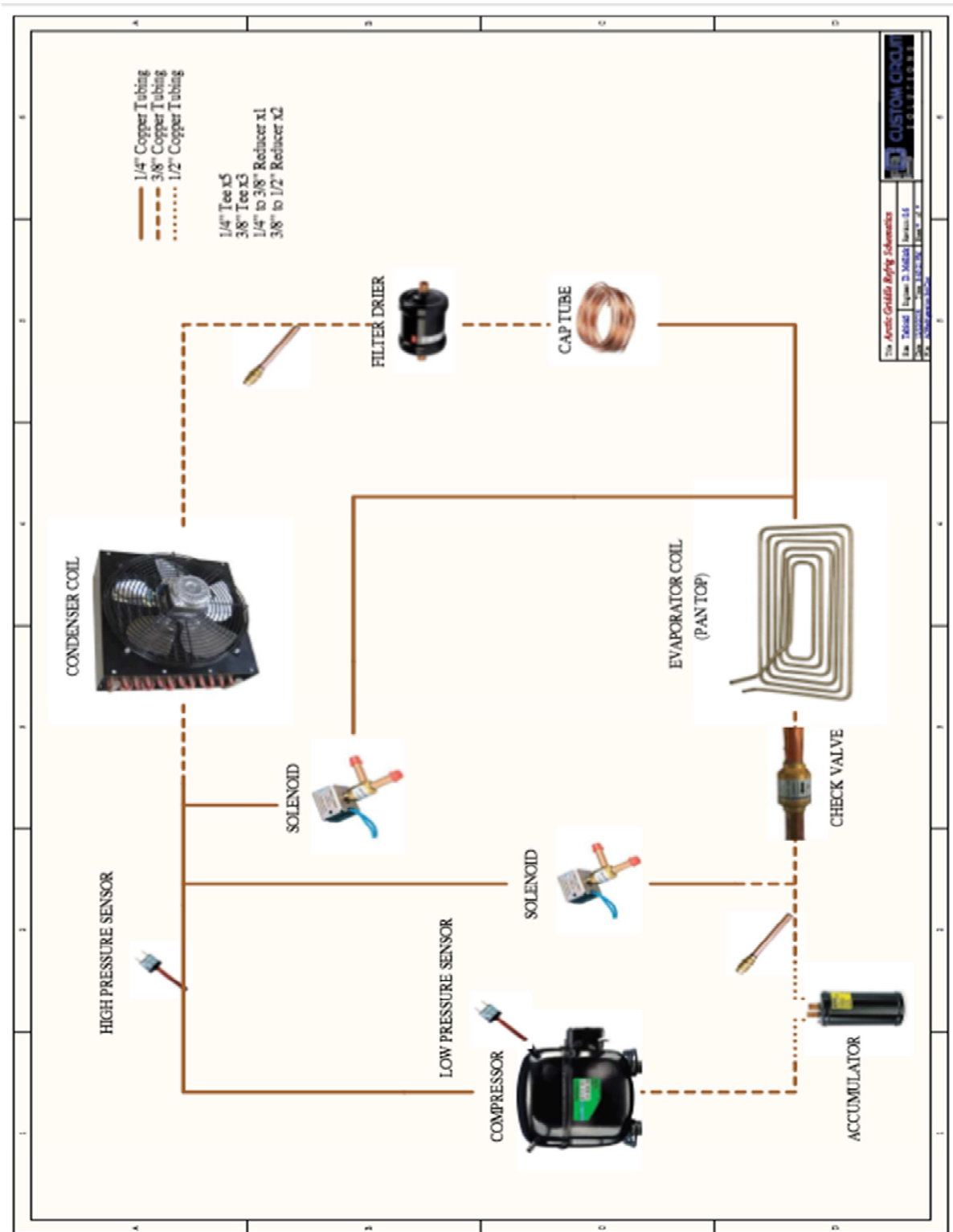
High Compressor Discharge Temperature – This alert is triggered at a compressor discharge temperature of 88 degrees C. This is a warning that the system is beginning to overheat from its optimal operating temperature. The unit will flag an error and shutdown once it reaches 95 deg C. Read our troubleshooting guide below to resolve the problem. If none of the solutions apply, your unit may need higher power fans for your specific application.

Alert	Possible Problem	Solution
Low Pressure	Pan setpoint too low for too long	Raise the temperature of the pan to at least -25 degrees C.
	Restriction in refrigeration lines	Contact Arctic Griddle LLC
	Loss of refrigeration	Contact Arctic Griddle LLC
High Temp Warning	Lack of airflow	Clean the coils as shown in this manual and ensure at least 6" of airflow clearance between the front and back of unit
	High ambient temperature	The unit is not designed for continuous outdoor use past 90 degrees F.

Electrical Block Diagram



Refrigeration Block Diagram



Troubleshooting Guide

Symptom	Possible Problem	Solution
Unit runs but fails to reach the setpoint	Dirty condenser coils	Clean the coils as shown in this manual
	Poor airflow around the unit	Provide adequate spacing in front and behind the unit for proper airflow
	Excessive airflow across pan surface	Shield the pan from any airflow across the pan which can turn the unit into an air conditioner
	Direct sunlight	Block any direct sunlight hitting the pan surface. The unit cannot operate properly with the additional thermal load.
	Setpoint too low for conditions	The absolute minimum setpoint the unit can achieve depends on many environmental factors. A temp of -35C can be achieved under few conditions but -20C should be achieved under all. We recommend normal operation at -20C.
	Dead fan	Remove the back panel with the fans attached and start the unit to verify all three fans are operational. Only replace with same 24VDC fans.
Front panel display doesn't turn on when flipping the power switch	Fuse may have blown	The fuse should not blow under normal operation. With unit unplugged, check inside and out for signs of damage before replacing fuse and testing again. Only replace with same size fuse as factory installed.
	Ribbon cable may be disconnected	If the unit beeps when turning on but the front panel fails to light up, the ribbon cable may have become disconnected. This can happen if the unit is mishandled during transport. The retention clips on both ends of the cable are designed

		<p>to prevent this; however, the connectors can still come out enough to become disconnected. They can be snapped back into place.</p>
	<p>Circuit breaker may have tripped</p>	<p>The AG-1000 has a high in-rush current when the compressor turns on. Only one AG unit should be operated on a 15 Amp circuit. Two units can be operated on a 20 Amp circuit. If other devices are being powered from the same circuit it may be enough to trip the circuit breaker upon compressor startup.</p>
	<p>GFCI outlet may have tripped</p>	<p>Check for tripped GFCI outlet. If tripped, test the AG-1000 on a different GFCI circuit (not just different outlet on same GFCI circuit). If the AG-1000 trips the GFCI a second time immediately send the unit in for inspections. If the second GFCI doesn't trip replace the first GFCI unit.</p>

Document Revisions

Date	Revision	Changes
12/11/18	1.2	First public release
3/9/19	1.3	Added power cord safety warning Added "Temperature Regulation and Sensing" section Added information about the front display not working
4/5/19	1.4	Added safety information if the unit is dropped