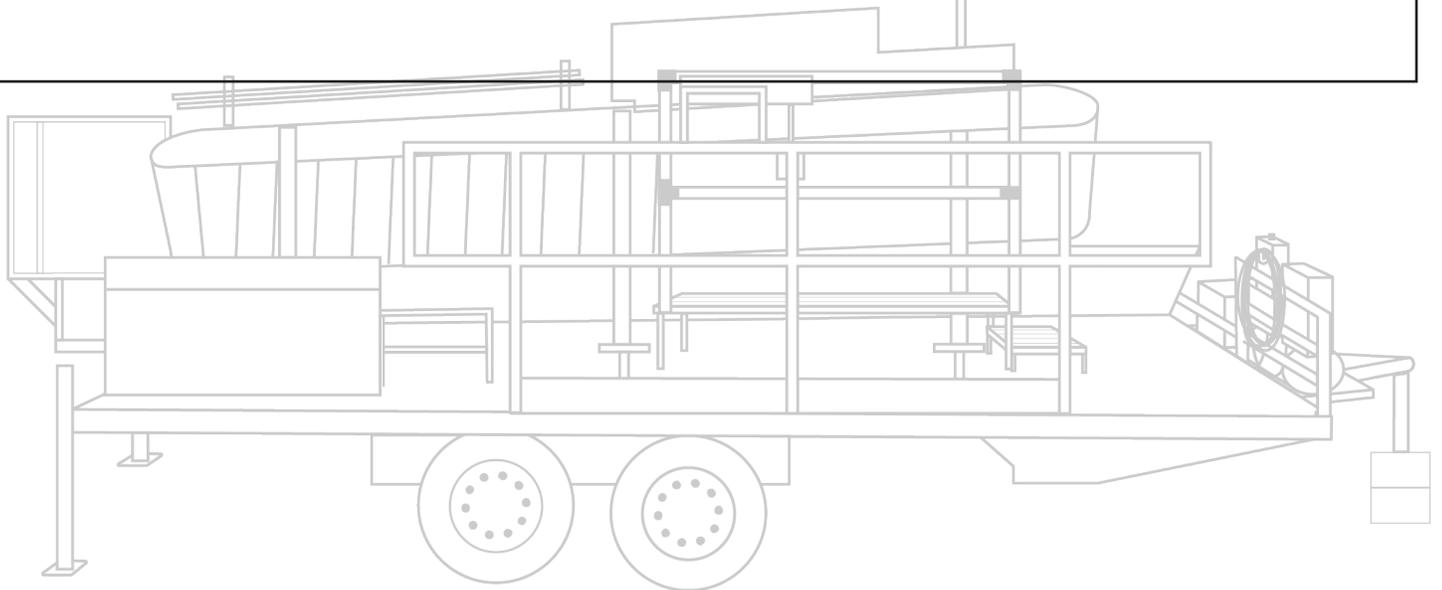


OPERATIONS MANUAL

DEPOPULATION METHOD: V-RESTRAINER



Prepared by:
Swine Medicine Education Center (SMEC)
Iowa State University
College of Veterinary Medicine

Funded by:
Iowa Department of Agriculture
and Land Stewardship (IDALS)

INTRODUCTION:

During the COVID-19 pandemic, there was a supply chain disruption that created a short term interruption of packing plant capacity, and there was a backlog of slaughter weight animals that needed to be euthanized. During this time, several AVMA approved methods of depopulation were evaluated for scale up in the event that mass depopulations would have been needed. Mass depopulation remains a concern in the event of a Foreign Animal Disease (FAD) diagnosed in the United States swine herd. This manual contains instructions, equipment, budget and additional resources for a v-restrainer method. The v-restrainer method refers to the method of restraint during which pigs are electrically stunned with a commercial market hog stunner and subsequently euthanized by a pneumatic penetrating captive bolt gun. Pilot studies have been designed and conducted for small loads of market weight animals, replicated to understand reliability in the field, and monitored sufficiently to develop data that would describe performance capabilities in further scaled situations. The information gained will advance preparation for FAD response and future market interruptions or pandemics. A potential immediate benefit will be the adoption of scaled up preferred methods (CO₂ and penetrating captive bolt) over methods used during constrained circumstances.

The v-restrainer concept involves building a mobile depopulation station utilizing several different technologies that are already in existence. The v-restrainer principle is based on acquiring a v-shaped restraining system that were predominantly used in pork processing plants as a method of restraining the animals in rapid sequence. Once the animal enters the unit, it reaches the midpoint of the v-restrainer, where the animal is electrically stunned using a commercial hog stunner. This renders the animal insensible and keeps the head in perfect position for delivery of the captive bolt. At the end of the v-restrainer, the stunned animal is euthanized by use of pneumatic, penetrating captive bolt device applied to the skull. The carcass is then discharged from the v-restrainer and travels down the discharge chute and onto the ground, a bucket or a series of conveyor belts designed to facilitate carcass removal and then to a carcass disposal location.

GROUND VIEW – OVERALL SET UP

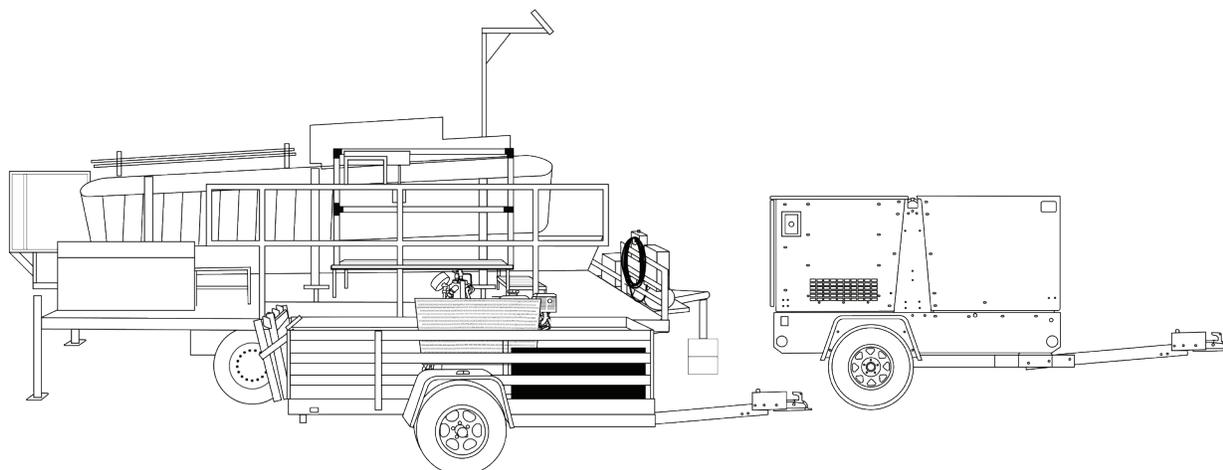


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SUPPLIES & PERSONNEL:

TOOLS NEEDED:

- | | | |
|---|--|--|
| <input type="checkbox"/> Extension cord (2) | <input type="checkbox"/> Rubber Boots (9) | <input type="checkbox"/> 2-5/16th ball for trailer |
| <input type="checkbox"/> Hammer | <input type="checkbox"/> Pliers | <input type="checkbox"/> 2 inch ball for generator trailer |
| <input type="checkbox"/> Level | <input type="checkbox"/> Gloves | <input type="checkbox"/> Cinder block for trailer hitch jack |
| <input type="checkbox"/> Crescent wrench (medium) | <input type="checkbox"/> Cloth coveralls | <input type="checkbox"/> Roll of electrical tape |
| <input type="checkbox"/> Hex wrenches (5/16) | <input type="checkbox"/> Volt tester | <input type="checkbox"/> Flat head screwdriver |
| <input type="checkbox"/> Sockets (11/16) | <input type="checkbox"/> 3/4 ton truck or larger | <input type="checkbox"/> Eye protection |
| | | <input type="checkbox"/> Ear protection |

TOTAL PEOPLE NEEDED:

MINIMUM OF 9

- 2 people to load the pigs out of the barn
- 1 person to move the pig through the ramp and into the V-restrainer
- 1 person to run the V-restrainer
- 1 person to stun the pigs
- 1 person to use the pneumatic captive bolt gun
- 1 person to check for insensibility and death at the end of the discharge chute
- 1 safety manager
- 1 electrician/ag engineer

It is important to have enough labor to allow for rotation of duties as the electrical stunner and captive bolt gun operators will need to be changed hourly.

ESTIMATED TIME FOR SETUP:

First time setup:
60-90 minutes

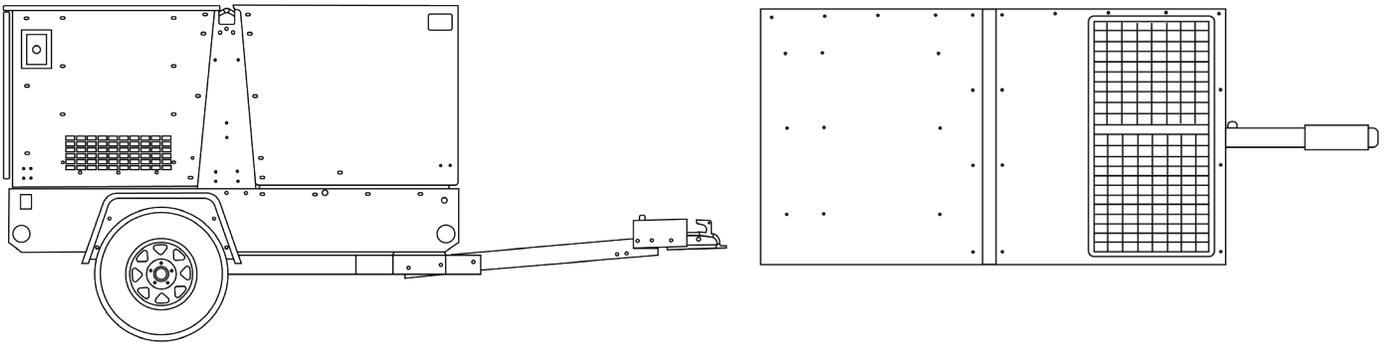
Repeated setup:
60 minutes

PARTS:

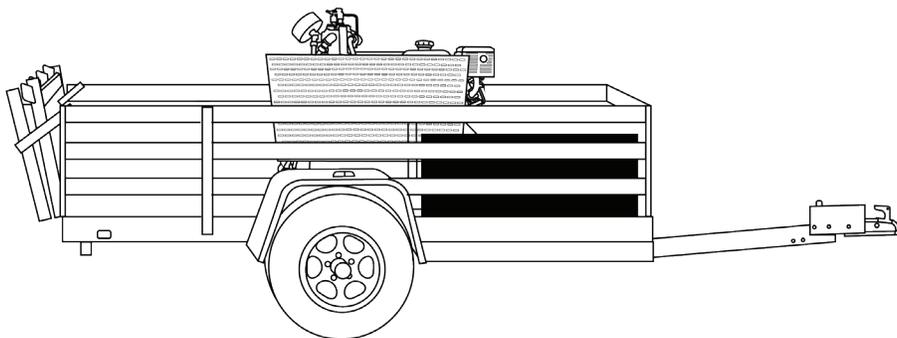
GENERATOR

The 7.5 hp electrical motor that operates the v-restrainer requires 3 phase electricity. Most sites do not have 3 phase electricity, so a portable generator may need to be rented to power the v-restrainer trailer. Generators can be rented from any large equipment rental place (e.g. United Rentals)

Minimum prime power rating: 25 kVA at 208 V / 3-phase



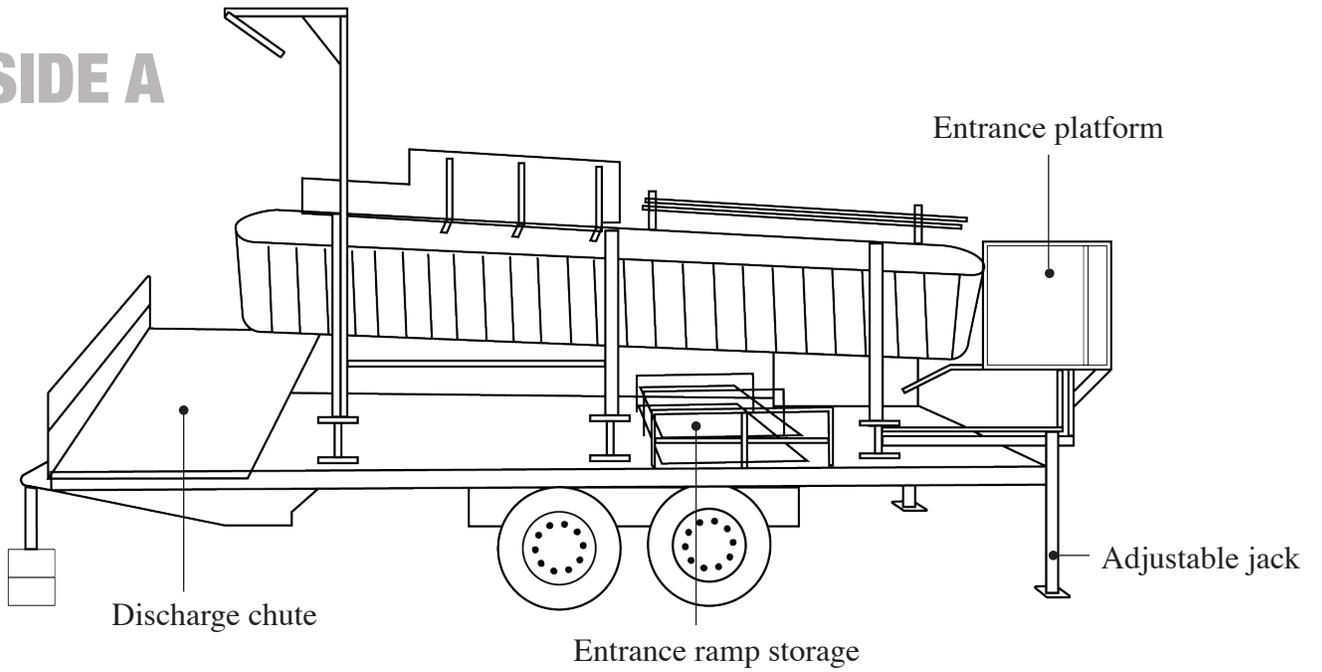
AIR COMPRESSOR TRAILER



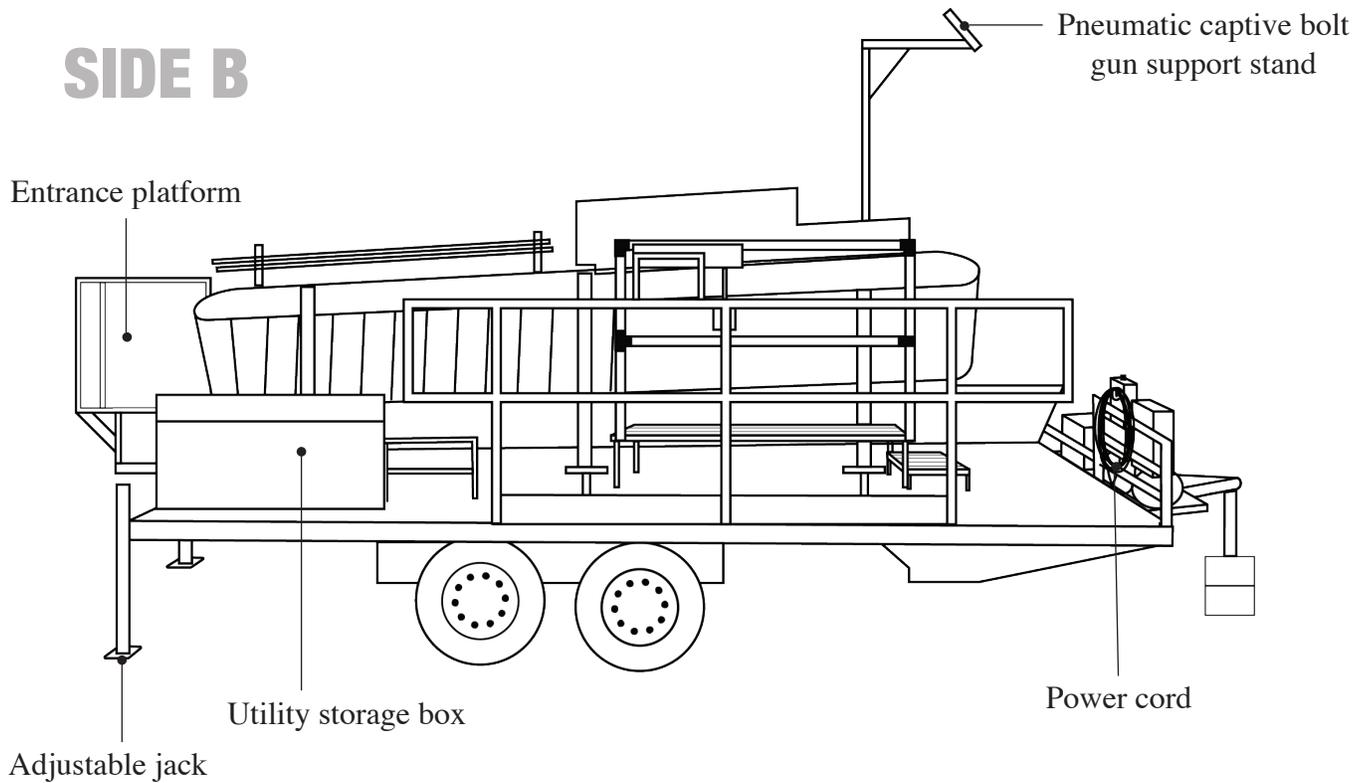
PARTS:

V-RESTRAINER

SIDE A

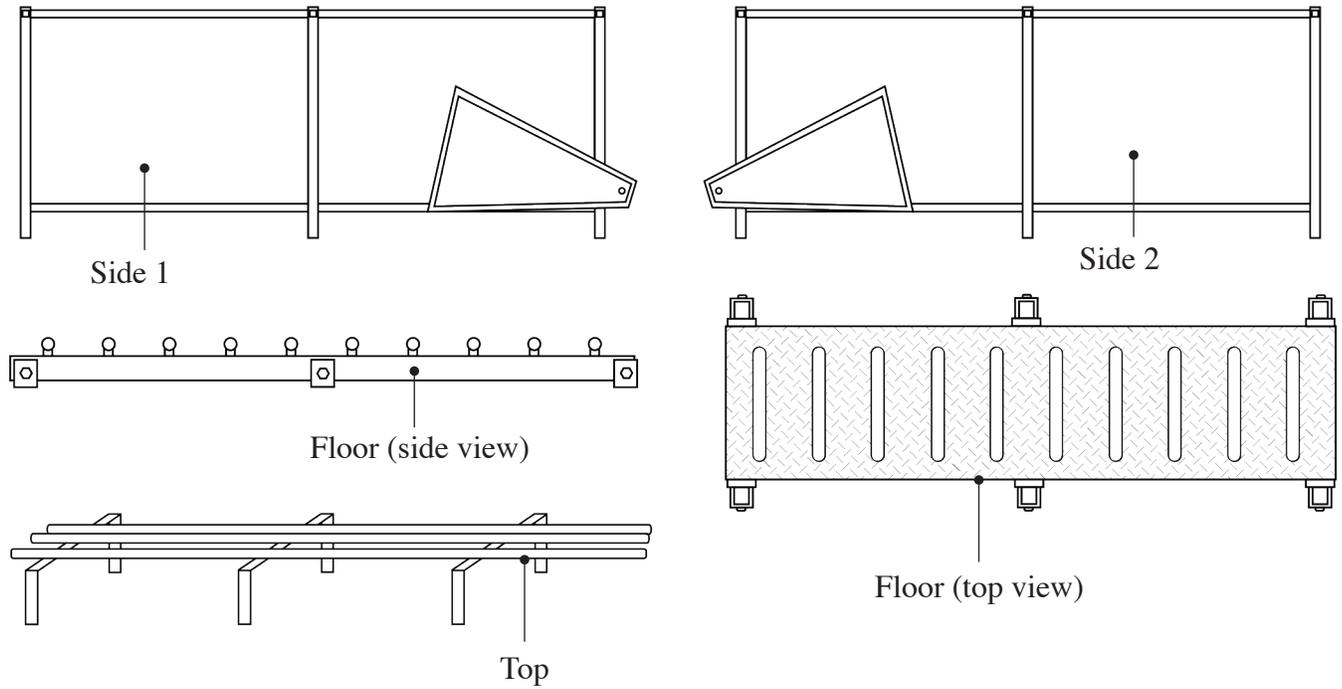


SIDE B

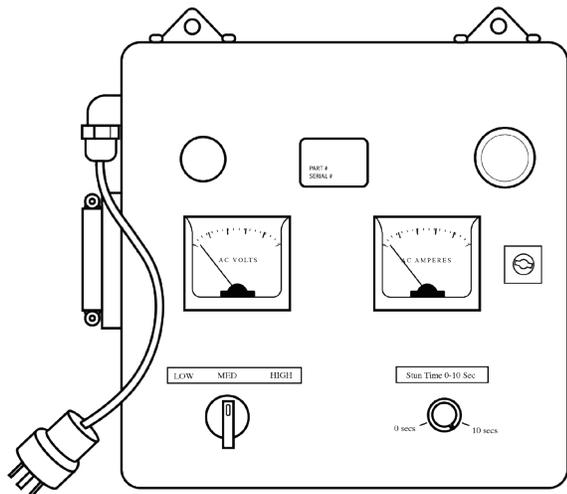


PARTS:

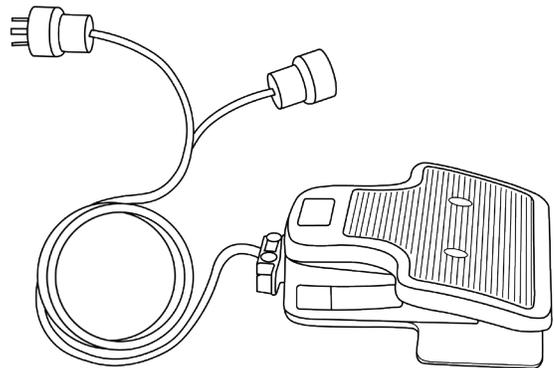
ENTRANCE RAMP



ELECTRICAL STUNNER BOX

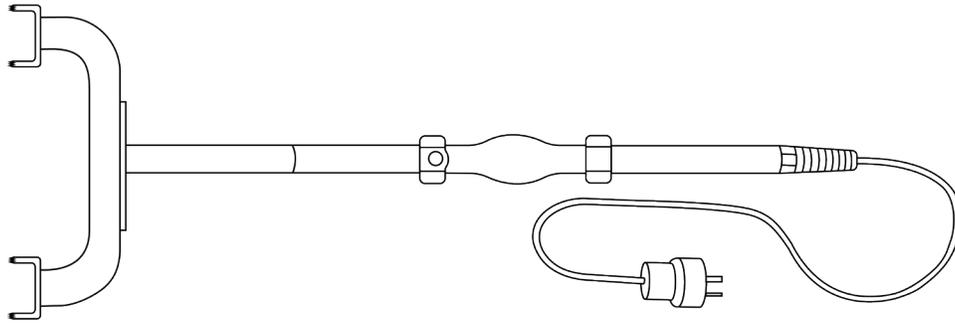


FOOT PEDAL

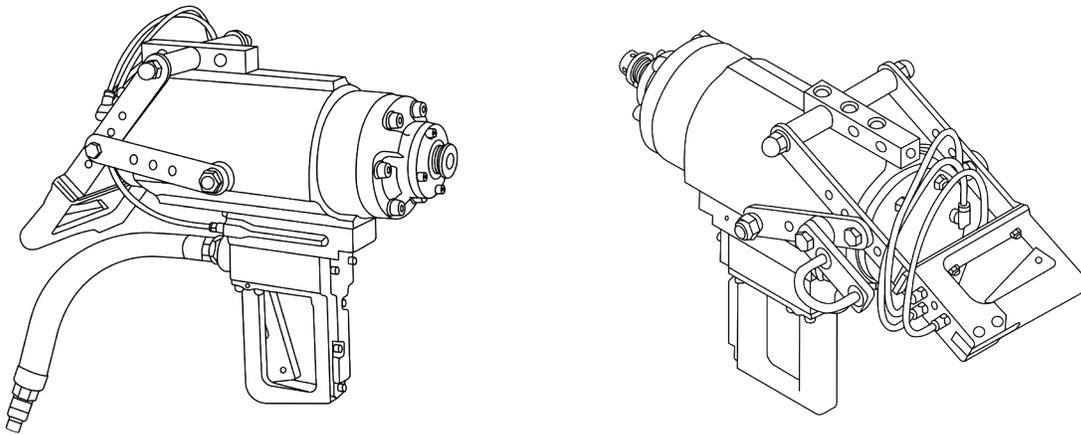


PARTS:

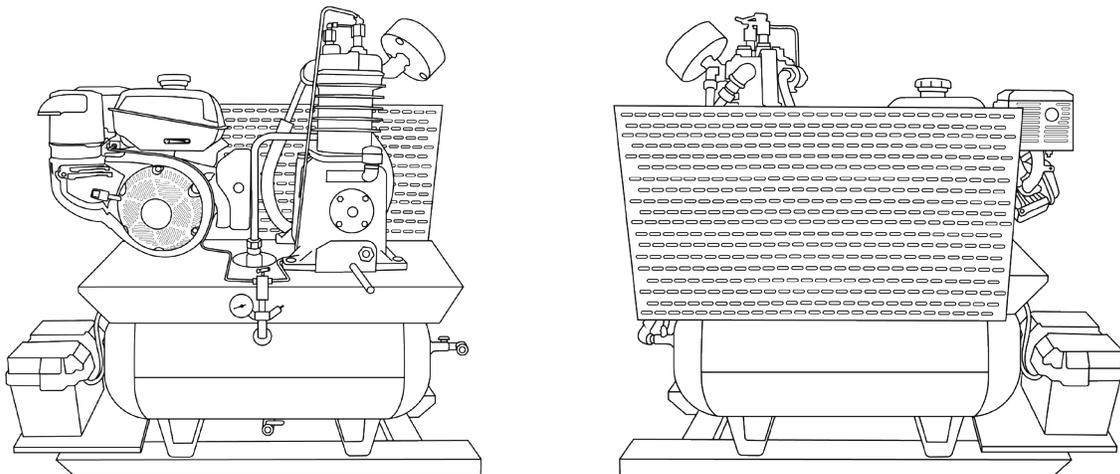
ELECTRICAL STUNNER WAND



PNEUMATIC CAPTIVE BOLT GUN

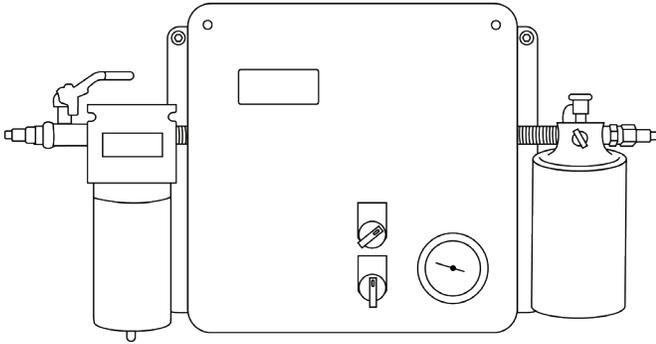


AIR COMPRESSOR

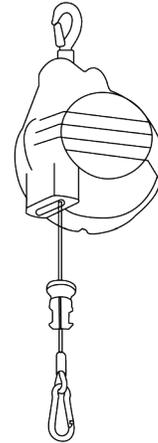


PARTS:

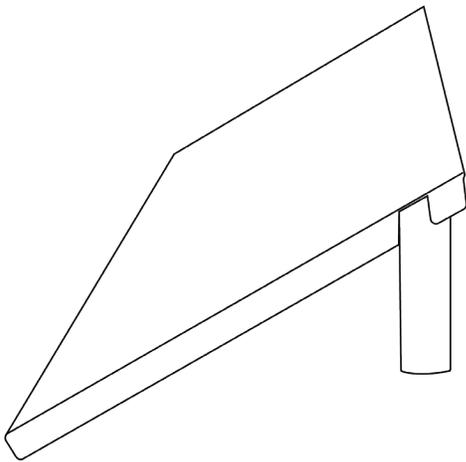
AIR COMPRESSOR CONTROL BOX



COUNTER BALANCE



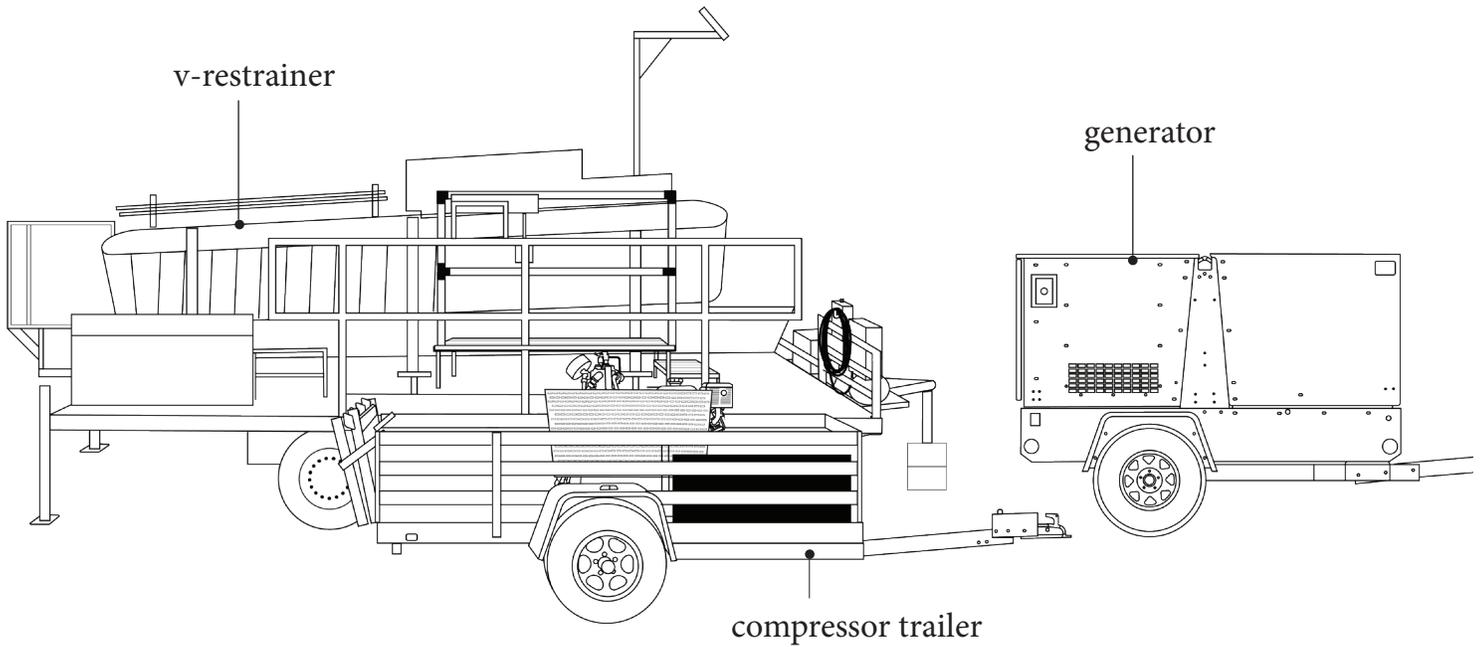
SLIDE EXTENSION RAMP



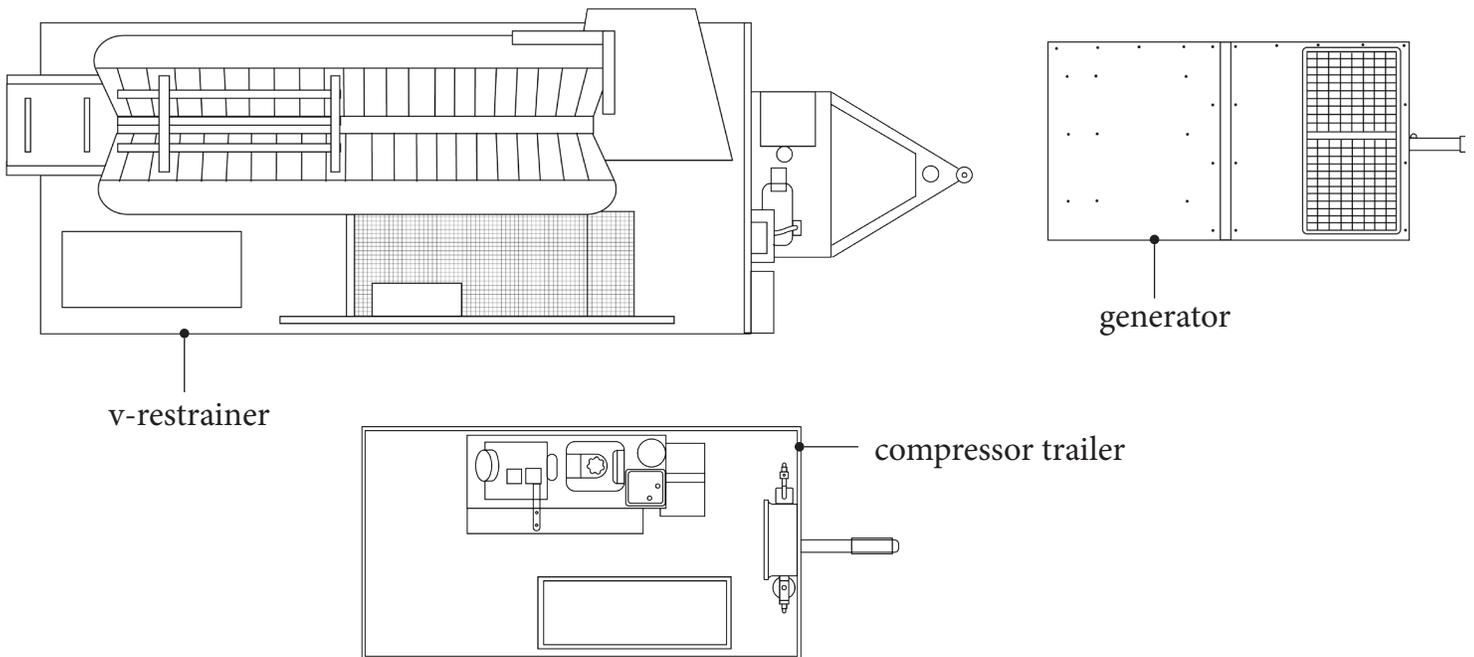
ASSEMBLY INSTRUCTIONS:

After obtaining the three major parts, assembly can begin. Below is a diagram of the overall set up.

GROUND VIEW - OVERALL SET UP



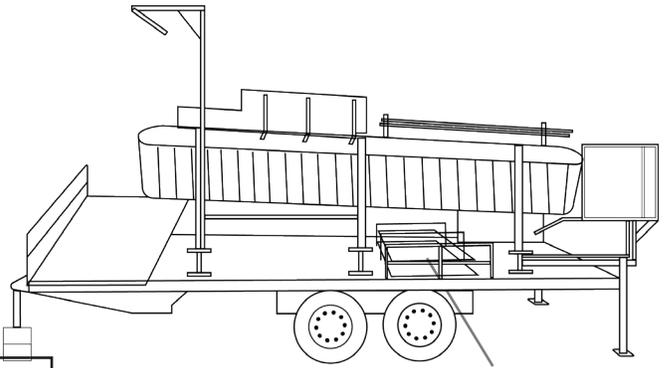
AERIAL VIEW - OVERALL SET UP



ASSEMBLY INSTRUCTIONS:

V-RESTRAINER

How to assemble the ramp

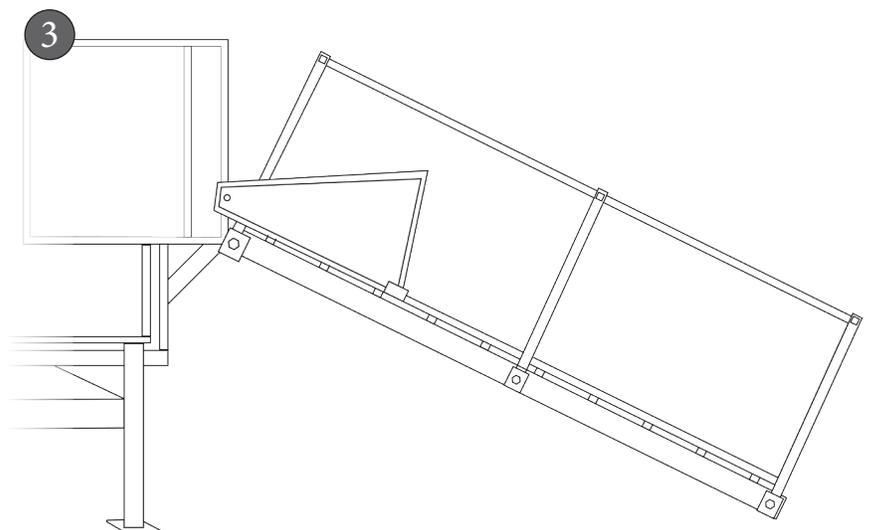
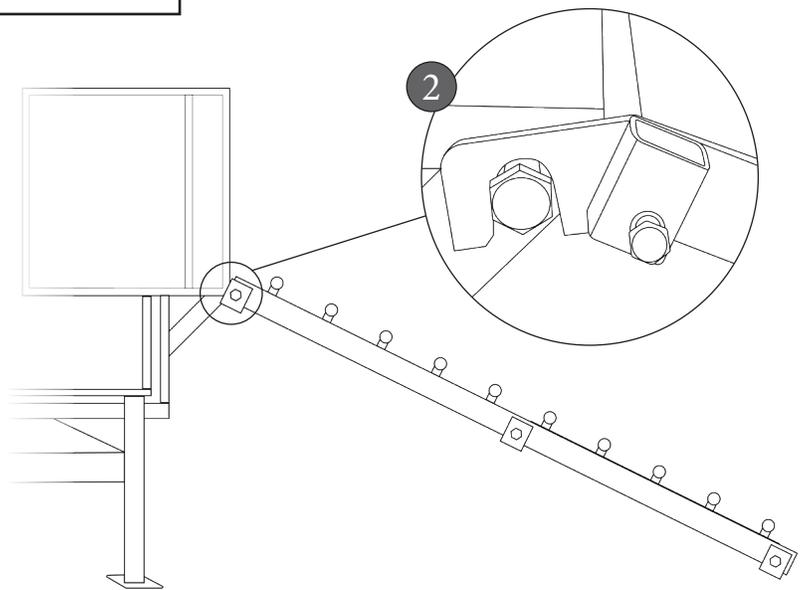


1 Ramp parts located here

NOTE: This step may be unnecessary depending on barn set up. If loading occurs at dock height (48”), then the V-restrainer can be backed directly up to the dock without putting on the ramp.

The ramp is adjustable from ground level up to dock height (48-50 inches). Once the ramp is installed, 2 people will need to lift the ramp while the trailer is backed into position and the ramp placed where pigs will be loaded onto the ramp.

1. Remove end retaining pin to remove ramp sides and top from storage rack.
2. Place ramp floor on the 2 pins on the floor of the entrance ramp into the v-restrainer.
3. Place each of the 2 chute sides into the notches in the floor ramp. Bolts on the floor ramp may need to be loosened first. Once sides are in place, hand tighten the bolts until the top is put on.

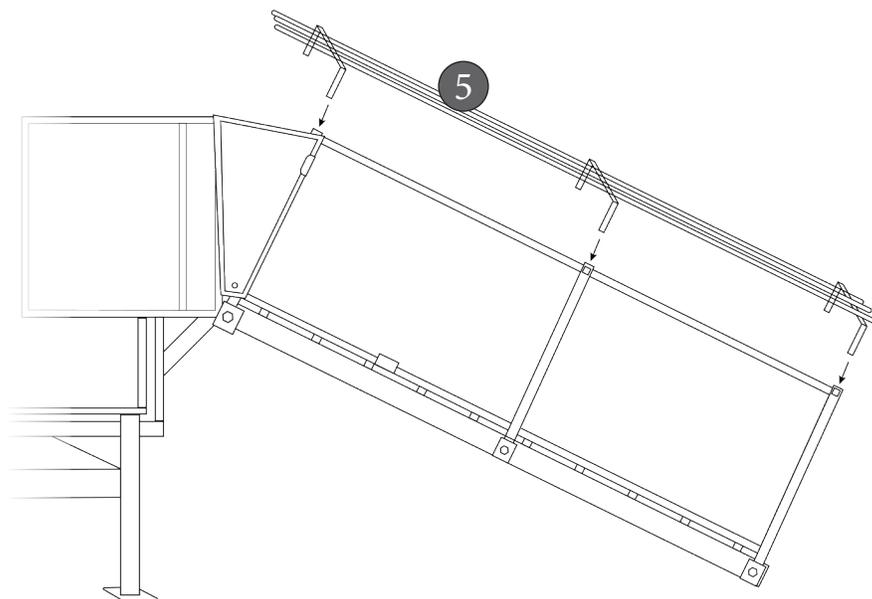
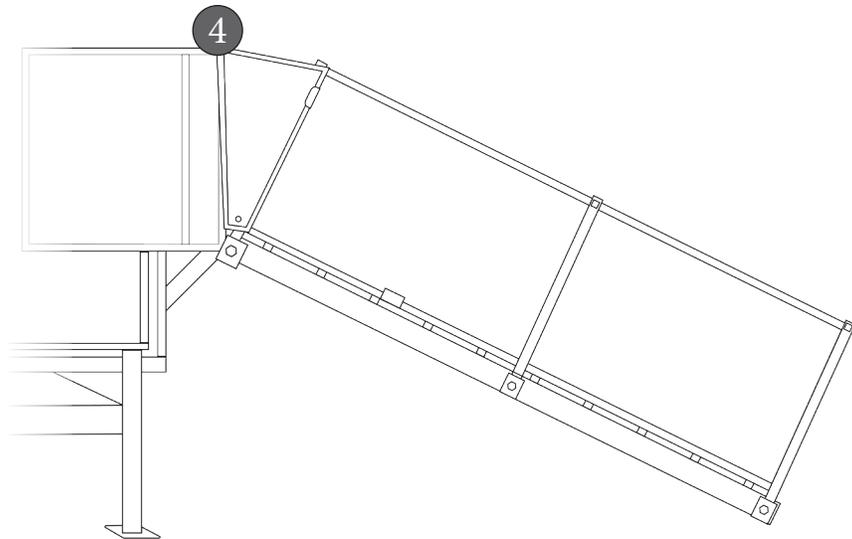


ASSEMBLY INSTRUCTIONS:

V-RESTRAINER

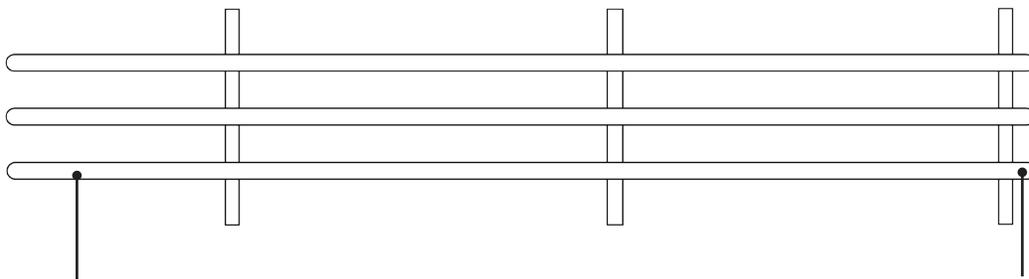
How to assemble the ramp

4. Rotate side panel to close the gap between the ramp platform and ramp sides. Depending on the height of the platform that the pigs are being loaded from, the side panels may or may not be necessary to use.
5. Place the top and align with the holes on the sides of the ramp. Once the top is on and secured, tighten all the bolts with pliers or a crescent wrench.



NOTE: When placing the top on, the end of the rails that extends farther out is attached closest to the entrance ramp.

Top piece - aerial view



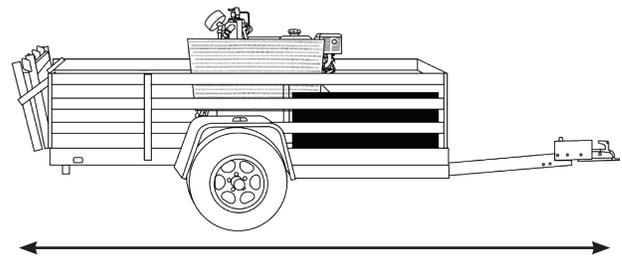
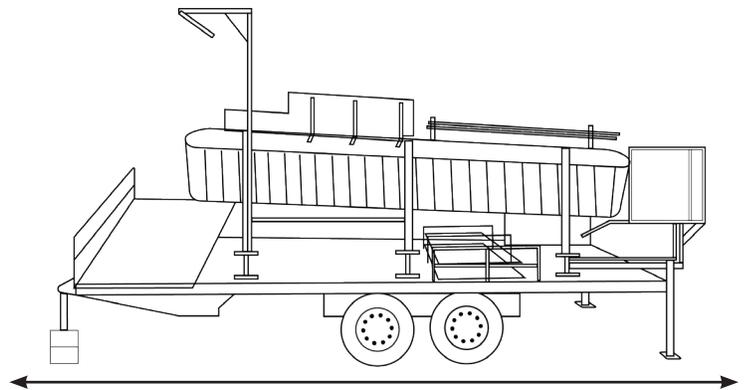
this end closest to the entrance platform.

this end closest to the ground.

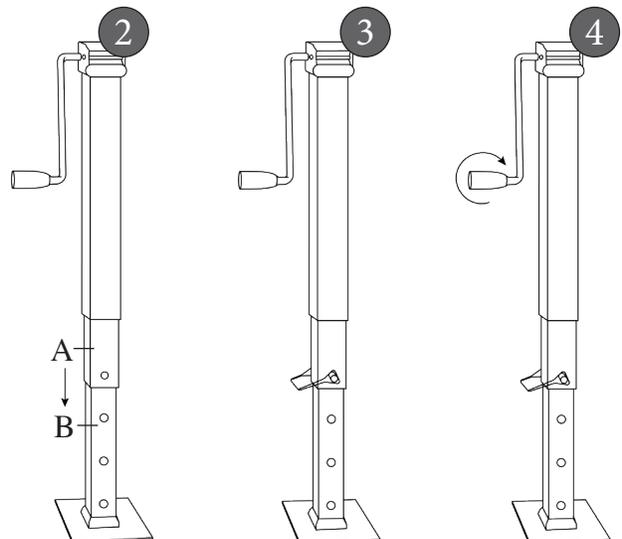
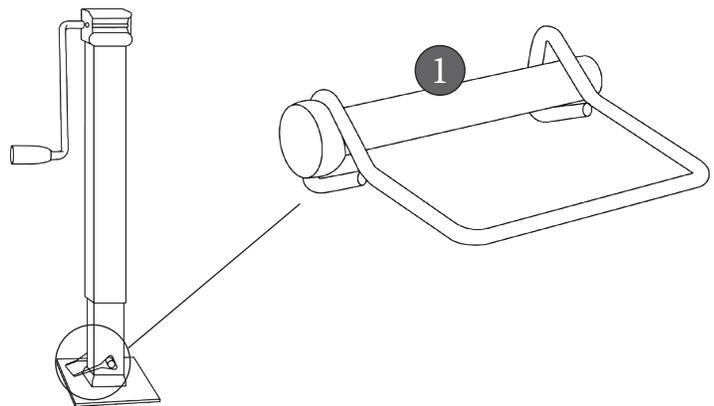
ASSEMBLY INSTRUCTIONS:

V-RESTRAINER & AIR COMPRESSOR Level / support legs

Both the v-restrainer and compressor trailer need to be level for safety and operation purposes. The compressor trailer has to be parked on flat ground as there are no trailer mechanisms for leveling.



1. To level and stabilize the v-restrainer, remove trailer jack lock pin on the adjustable jack near the back of the v-restrainer.
2. Lower the drop leg, so the foot plate is on the ground.
3. Once stabilized, replace the lock pin.
4. Next, crank the handle clockwise to take weight.
5. Repeat process for both adjustable jacks.



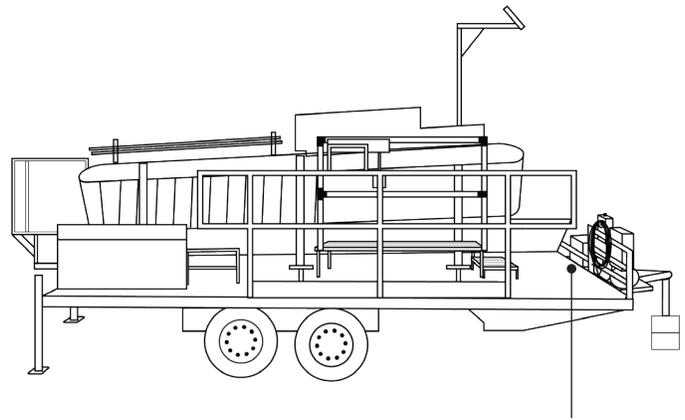
NOTE: Use the level to ensure that the trailer is level both left to right and front to back on the trailer. Set the level across the back of the trailer equidistant from the two leveling jacks. If the trailer is not level, then raise or lower one of the jacks and then check again with the level.

ASSEMBLY INSTRUCTIONS:

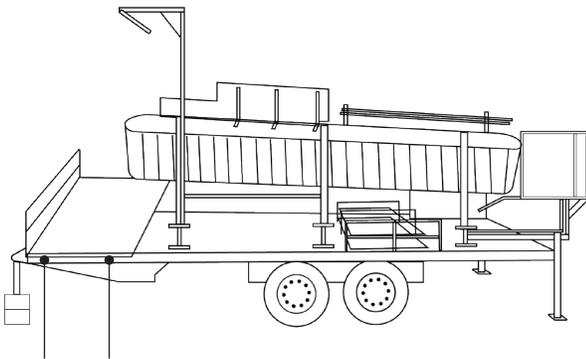
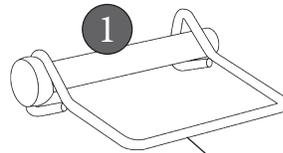
V-RESTRAINER

How to assemble slide extension ramp

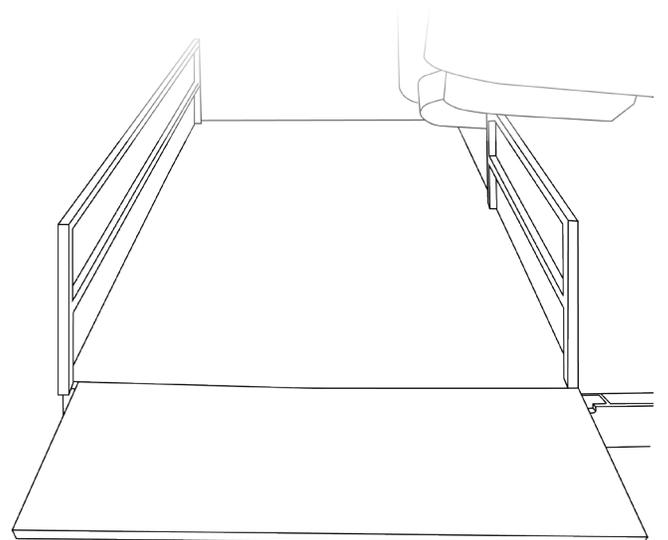
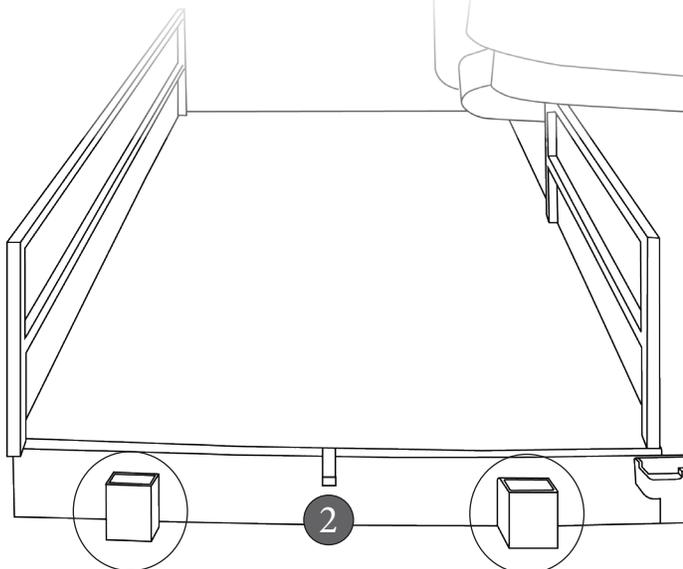
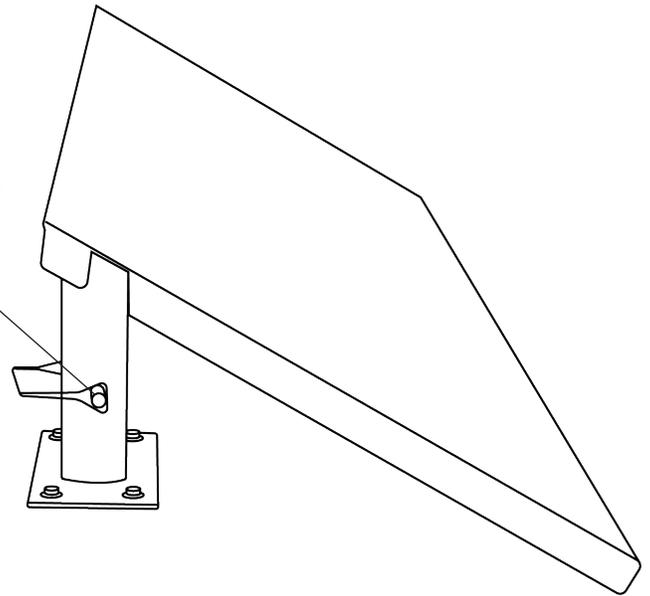
1. Remove the pin to
remove the extension.
2. Place extension legs into
slots.



ramp extension piece location



slots location



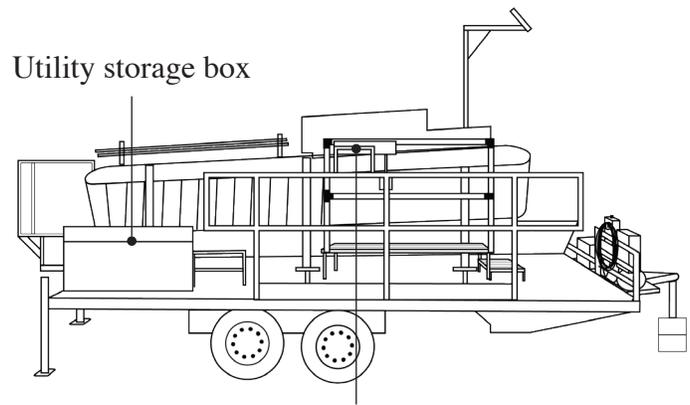
ASSEMBLY INSTRUCTIONS:

V-RESTRAINER

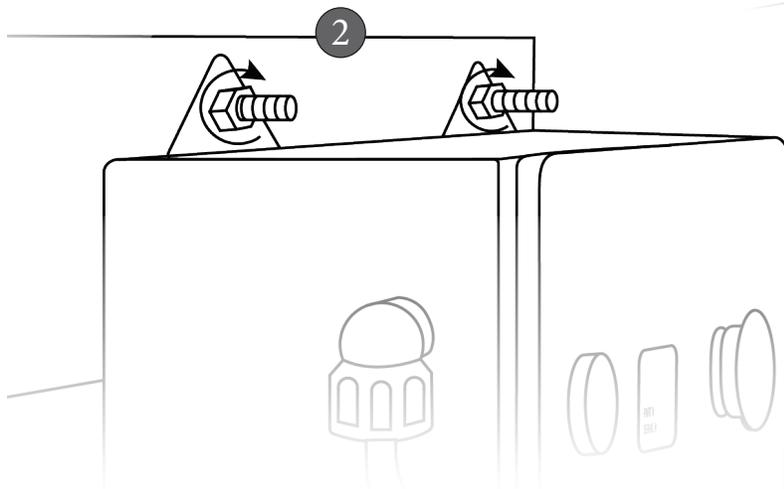
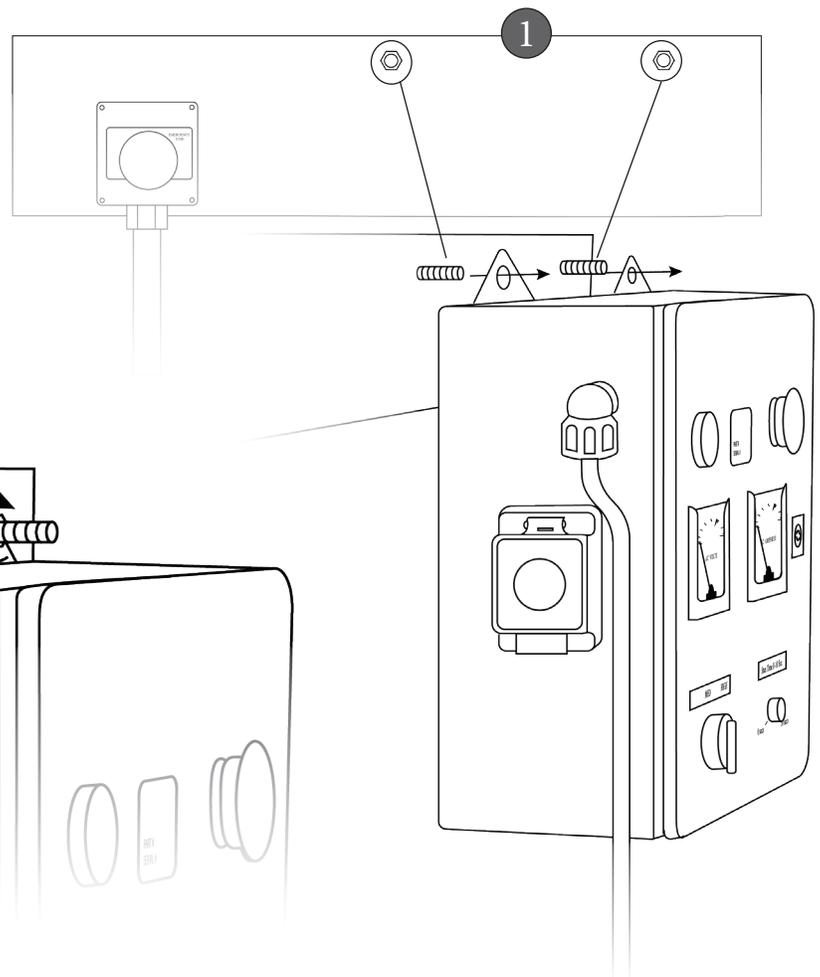
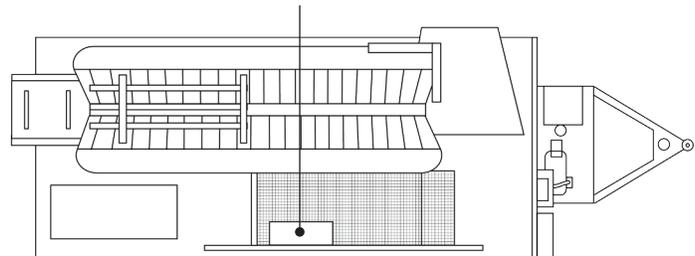
How to hookup the Jarvis Electrical Stunner

CAUTION: The Jarvis electrical stunner box is extremely heavy and will require 2 people to take it out of the utility storage box and install it on the guardrail on the v-restrainer

1. There are 2 bolts on the trailer to mount the stunner box. Remove the nuts and washers and keep them in your pocket. Lift the stunner box and place on the v-restrainer trailer by placing the stunner box on the 2 bolts.
2. Place the washers and nuts back onto the bolts. Tighten with a crescent wrench to ensure stunner box is secure.



The electrical stunner box placement location is on the elevated stand.

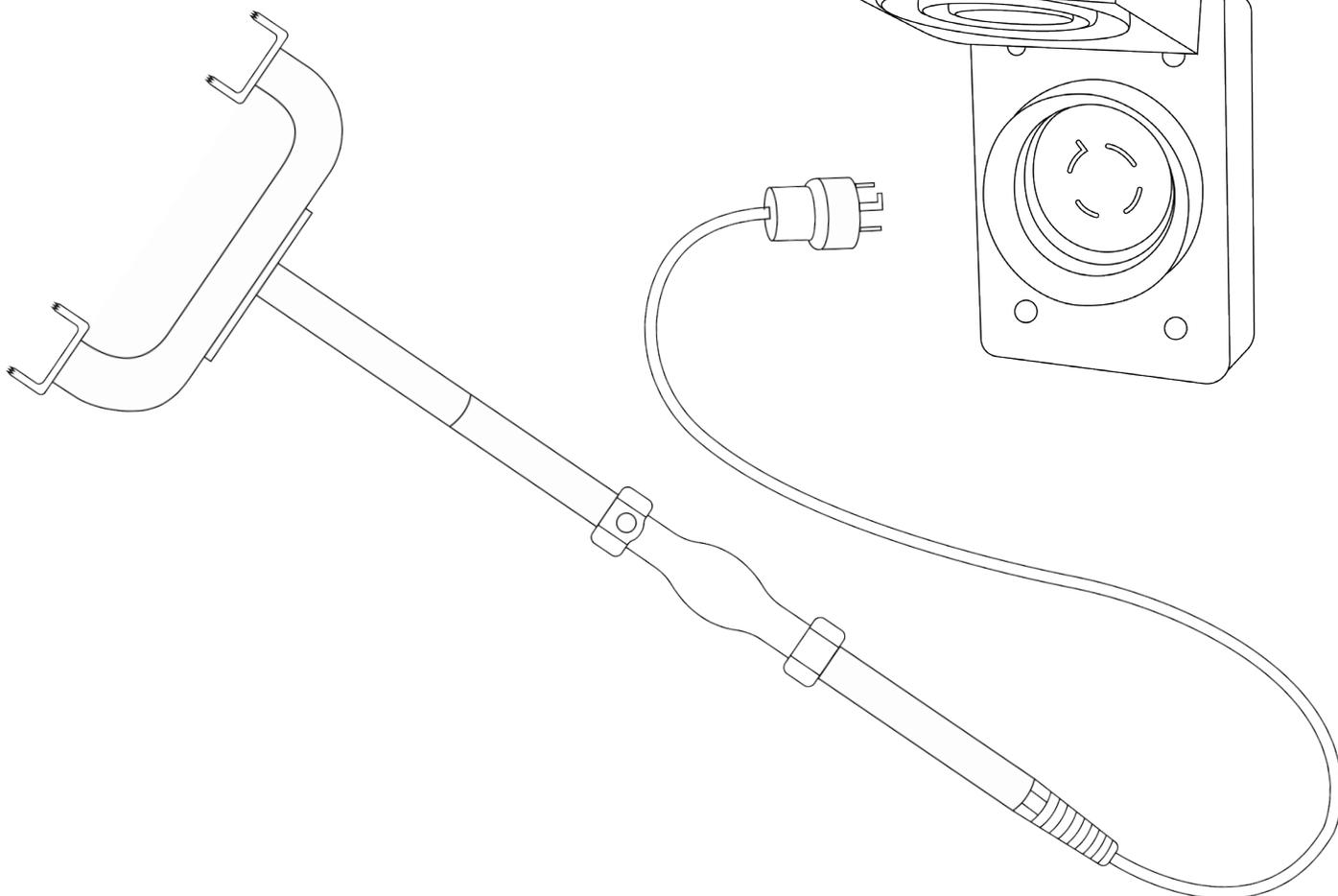


ASSEMBLY INSTRUCTIONS:

V-RESTRAINER

How to hookup the Jarvis Electrical Stunner

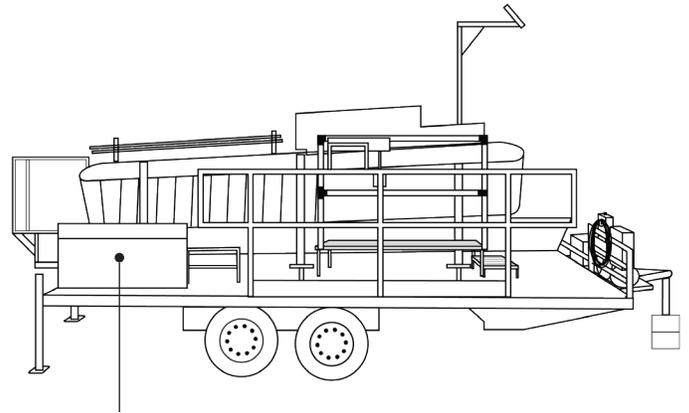
3. Plug the wand into the stunner box. Lift up the yellow flap on the left side of the stunner box (as you are facing the mounted stunner box). There is one prong that has an extra blade that will only fit into one slot in the stunner box, so be sure to align the plug and receiver ends to ensure the wand is plugged in correctly.



ASSEMBLY INSTRUCTIONS:

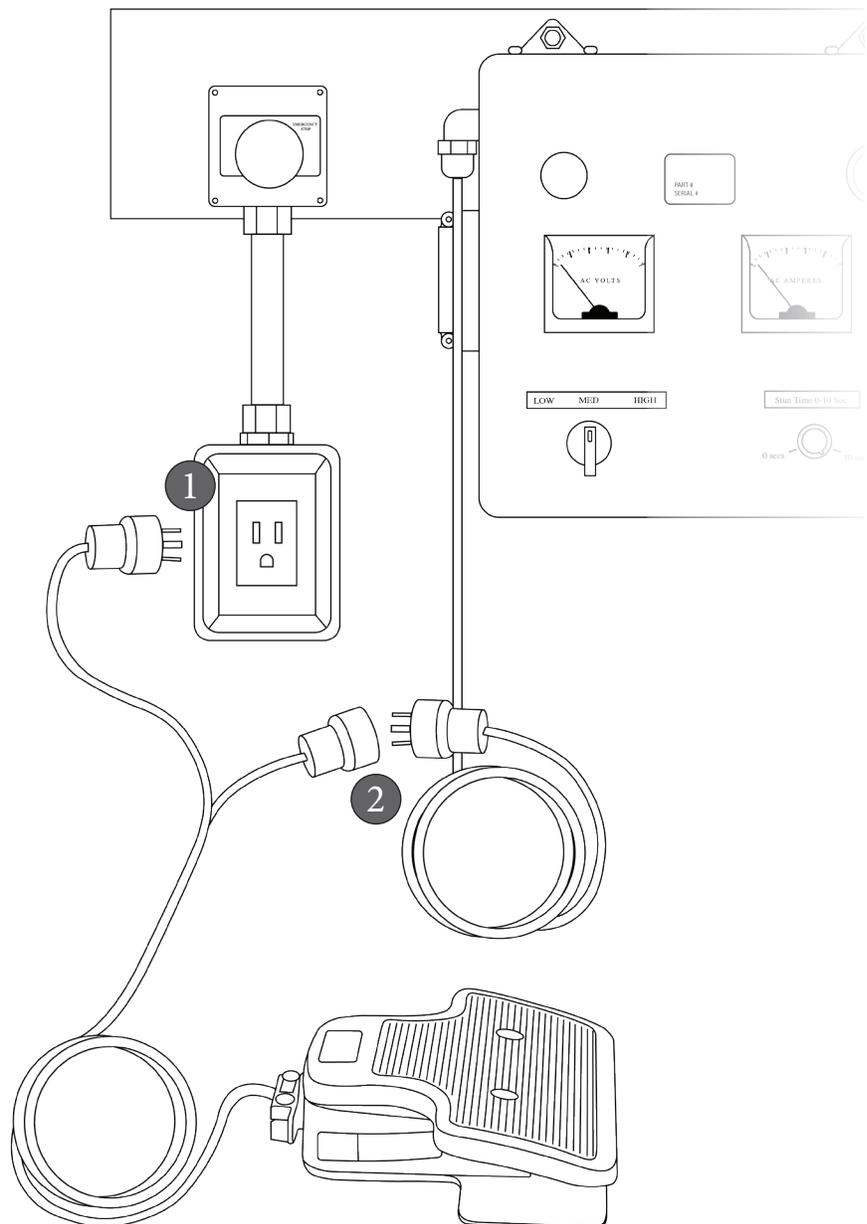
V-RESTRAINER

How to hookup the safety foot pedal for the electrical stunner



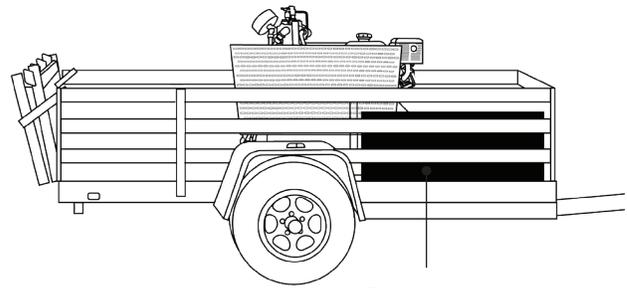
Foot pedal located here

1. Take the foot pedal out and plug the male end (1) into the outlet box right underneath the E-stop (red button).
2. Plug the male end coming from the stunner box into the female end of the foot pedal.



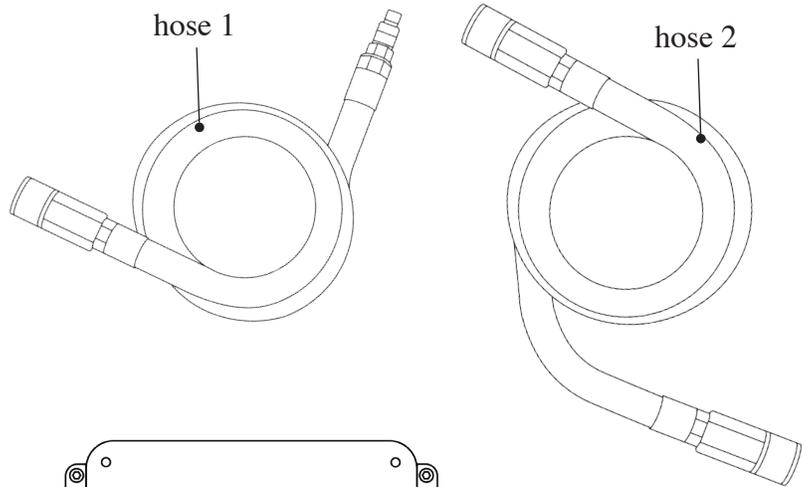
ASSEMBLY INSTRUCTIONS:

COMPRESSOR TRAILER Setting up the air compressor

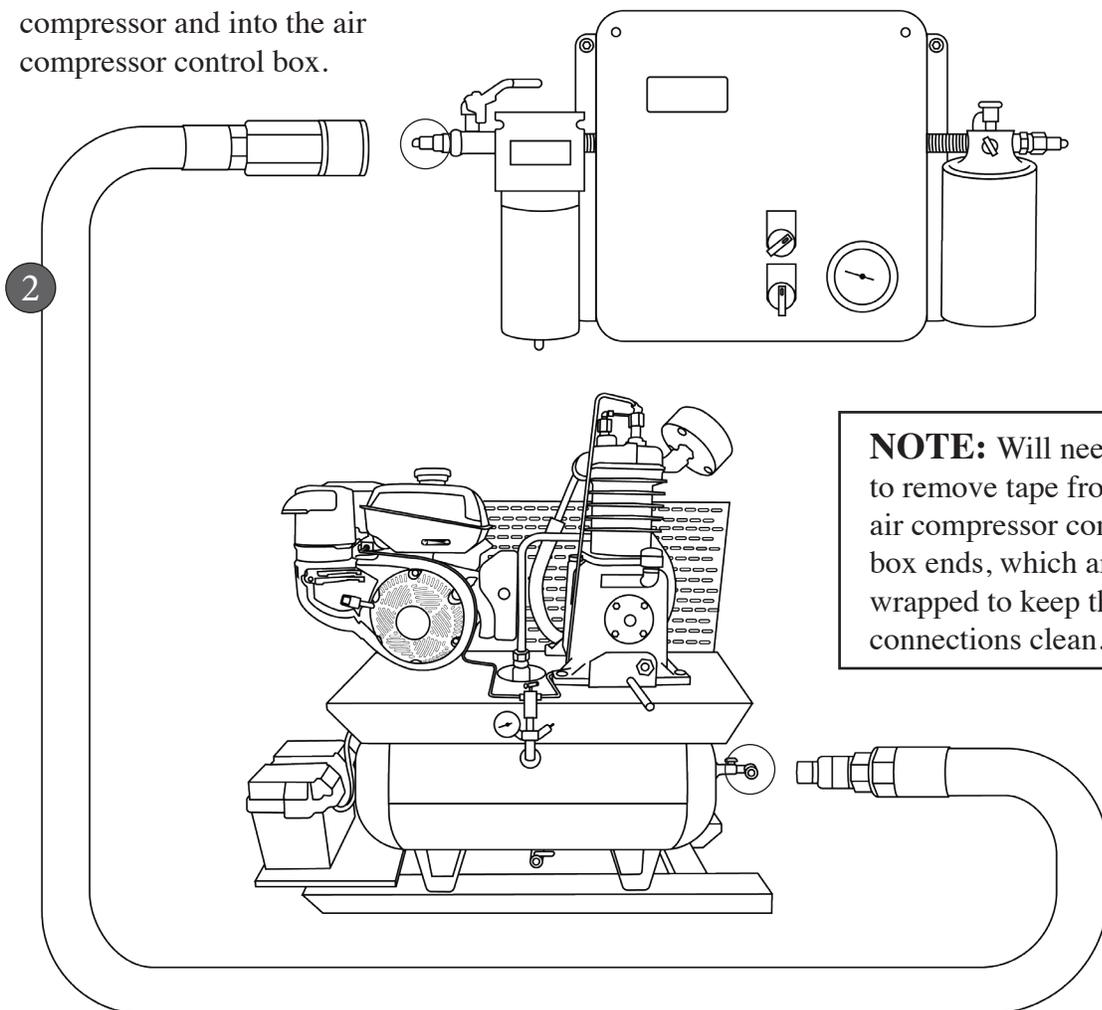


1 hoses located in storage box here

1. Remove the two red air hoses (one shorter with a male and a female end, one longer with two female ends) that will connect the air compressor to the air compressor control box and from the air compressor control box to the pneumatic captive bolt gun. Hoses 1 and 2 may be connected together for storage.



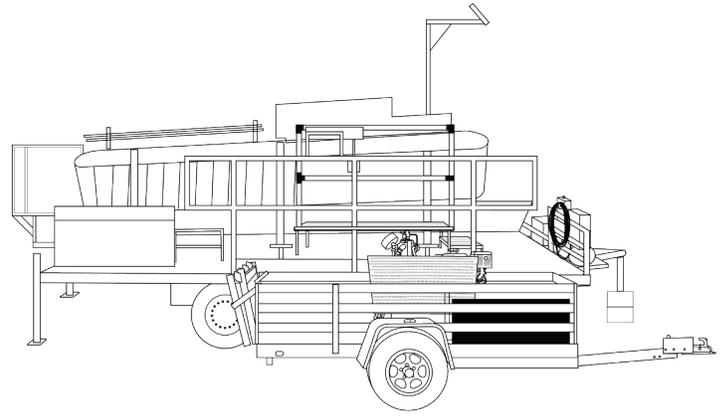
2. Hose 1 (male and female) will be connected from the air compressor and into the air compressor control box.



NOTE: Will need to remove tape from air compressor control box ends, which are wrapped to keep the connections clean.

ASSEMBLY INSTRUCTIONS:

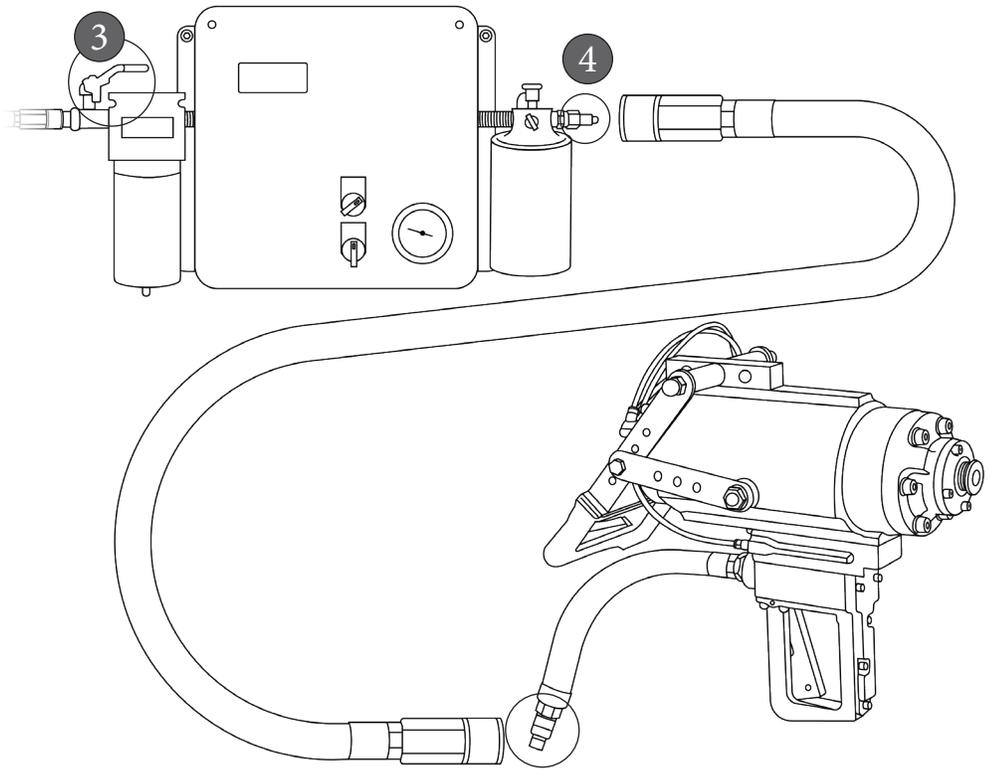
COMPRESSOR TRAILER Setting up the air compressor



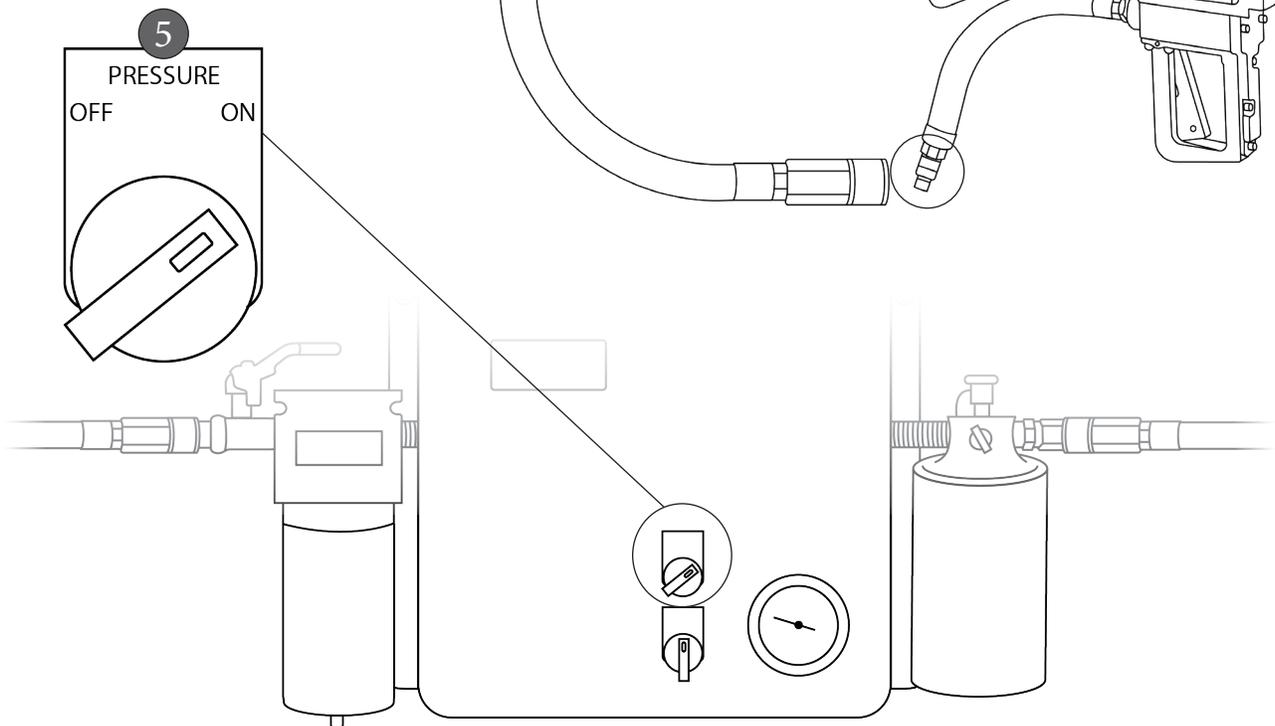
3. Verify valve to water separator is open on the air compressor control box. The valve is open when the handle is parallel to the hose.

Due to hose 2 length, park the trailer next to the generator, within 20-30 feet of the front of the v-restrainter trailer, and ensure that the air compressor is parked on level ground

4. Take hose 2 (2 female ends) and hook it up on the other side of the air compressor control box, with the other end of the hose connecting to the Jarvis pneumatic captive bolt gun.

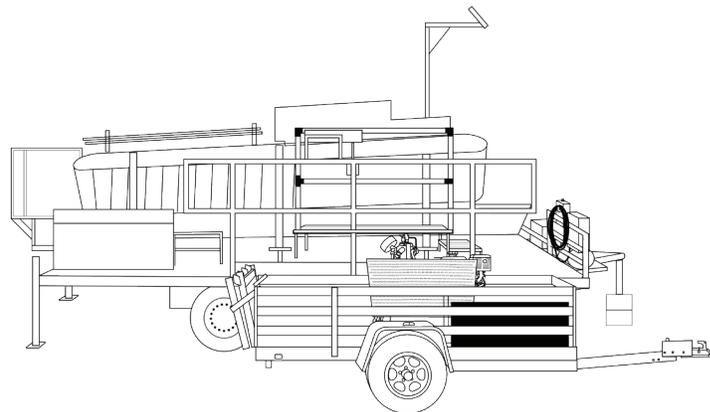


5. Ensure that the switch on the air compressor control box is turned to the ON position, prior to starting the compressor.



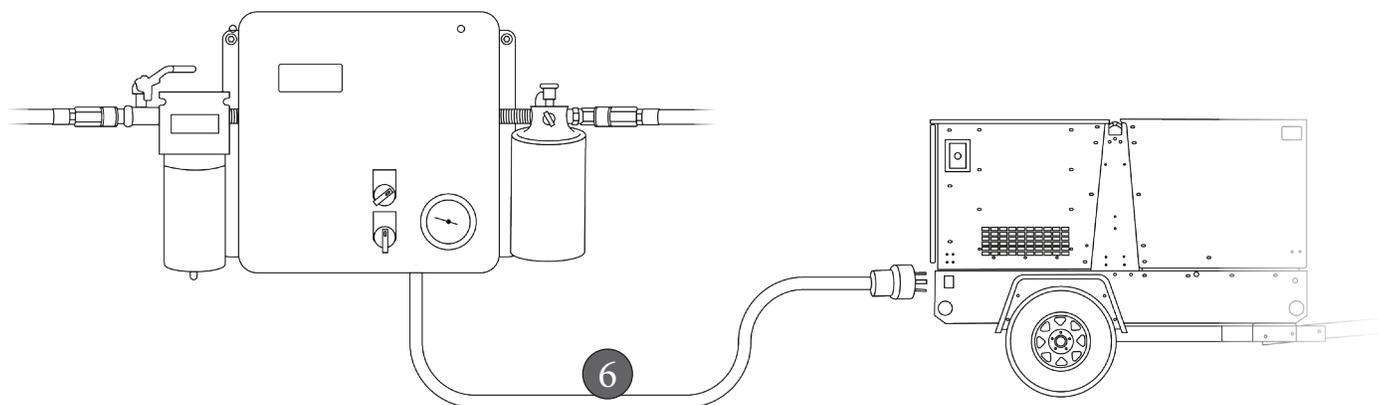
ASSEMBLY INSTRUCTIONS:

COMPRESSOR TRAILER Setting up the air compressor



6. Plug the air compressor control box into an outlet on the generator.

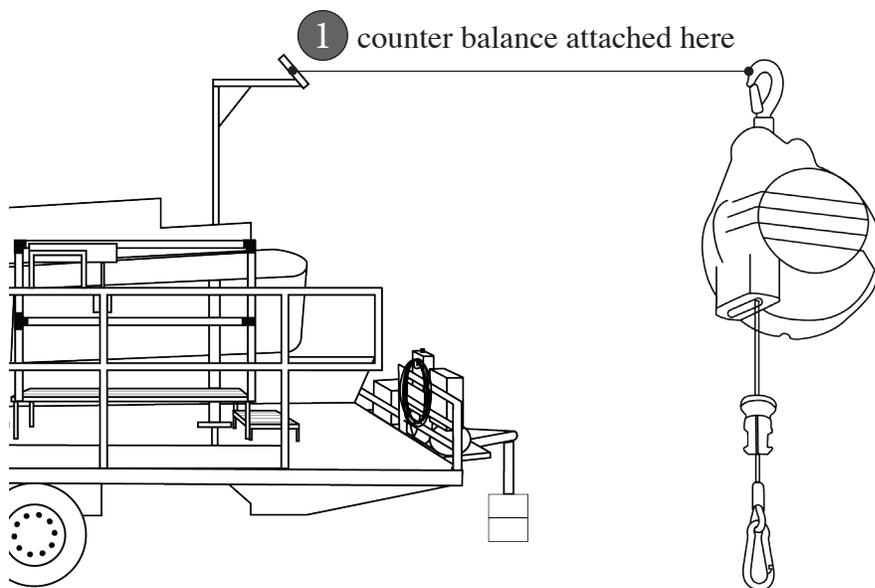
Due to hose 2 length, park the trailer next to the generator and within 20-30 feet of the front of the v-restrainer trailer and ensure that the air compressor is parked on level ground



V-RESTRAINER Attaching the counter balance

1. Hang the counter balance onto the captive bolt gun stand on the v-restrainer. This is to help support the weight of the Jarvis USSS-1 pneumatic captive bolt gun.

NOTE: After testing gun speed, (directions on page 39) you will attach the Jarvis USSS-1 pneumatic captive bolt gun to the counter balancer.



ASSEMBLY INSTRUCTIONS:

V-RESTRAINER

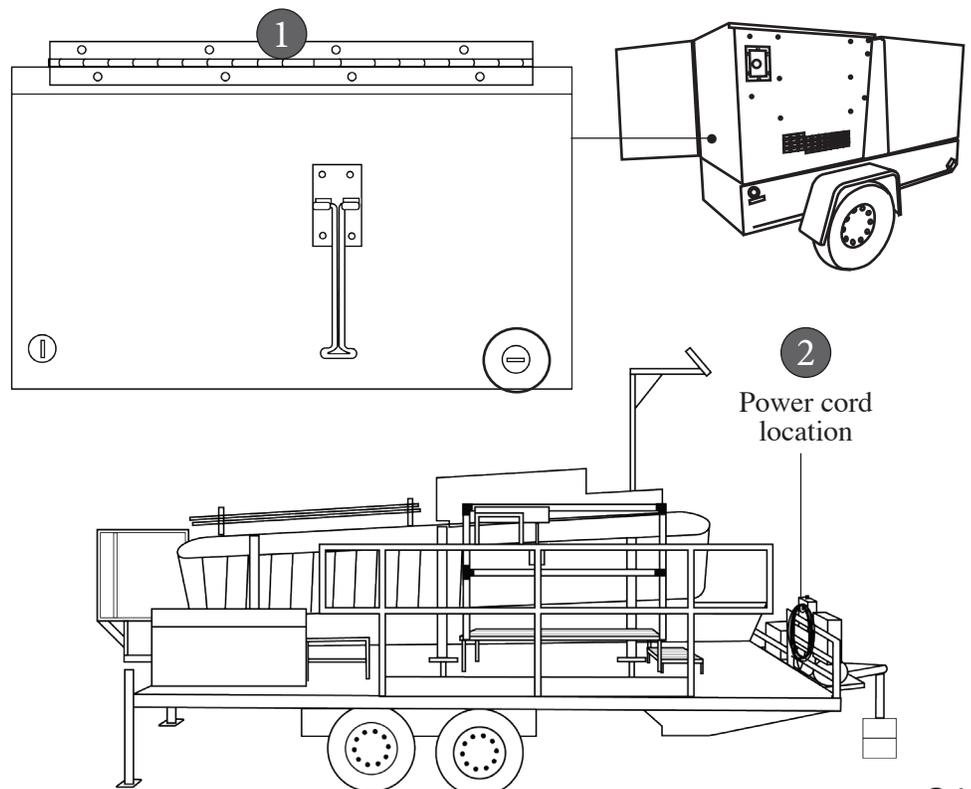
How to hookup the v-restrainer to the 3 Phase power source

The 7.5 hp electrical motor that operates the v-restrainer requires 3 phase electricity. **Most sites do not have 3 phase electricity, so a portable generator may need to be rented to power the v-restrainer trailer.** Generators can be rented from any large equipment rental place (e.g. United Rentals)

Minimum prime power rating: **25 kVA at 208 V / 3-phase**

NOTE: These are the instructions for the MAGNUM PRO Model MMG25IT4 19-29 KVA Generator. Setup may vary for different generators. Please consult the generator manual or have the generator owner walk through the start up sequence with you prior to using it.

1. Use a flat head screwdriver to turn the lock on the back panel of the generator. This opens the area to attach the cords to the generator. The flap will lift up and can be locked to stay open while the wires are attached to the generator.
2. The power cord from the v-restrainer trailer is on a hook on the front of the trailer, right behind the fuse box.



ASSEMBLY INSTRUCTIONS:

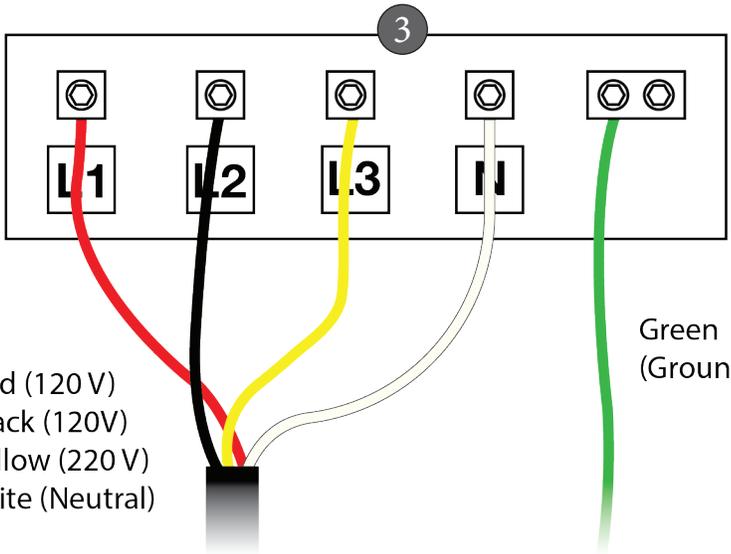
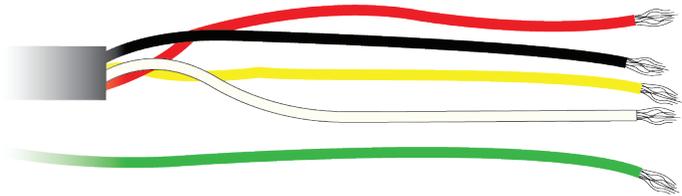
V-RESTRAINER

How to hookup the V-restrainer to the 3 Phase power source

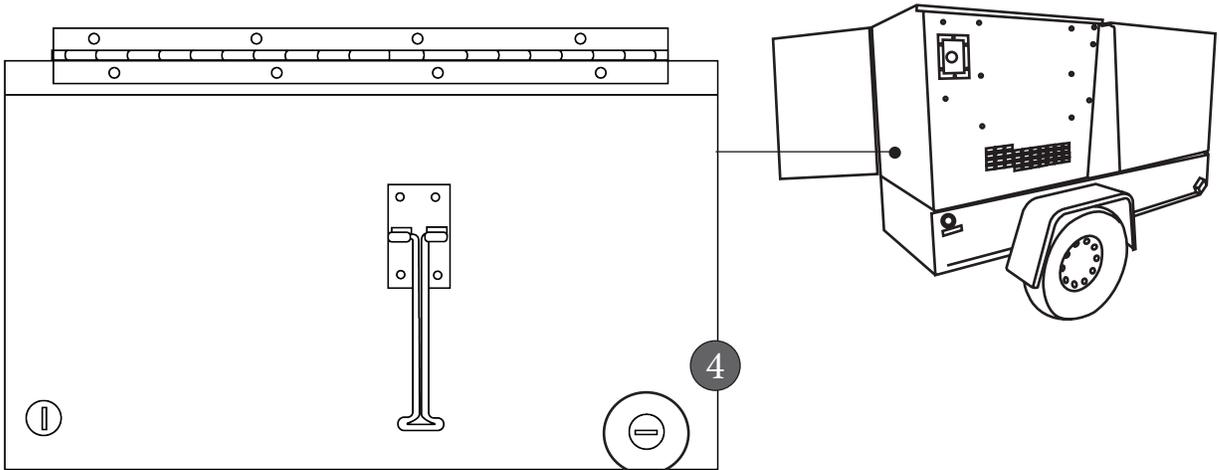
NOTE: These are the instructions for the MAGNUM PRO Model MMG25IT4 19-29 KVA Generator. Setup may vary for different generators. Please consult the generator manual or have the generator owner walk through the start up sequence with you prior to using it.

- The power cord is comprised of multiple smaller wires. There is a green, yellow, white, black and red cord. All cords have frayed, exposed ends to be inserted into the generator. Use a 5/16 hex wrench to secure the wires.

NOTE: Make sure wire and not plastic is clamped. The diagram on the right is the wire set up for the MAGNUM PRO Model MMG25IT4 19-29 KVA Generator.



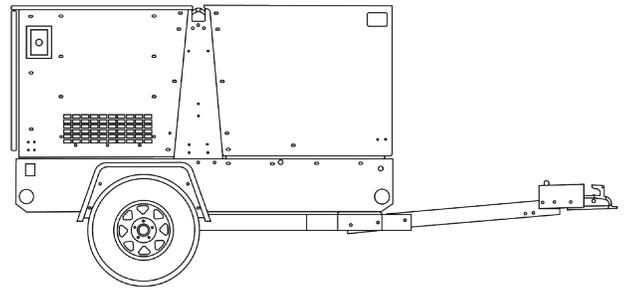
- Once the wires are hooked up, lower the flap over the wires and lock the black panel with a flathead screwdriver. **The generator will NOT operate unless the panel flap covering the wired connections to the generator is locked in place.**



ASSEMBLY INSTRUCTIONS:

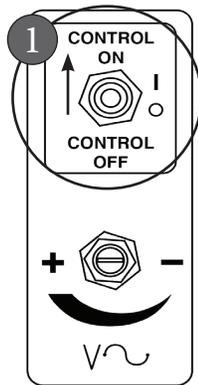
GENERATOR

Starting up the generator

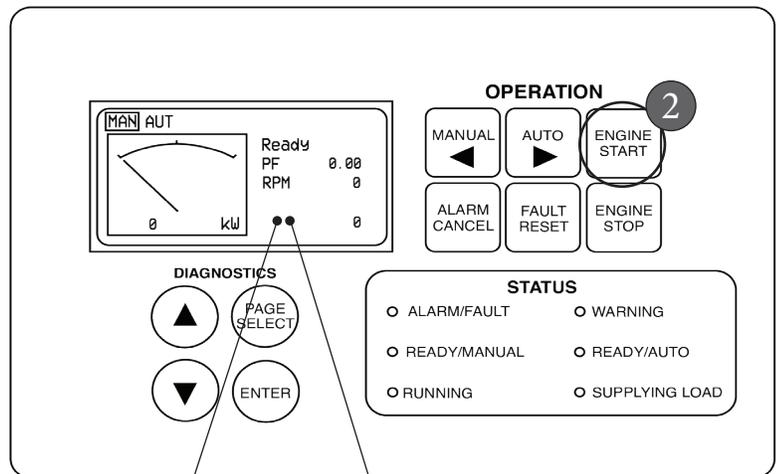


NOTE: These are the instructions for the MAGNUM PRO Model MMG25IT4 19-29 KVA Generator. Setup may vary for different generators. Please consult the generator manual or have the generator owner walk through the start up sequence with you prior to using it.

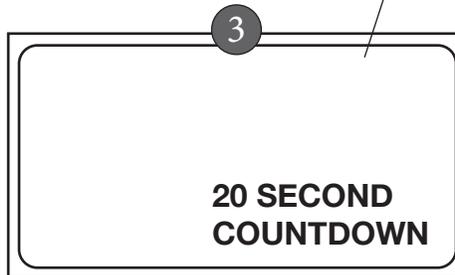
1. Turn on the generator control panel by flipping the switch up to the “Control On” position.



2. Start the generator engine by pressing the “ENGINE START” button and holding for 3 seconds.



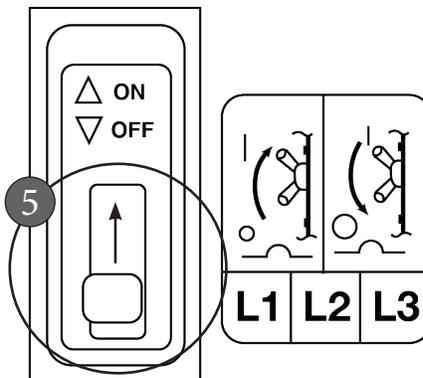
3. There will be a 20 second countdown that will show up in the control panel display, before the engine actually starts.



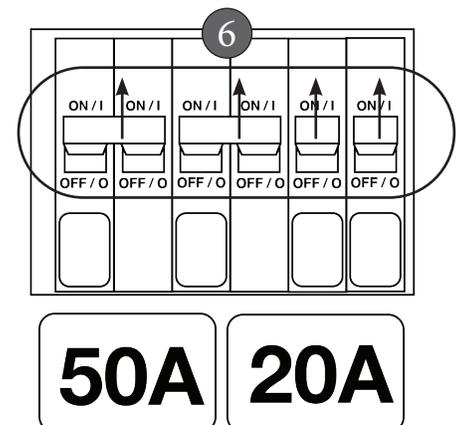
4. Once the engine starts there will be another 45 second countdown (can be viewed on generator panel display) before the other switches can be engaged.



5. Once the 45 second countdown is finished, then turn on the main power switch.



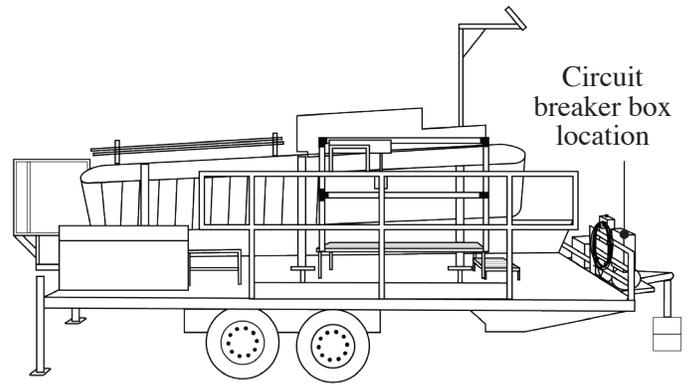
6. Turn on the circuit breakers on the generator control panel. Turn on the 50 A and 20 A breakers.



ASSEMBLY INSTRUCTIONS:

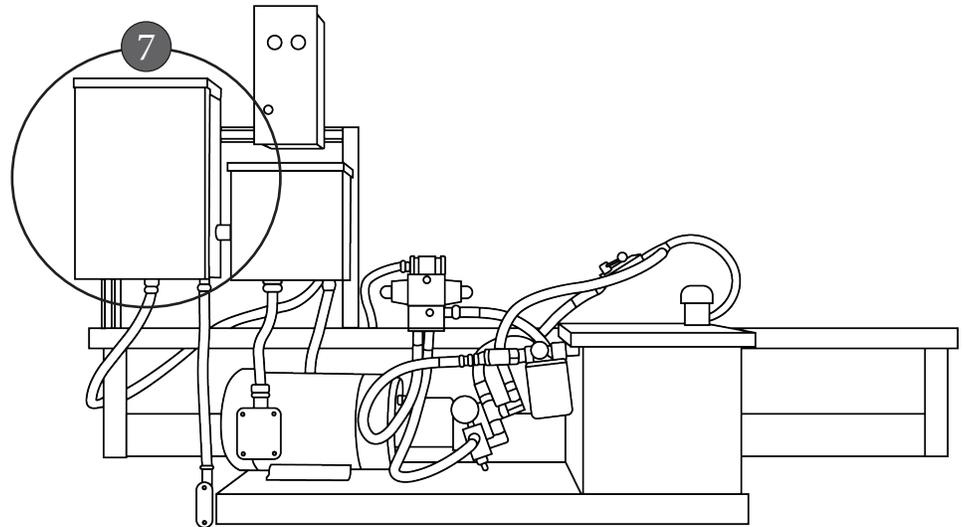
GENERATOR

Starting up the generator

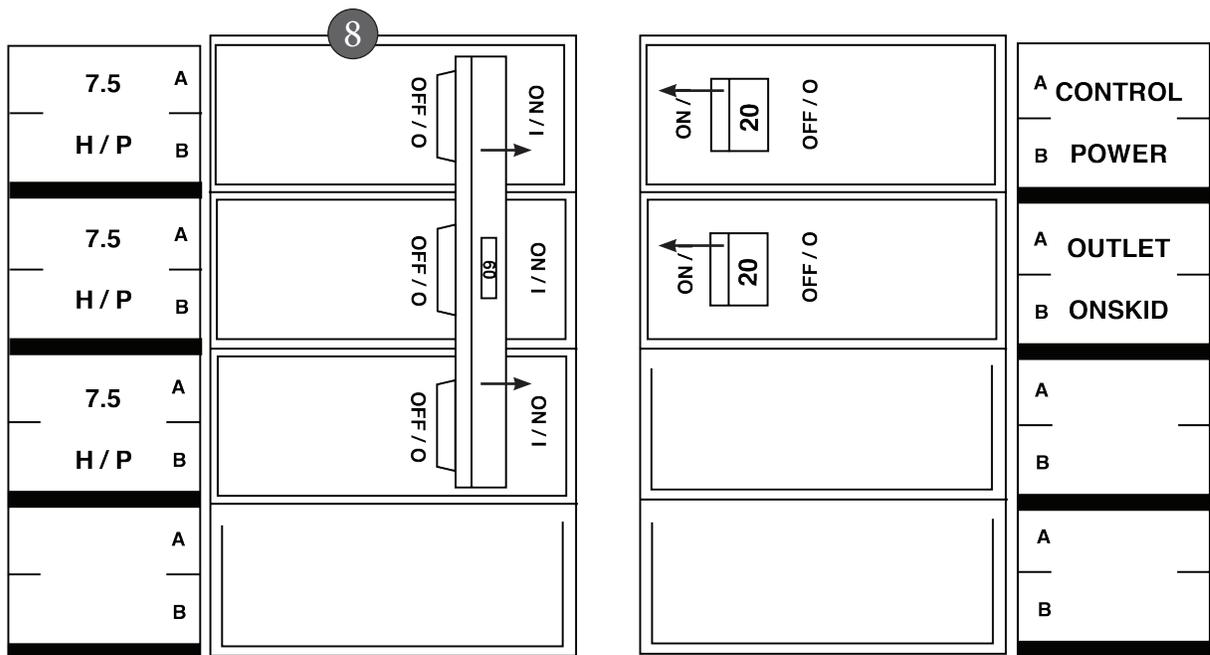


NOTE: These are the instructions for the MAGNUM PRO Model MMG25IT4 19-29 KVA Generator. Setup may vary for different generators. Please consult the generator manual or have the generator owner walk through the start up sequence with you prior to using it.

- Go to the v-restrainer trailer and open the circuit breaker box. Slide the tab to free the door, slide the door down allowing it to swing open to the left.



- Turn on all the breaker switches in the circuit breaker box on the v-restrainer trailer.



SAFETY GUIDELINES:

JARVIS ELECTRIC STUNNER

WARNING:

THIS STUNNER PRODUCES A LETHAL VOLTAGE.
NEVER ALLOW HUMAN CONTACT WITH STUN PRODUCTS.

The JR Stunner System is designed to Stun/Kill livestock. Extreme caution must be taken when operating this system. All users should read, have continued access to and understand the following safety precautions. This list is a guideline for system safety precautions, it is not stated or implied that this list encompasses all safety measures required to perform safe operation. These safety guidelines are periodically revised, if you wish to receive the latest revision of safety guidelines please Call Jarvis Products Corp. (860) 347 – 7271 and leave a name, address, and telephone number.

- (1) Read entire JR Stunner manual and Safety Guidelines before attempting to operate this equipment. Follow all operating instructions.
- (2) Retain all manuals and instructions for future reference.
- (3) Follow all warnings in the manuals and guidelines for this product.
- (4) The JR Stunner is equipped with a grounding type power plug (two blades and a round pin); this power plug will fit only into a grounding type receptacle with matching openings. This is a safety feature. Do not defeat it. If you need an extension cord, use only a grounding type extension cord.
- (5) This product is for use on a single-phase 115-volt nominal power system. If you require operation on other power systems, DO NOT proceed until you have contacted the factory.
- (6) This device requires a dedicated 15-amp service. Do not connect any other device in parallel with this system. Overloaded AC outlets, extension cords, frayed power cords, damaged or cracked wire insulation, and broken plugs are dangerous. They may result in a shock or fire hazard. Periodically examine the cord, and if its appearance indicates damage or deteriorated insulation, have it replaced by your service technician.
- (7) Power-supply cords should be protected from damage. Cords should be routed so that they are unlikely to incur damage from foot traffic or other equipment.
- (8) The stunner should never be placed near or over any heat source.
- (9) Do not attempt to connect any additional attachments to the stunner. Do not attempt any alterations to the stunner. Doing so may cause damage to equipment and a shock hazard to humans, and could void stunner warranty. If modifications are absolutely necessary consult factory before proceeding, and only allow a work to be performed by a qualified electrician.
- (10) Do not use this product near water. Ventilation slots and openings are part of the enclosure of the stunner, and a risk of electrical shock exists if the product comes into contact with a water source.

JARVIS ELECTRIC STUNNER SAFETY GUIDELINES (CONT)

(11) Do not place this product on an unstable surface or support. The product may fall, causing serious injury to people as well as serious damage to the product. Any mounting of the stunner must ensure its stability.

(12) The stunner box should never be opened by anyone except by a qualified electrician after contacting the factory. No service should be attempted on the stunner equipment before consulting the factory. Any service instructions given by the factory should only be carried out by a qualified electrician.

(13) Disconnect this stunner from the power supply and contact the factory for service if any of the following conditions occur: damage to the power-supply cord or plug; water has come into contact with the unit; if the product has been dropped or damaged; if the product does not operate normally by following the operating instructions and manuals; and if the product exhibits a distinct change in performance.

The full jarvis jr electric stunner instruction manual can be found [here](https://iastate.box.com/s/wj82e9v8uwb810tkrs106txqgut42drc)
<https://iastate.box.com/s/wj82e9v8uwb810tkrs106txqgut42drc>

JARVIS USSS-1 PNEUMATIC STUNNER

WARNING:

NEVER ALLOW HUMAN CONTACT WITH STUN PRODUCTS.

- (1) Remove and repair any tool that malfunctions. All personnel must be instructed to remove any malfunctioning equipment.
- (2) Ensure that all employees who use this tool are trained in the proper use of this tool and are aware of the dangers that may arise if they do not follow procedures outlined in this brochure.
- (3) Ensure that all employees are instructed not to walk in front of the tool during its use, and to never put fingers, hands or other parts of the body directly in front of the tool.
- (4) The tool is designed and intended to be powerful. This fact should be obvious to your employees, but you must emphasize it to them.
- (5) Ensure eye and ear protection is worn at all times when operating the tool.
- (6) Never make modifications or alterations to the tool. Replace any missing or illegible labels.
- (7) Ensure that proper procedures are established in accordance with OSHA's lockout/tagout procedures (29 CFR 1910.147) to prevent accidental startup or release of stored energy.
- (8) Follow our installation and maintenance instructions for proper installation and care of the tool.
- (9) Avoid injury. Do not permit the tool to be misused.

JARVIS USSS-1 PNEUMATIC STUNNER SAFETY GUIDELINES (CONT)

- (10) If you resell or distribute a Jarvis product, you must provide the purchaser with the appropriate safety sheets and tool brochure. Additional copies of safety sheets and tool brochures will be provided upon request.
- (11) Disconnect air hose in accordance with OSHA's lockout/tagout procedures (29 CFR 1910.147) before performing any repair or maintenance.
- (12) Disconnect air hose -- or have the air hose disconnected -- in accordance with OSHA's lockout/tagout procedures (29 CFR 1910.147) before performing any cleanup.
- (13) Disconnect air hose when the tool is not being used.
- (14) Never put fingers, hands or other parts of the body directly in front of the tool.
- (15) Always wear eye and ear protection when operating the tool.
- (16) Always keep all body parts away from the stunning rod guide when triggers are activated.
- (17) Test the tool prior to use or daily. Using the Jarvis Stunner Tester is the preferred testing method; however the following procedure can also be used: Depress the main handle trigger and displace the stunning rod guide by pushing it against an unmounted rubber tire. The stunner should not activate until the auxiliary handle trigger is depressed. After the tool has been activated, release both triggers to prepare for the next firing. The stunning rod guide must return to the extended position. If the tool malfunctions, remove it from service and report or repair it immediately.
- (18) Never squeeze the triggers unless you want to use the tool.
- (19) Never make modifications or alterations to the tool. Replace any missing or illegible labels.

The full jarvis usss-1 pneumatic stunner instruction manual can be found [here](https://iastate.app.box.com/file/854433984701)
<https://iastate.app.box.com/file/854433984701>

GENERATOR

WARNING:

REFER TO SPECIFIC SAFETY LITERATURE ON UNIT OBTAINED/RENTED. THE FOLLOWING MODEL WAS USED IN THE PILOT STUDY AND INCLUDED FOR GENERAL GUIDANCE.

Before using the unit, be sure to read and understand all of the instructions. This equipment was designed for specific applications; **DO NOT** modify or use this equipment for any application other than which it was designed for. Equipment operated improperly or by untrained personnel can be dangerous. Read the operating instructions and familiarize yourself with the location and proper use of all instruments and controls. Inexperienced operators should receive instruction from someone familiar with the equipment before being allowed to operate or set up the unit. The following points should be practiced at all times:

- The area immediately surrounding the unit should be dry, clean, and free of debris.
- **NEVER** start a unit in need of repair.
- Make certain the unit is securely fastened to a good earthen ground before use.
- **NEVER** operate the unit on a combustible surface.
- **NEVER** operate the unit if any of the following conditions exist during operation:
 - (1) Noticeable change in engine speed.
 - (2) Loss of electrical output.
 - (3) Equipment connected to the generator overheats.
 - (4) Sparking occurs.
 - (5) Engine misfires or there is excessive engine/generator vibration.
 - (6) Protective covers are loose or missing.
 - (7) If the ambient air temperature is above 120°F (49°C).
- Make sure slings, chains, hooks, ramps, jacks, and other types of lifting devices are attached securely and have enough weight-bearing capacity to lift or hold the equipment safely. Always remain aware of the position of other people around you when lifting the equipment.
- **NEVER** operate a unit while tired, distracted, or under the influence of drugs or alcohol.

ENGINE SAFETY

Internal combustion engines present special hazards during operation and fueling. Failure to follow the safety guidelines described below could result in severe injury or death. Read and follow all safety warnings described in the engine operator's manual. A copy of this manual was supplied with unit when it was shipped from the factory.

- **DO NOT** run engine indoors or in an area with poor ventilation. Diesel engine exhaust contains carbon monoxide, a deadly, odorless and colorless gas which, if inhaled, can cause nausea, fainting or death. Only use this unit outside and away from windows, doors, and ventilation equipment.
- **DO NOT** fill fuel tank near an open flame, while smoking, or while engine is running. **DO NOT** fill tank in an enclosed area with poor ventilation.
- **DO NOT** operate with the fuel tank cap loose or missing.
- **DO NOT** touch or lean against hot exhaust pipes or engine cylinders.
- **DO NOT** clean air filter with gasoline or other types of low flash point solvents.
- **DO NOT** remove engine coolant cap while engine is hot.
- **DO NOT** operate the unit without a functional exhaust system.
- Prolonged exposure to sound levels in excess of 85 dB(A) can cause permanent hearing loss. Wear hearing protection when working around a running engine.
- Keep hands, feet and loose clothing away from moving parts on the generator and engine.

GENERATOR SAFETY GUIDELINES (CONT)

- Keep area around exhaust pipes and air ducts free of debris to reduce the chance of an accidental fire.
- Batteries contain sulfuric acid which can cause severe injury or death. Sulfuric acid can cause eye damage, burn flesh or eat holes in clothing. Protective eye wear and clothing are necessary when working on or around the battery. Always disconnect the negative (-) battery cable from the corresponding terminal before performing any service on the engine or other components.

TOWING SAFETY

Towing a trailer requires care. Both the trailer and vehicle must be in good condition and securely fastened to each other to reduce the possibility of an accident. Also, some states require that large trailers be registered and licensed. Contact your local Department of Transportation office to check on license requirements for your particular unit.

- Check that the hitch and coupling on the towing vehicle are rated equal to, or greater than, the trailer's Gross Vehicle Weight Rating (GVWR).
- Check tires on trailer for tread wear, inflation, and condition.
- NEVER tow trailer using defective parts. Inspect the hitch and coupling for wear or damage.
- Make sure the trailer hitch and the coupling are compatible. Make sure the coupling is securely fastened to the vehicle.
- Connect safety chains in a crossing pattern under the tongue and **ATTACH THE BREAKAWAY CABLE TO THE REAR BUMPER OF THE TOWING VEHICLE**. Do not attach the cable to the trailer hitch.
- Make sure the directional and brake lights on the trailer are connected and working properly.
- Check that the lug nuts holding the wheels are tight and that none are missing.
- Maximum recommended speed for highway towing is 45 mph (72 km/h). Recommended off-road towing speed is not to exceed 10 mph (16 km/h) or less, depending on terrain.

Before towing the trailer, check that the weight of the trailer is equal across all tires. On trailers with adjustable height hitches, adjust the angle of the trailer tongue to keep the trailer as level as possible. On units equipped with a tandem axle trailer, a large angle between the trailer and tow vehicle will cause more weight to be carried by one axle, which could cause premature wear on the tires and axles and cause potentially unsafe operating conditions.

The trailer is equipped with hydraulic surge brakes or electric surge brakes. Check the operation of the brakes by braking the vehicle at a slow speed before entering traffic. Both the trailer and the vehicle should brake smoothly. If the trailer seems to be pushing, check the level in the surge brake fluid reservoir.

When towing, maintain extra space between vehicles and avoid soft shoulders, curbs and sudden lane changes. If you have not pulled a trailer before, practice turning, stopping, and backing up in an area away from heavy traffic.

A film of grease on the coupler will extend coupler life and eliminate squeaking. Wipe the coupler clean and apply fresh grease each time the trailer is towed.

The full magnum generator instruction manual can be found [here](#)

https://www.generacmobileproducts.com/Industrial/GeneracMobile/media/library/Downloads/Generators/Diesel/Generac-Mobile-Products_manual-operations_Diesel-Generator-MMG25FHI-MMG35FHD-MMG45FHK-MMG55FHD.pdf

Always review generator specific safety instructions before use.

V-RESTRAINER TRAILER

WARNING:

- (1) When troubleshooting any electrical issues, be sure to have all the breaker switches off on the trailer fuse box and on the generator.
- (2) Anyone operating near the v-restrainer while it is moving must NOT have any loose fitting clothing on.
- (3) Anyone operating the electrical stunner must be wearing rubber boots.
- (4) Anyone operating the electrical stunner must be sure to avoid pressing the button while the stunner wand is contacting any metal surface.
- (5) If the v-restrainer needs to be stopped immediately, this can be done by pressing the red E-stop button, located by the stunner box on the trailer.
- (6) Fractious animal / human interaction considerations:
 - Animal handling and movement should be reserved for personnel previously experienced with animal interaction and familiarity with industry standards for animal loading, unloading and movement.
 - Animal handling personnel should be NPB - PQA and TQA certified.
 - Sort boards of appropriate size should be used between the animal handler and the animals.
- (7) Mechanized equipment exposure/operation considerations:
 - The safety manager should remain diligent during the movement of live pigs and the removal of carcasses.
 - Personnel not operating equipment or serving as safety manager should remain beyond the safety perimeter during loading and unloading of animals and carcasses.
 - Equipment safety features should be kept intact and subjected to routine safety and maintenance checks as appropriate for the specific equipment used by the operator and owner of the equipment.
- (8) Deployment of backup euthanasia tool considerations:
 - It is theoretically possible that fractious animals could become non-ambulatory during loading or incompletely euthanized through the process. An alternative, individual animal euthanasia technique approved by the American Veterinary Medical Association, such as penetrating captive bolt should be available in preparation for these potential adverse outcomes. The safety concerns these bring to the mass depopulation should be reviewed and understood by personnel operating them and discussed with the safety officer. Considerations associated with all of the possible techniques are beyond the scope of this manual. If you bring it, know how to use it safely.

V-RESTRAINER TRAILER SAFETY GUIDELINES (CONT)

(9) Psychological stress considerations:

- The psychological and emotional stress of euthanizing animals is well documented elsewhere. One can reasonably expect those stresses to be amplified due to mass depopulation, especially if the depopulation is necessitated by circumstances other than relieving animal suffering and pain. All personnel should be alert for signs that co-workers are struggling and work to create an empathetic and caring environment that allows for dissipation of emotional stress or provides an opportunity for affected personnel to remove themselves from the situation without negative consequences.

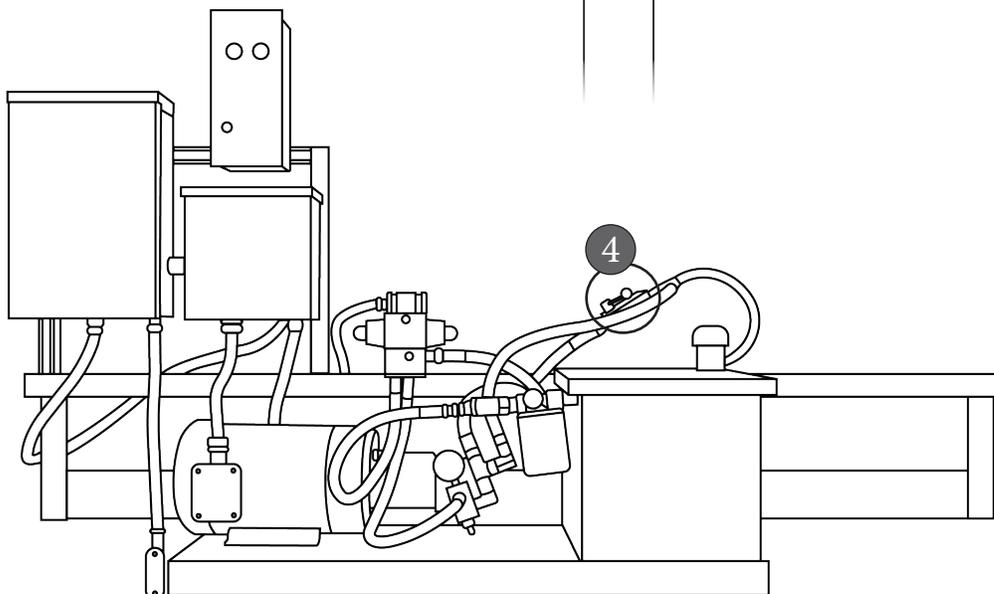
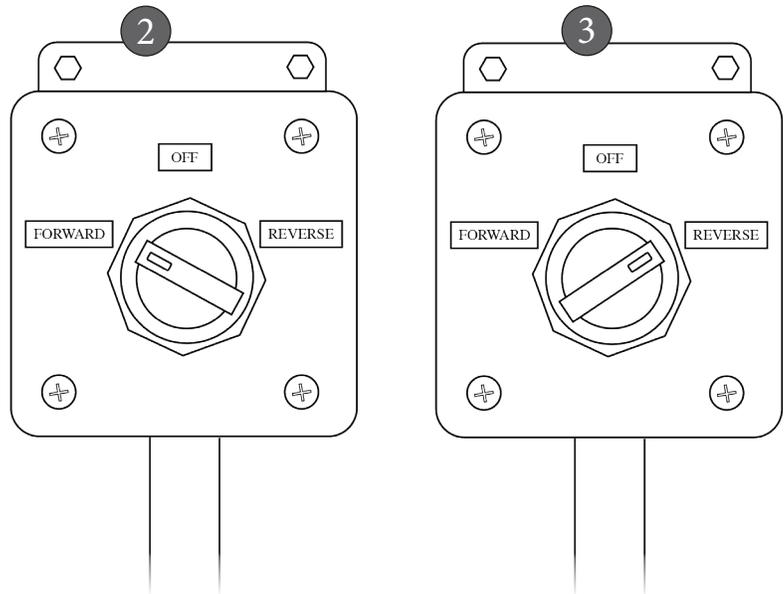
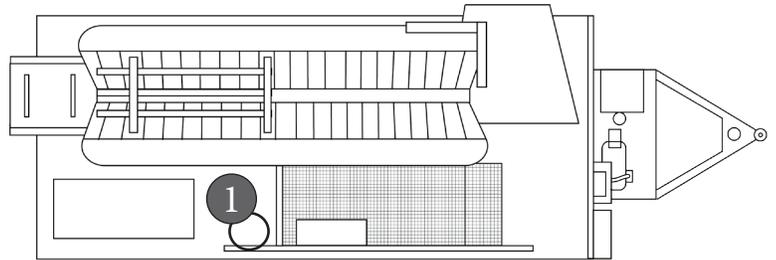
OPERATION INSTRUCTIONS:

Once the generator is supplying power to the v-restrainer, it is time to test the v-restrainer.

V-RESTRAINER

HOW TO ENGAGE THE V-RESTRAINER BELT

1. Locate the v-restrainer control switch, which is next to the Jarvis electrical stunner box. The control should be switched in the middle, which is OFF.
2. Turn the switch to the forward position and ensure that the v-restrainer belt is moving forward.
3. Turn the dial back to the OFF position for a few seconds, then turn the switch to REV (reverse) and verify that the reverse setting is working. Then return the switch to the OFF position.
4. The speed of the v-restrainer can be adjusted by a lever sitting on top of the hydraulic oil reservoir.

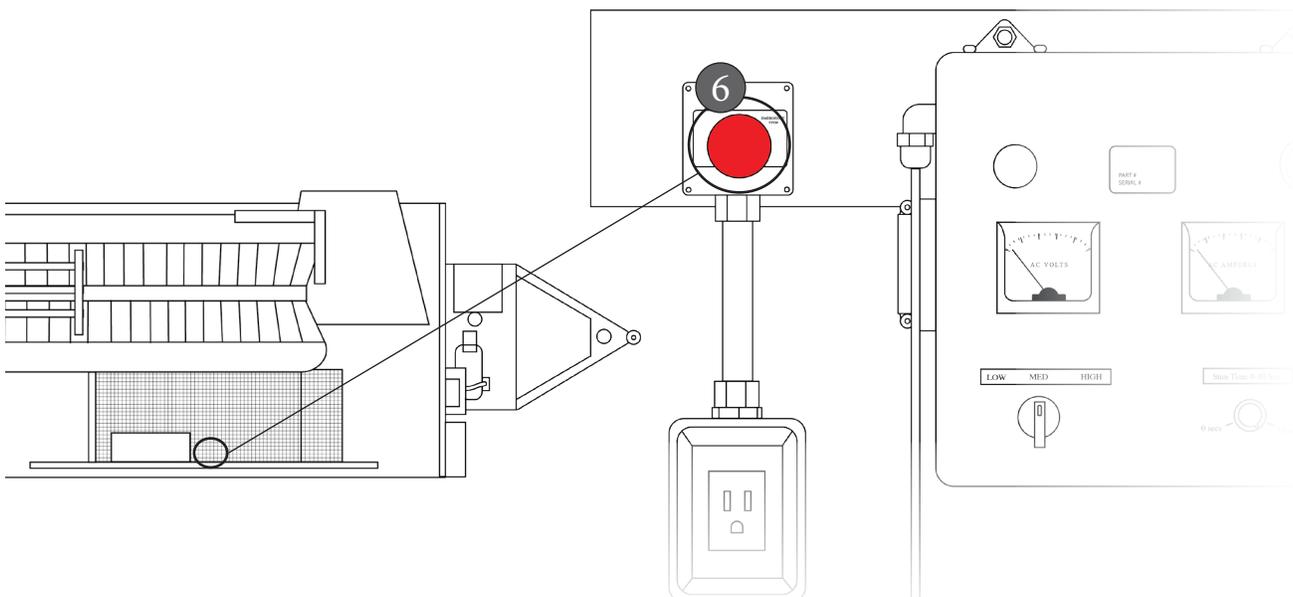
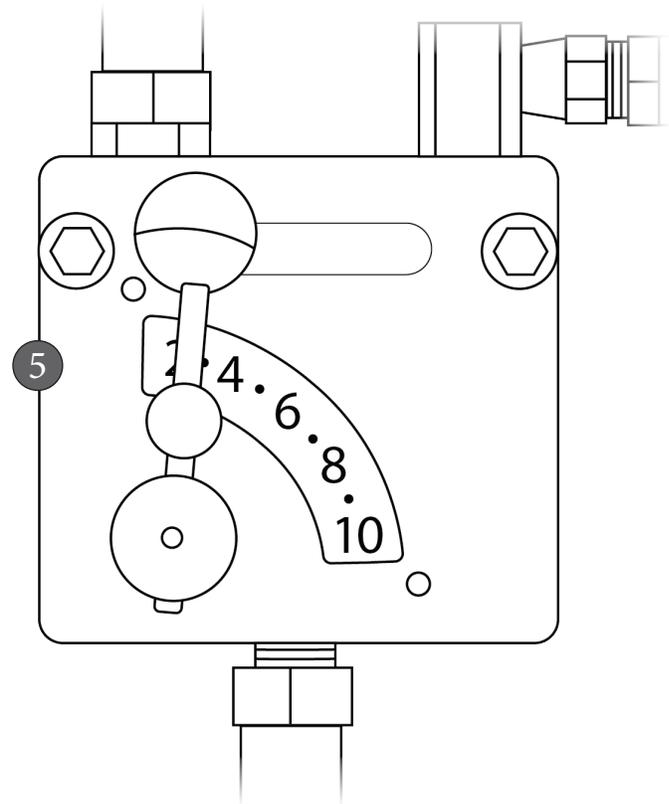


OPERATION INSTRUCTIONS:

V-RESTRAINER

HOW TO ENGAGE THE V-RESTRAINER BELT (CONT)

5. The slowest setting is when the dial number is set to 2. The v-restrainer speeds up as the lever is moved to higher numbers (clockwise). Proper setting for the correct speed should be with the lever set to 2. With the dial setting at 2, the pig should take approximately 12 seconds from the time it enters the stunning area of the v-restrainer until it is discharged on the discharge chute. Small changes can be made to increase or decrease speed to achieve 12 seconds.
6. If there is any issue with v-restrainer and it needs to be stopped immediately, the stunner operator can use the red emergency stop (E-stop) button and it will shut the entire v-restrainer down.



OPERATION INSTRUCTIONS:

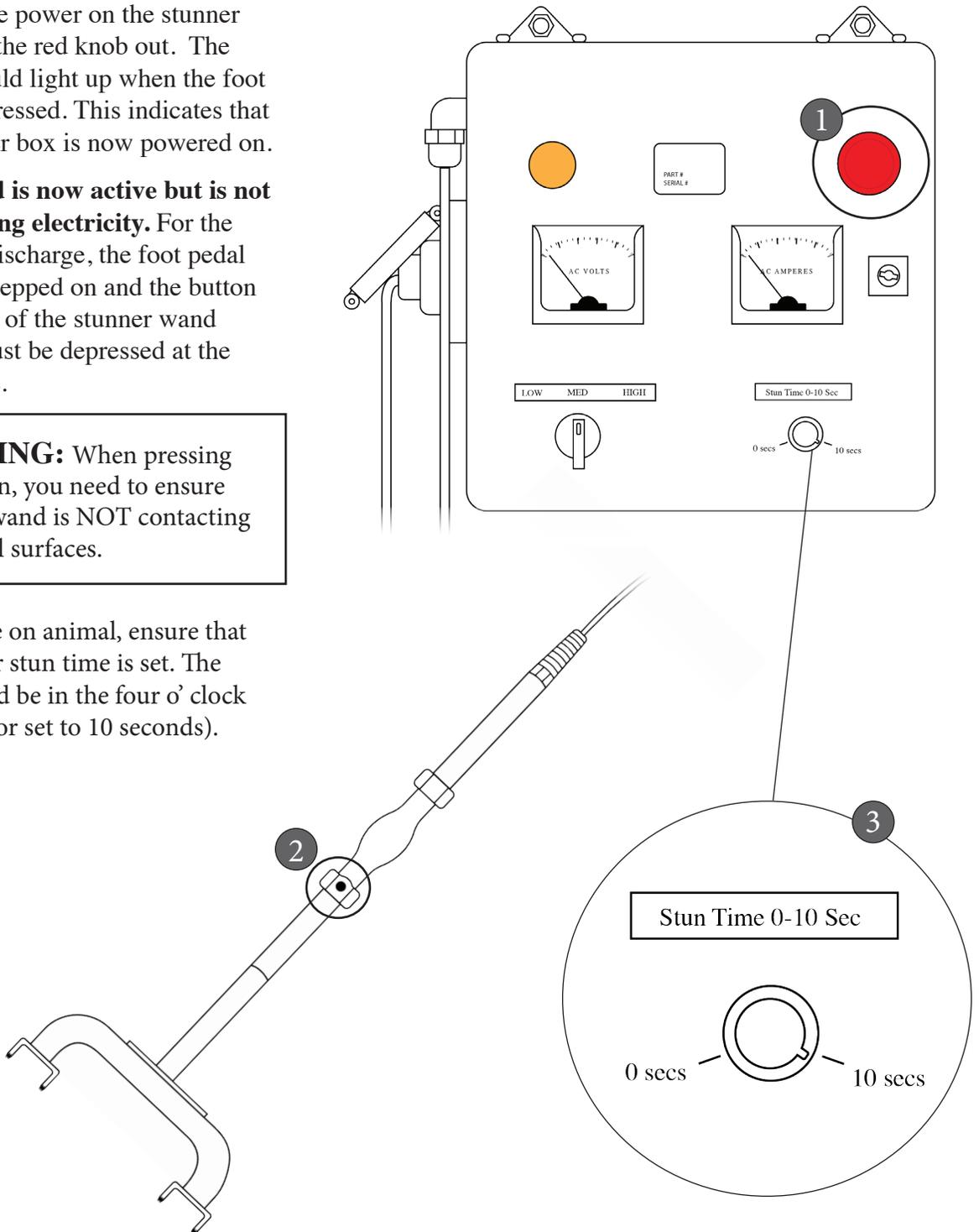
V-RESTRAINER

HOW TO TURN ON ELECTRICAL BOX

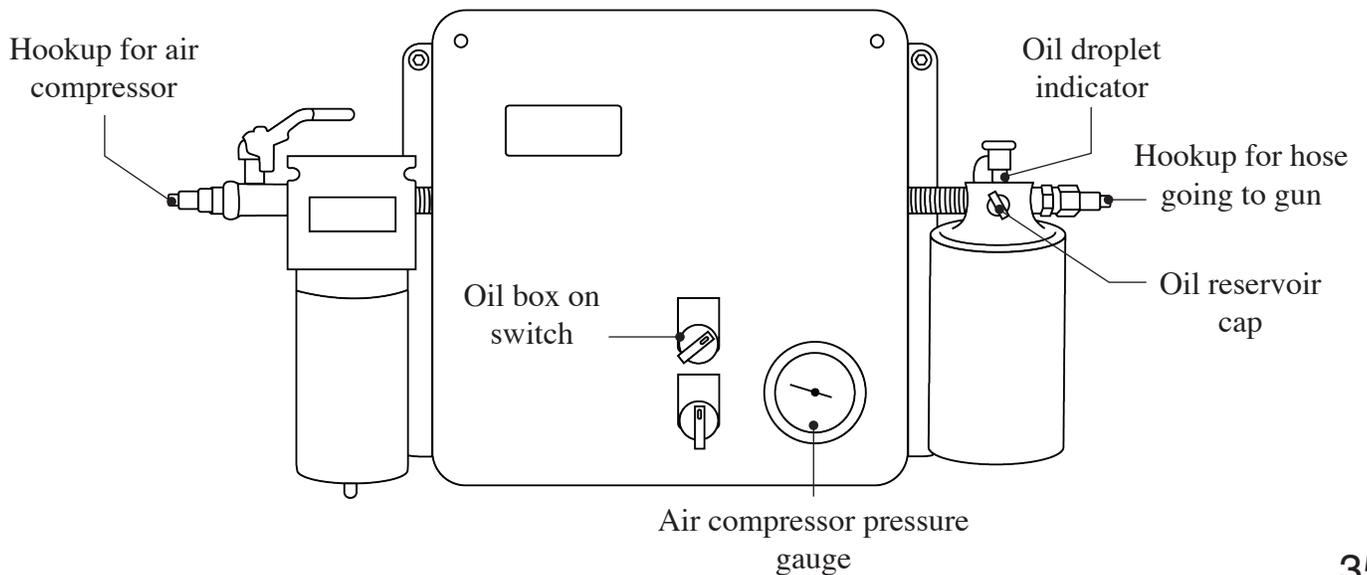
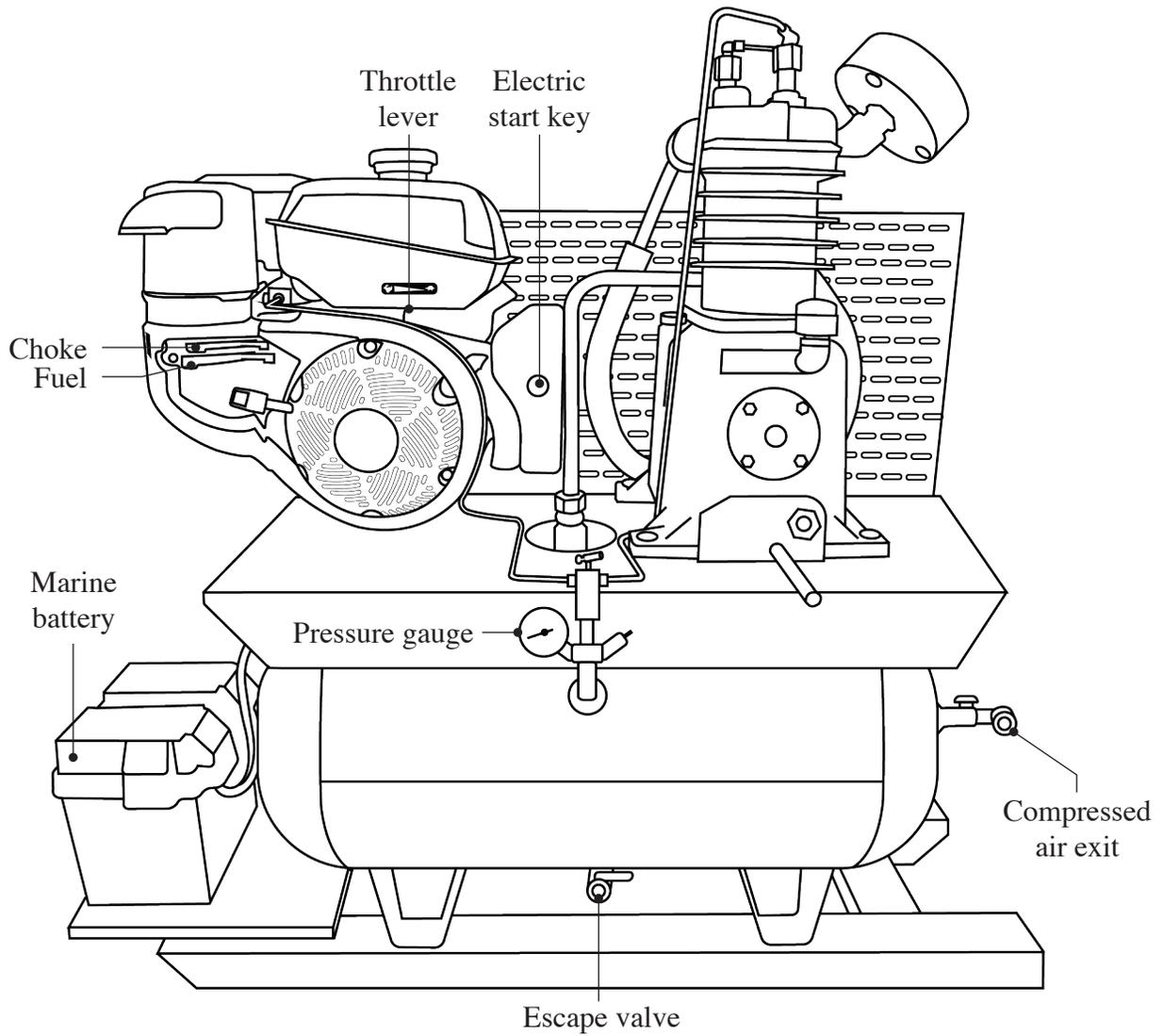
1. To turn the power on the stunner unit, pull the red knob out. The knob should light up when the foot pedal is pressed. This indicates that the stunner box is now powered on.
2. **The wand is now active but is not discharging electricity.** For the wand to discharge, the foot pedal must be stepped on and the button on the top of the stunner wand handle must be depressed at the same time.

WARNING: When pressing the button, you need to ensure that the wand is NOT contacting any metal surfaces.

3. Before use on animal, ensure that the proper stun time is set. The dial should be in the four o' clock position (or set to 10 seconds).



AIR COMPRESSOR & OIL BOX OVERVIEW

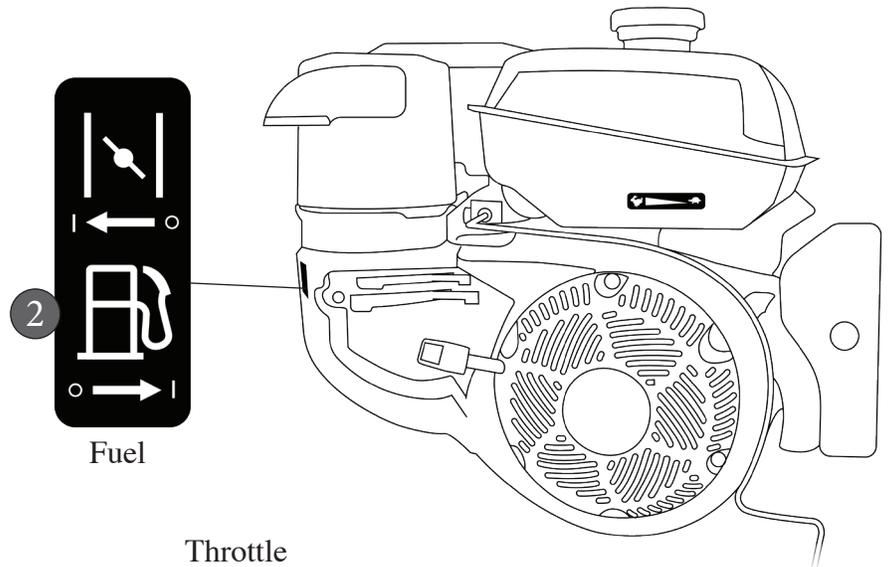
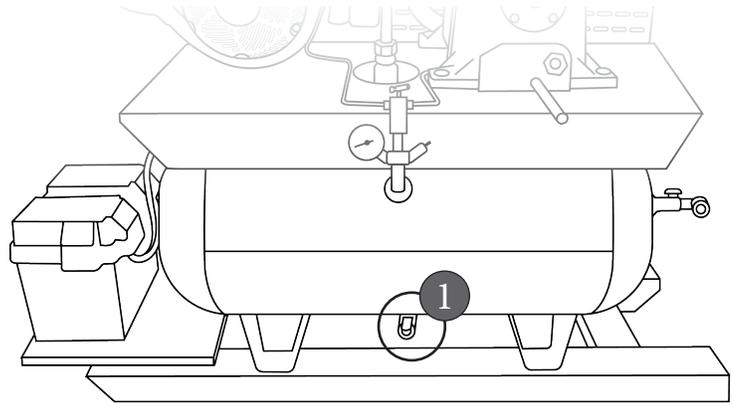


OPERATION INSTRUCTIONS:

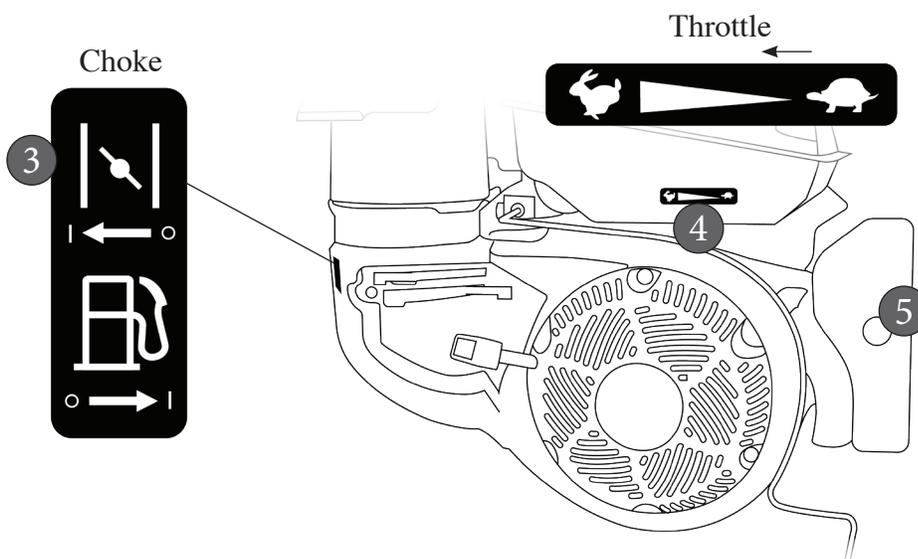
AIR COMPRESSOR

STARTING UP THE AIR COMPRESSOR

1. Open the escape valve underneath air compressor tank.
2. Turn the fuel on by moving the bottom lever from the left position all the way over to the right position.
3. Turn the choke on by moving the top lever from the right position all the way over to the left position.
4. Open the throttle slightly by moving the throttle lever from the right to the left with an inch adjustment.
5. Turn the key clockwise (to the right) in order to start the engine.



Fuel



Choke

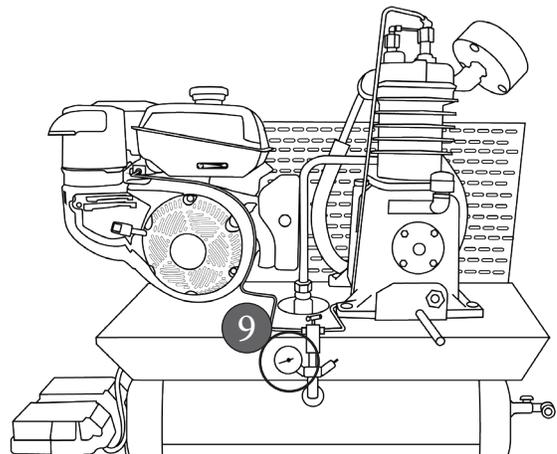
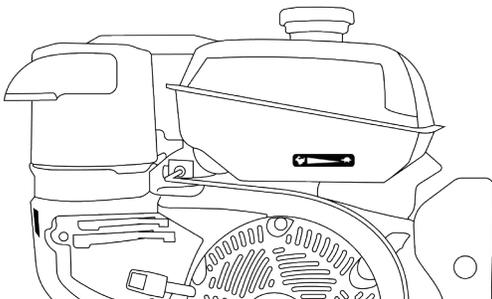
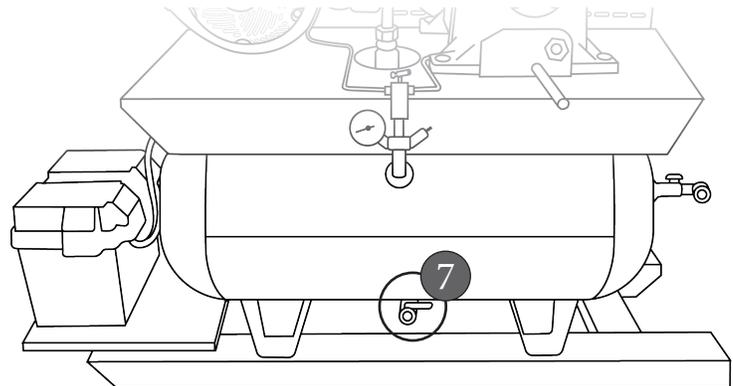
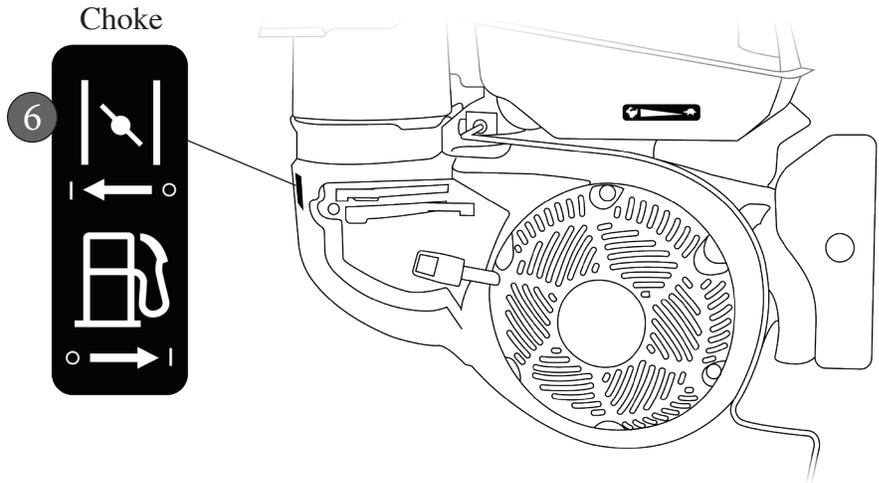
Throttle

OPERATION INSTRUCTIONS:

AIR COMPRESSOR

STARTING UP THE AIR COMPRESSOR (CONT)

6. Once the engine starts, then shut the choke off by moving the top lever back towards the right.
7. Monitor the escape valve under compressor tank and once it is no longer dripping out of the pipe, close the valve.
8. Increase engine speed by increasing the throttle (move the throttle handle all the way to the left).
9. Monitor the pressure. Once it reaches the maximum of 250 lbs psi, then engine will throttle (slow) down until you start to use the pneumatic gun, at which point it will speed up again to try and keep the tank pressure at 250 psi.



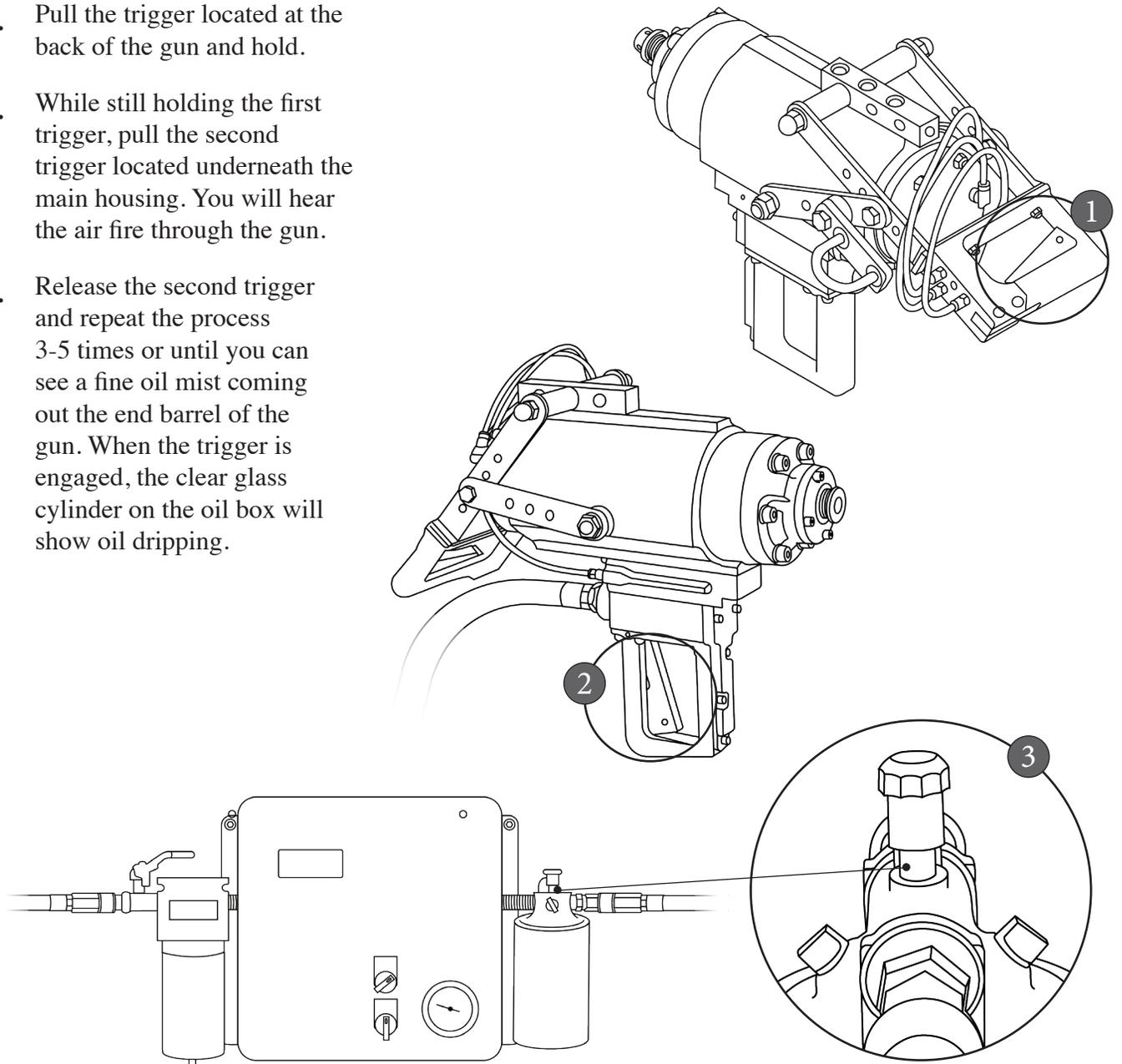
OPERATION INSTRUCTIONS:

PNEUMATIC GUN

LUBRICATING THE PNEUMATIC CAPTIVE BOLT GUN

NOTE: The pneumatic captive bolt gun works with a double trigger system. In order to get the oil into the gun chamber, prior to beginning to use on pigs, you will need to fire the gun 3-5 times or until you can see oil coming out from the end of the gun. The bolt will NOT come out with this procedure. **The bolt will only come out once the gun is pushed against a hard object (i.e. animal skulls).**

1. Pull the trigger located at the back of the gun and hold.
2. While still holding the first trigger, pull the second trigger located underneath the main housing. You will hear the air fire through the gun.
3. Release the second trigger and repeat the process 3-5 times or until you can see a fine oil mist coming out the end barrel of the gun. When the trigger is engaged, the clear glass cylinder on the oil box will show oil dripping.

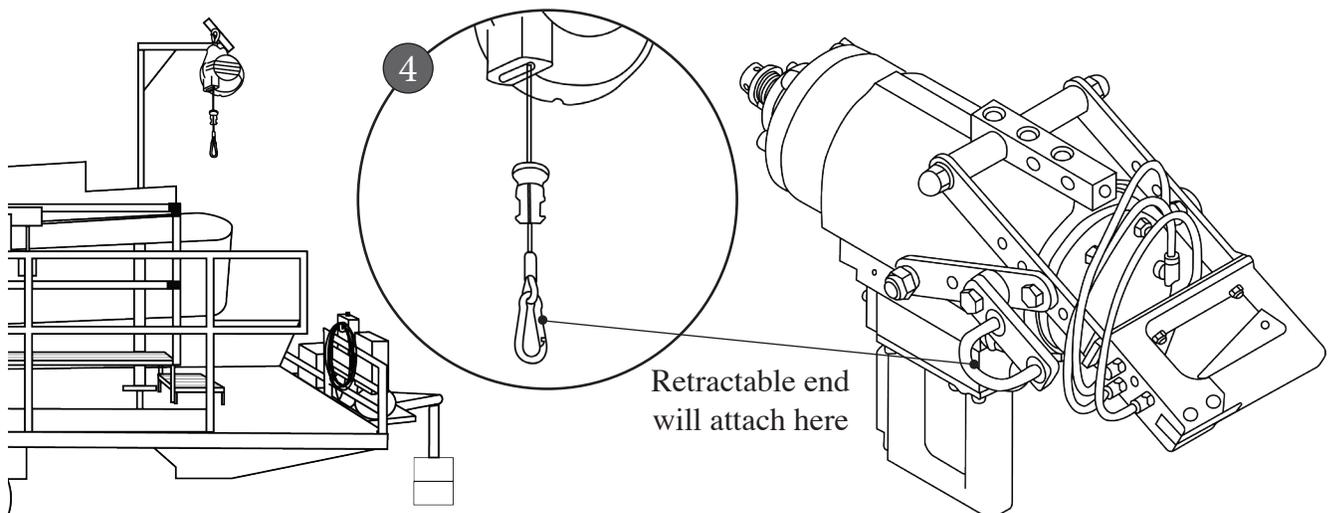
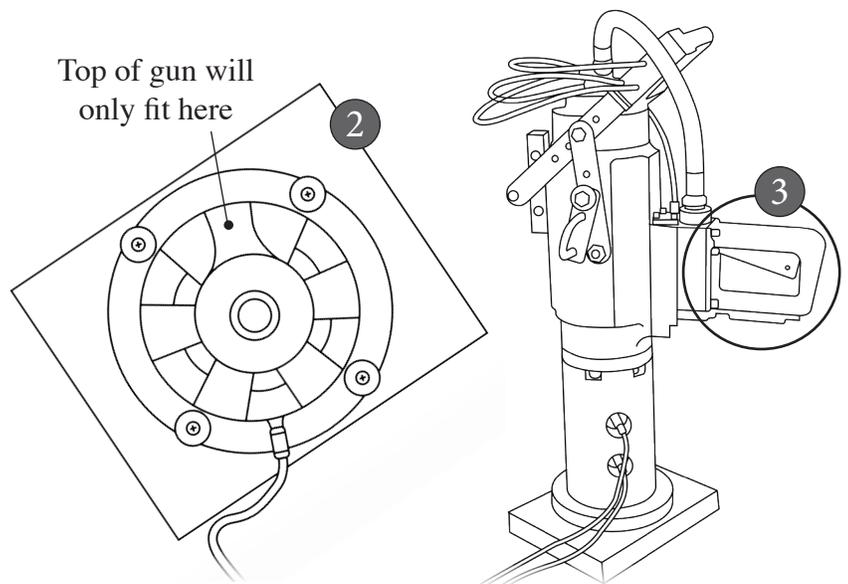
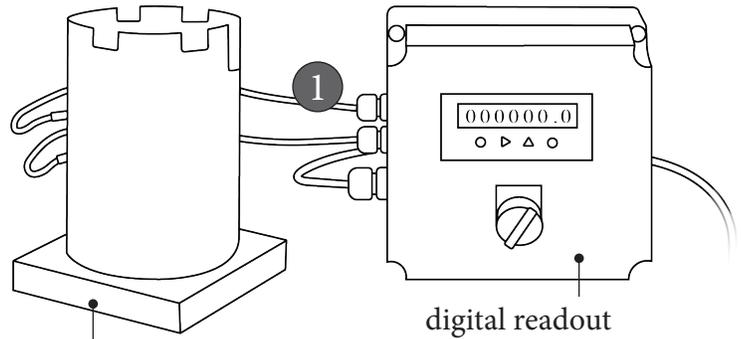


OPERATION INSTRUCTIONS:

PNEUMATIC GUN

TESTING THE FIRING SPEED OF THE PNEUMATIC CAPTIVE BOLT GUN

1. Plug the digital readout into a 110 volt outlet.
2. After the gun has been lubricated, insert the pneumatic captive bolt gun into the bolt testing housing. The top of the gun goes into the deepest notch.
3. Pull the second trigger located underneath the main housing, while holding the first trigger and you will hear the air fire through the gun. Look at the digital readout on the display. It should read between 1600-1700 psi. If psi does not read 1600-1700, hit reset and test again.
4. When speed is sufficient, remove the captive bolt gun from the main housing. Attach the Jarvis USSS-1 pneumatic captive bolt gun to the counter balancer by hooking it onto the U shaped support on the side of the USSS-1 stunner.



OPERATION INSTRUCTIONS:

HUMANE EUTHANASIA

ELECTRICAL WAND & PNEUMATIC CAPTIVE BOLT GUN USE

⚠ SAFETY ⚠

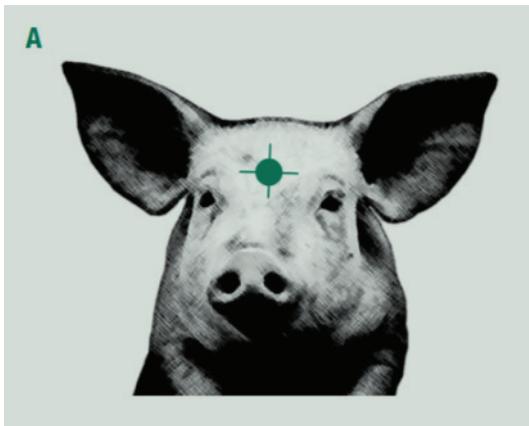
The electrical stunner wand operator must be wearing rubber boots while operating the stunner wand. The operator must NOT have any loose fitting clothing that could potentially get caught in the v-restrainer belts.

The stunning wand should be placed so that the right grip is placed in the groove directly behind the pig's ear and the left grip on the pig's shoulder or ribs. The prod should be held in place for 5-6 seconds of stun time and then released as the pig is reaching the end of the v-restrainer. The total transit time for pig from the time it reaches the stunner until it exits the v-restrainer should be approximately 12 seconds.



WARNING: The stunner wand operator must be sure that the foot pedal depressed and wand button pressed only after the wand is securely held into place on the pig. The button should be released as soon as the desired contact time is reached. The stunner wand operator must be sure that the wand does not make contact with any metal surfaces while the button is pressed.

As the stunned animal reaches the end of the v-restrainer, the pneumatic captive bolt gun operator should put the gun into position. Place the end of the gun between the eyes, about 1 inch above eye level (see figure A). While still holding the first trigger (behind the gun), pull the second trigger located underneath the main housing at the same time that you are pressing the tip of the gun against the pig's skull. You should feel the gun bounce back slightly against the skull and you should see where the bolt successfully penetrated. If the gun was not successfully fired, then repeat the above steps.



The bolt will not come out unless both triggers are pulled and tip of the gun is pressed against something solid. **Both triggers should NOT be pulled until the unit is just beginning to be placed on the skull of the pig.**

OPERATION INSTRUCTIONS:

HUMANE EUTHANASIA

CONFIRMING DEATH

Once the pig carcass has slid down the ramp, staff personnel should be there to assess insensibility via the following methods:

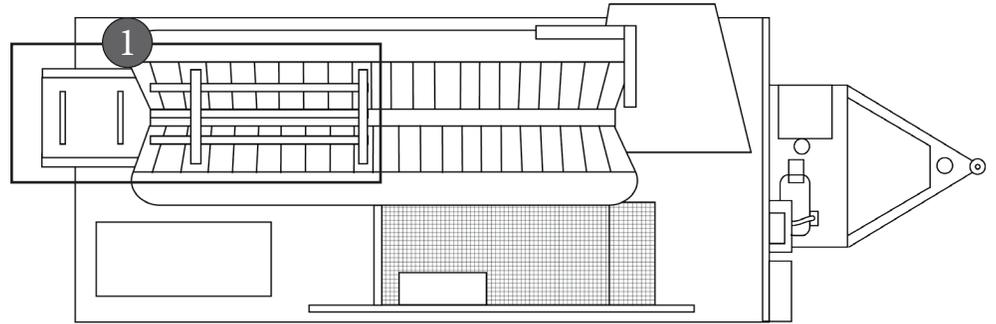
- Lack of rhythmic breathing
- Constricted pupils
- No attempts to raise the head (righting reflex)
- Absence of vocalization
- Absence of palpebral/corneal reflex
- No response to painful stimuli

If there is any response to any of the insensibility checks, then the animals should be euthanized via another approved method for the size of the pig. In most cases, the recommendation would be to have a captive bolt gun available for any failures.

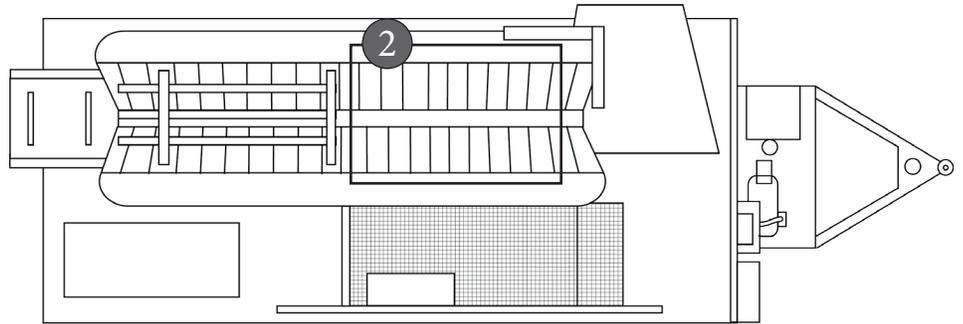
OPERATION INSTRUCTIONS:

ORDER OF EVENTS

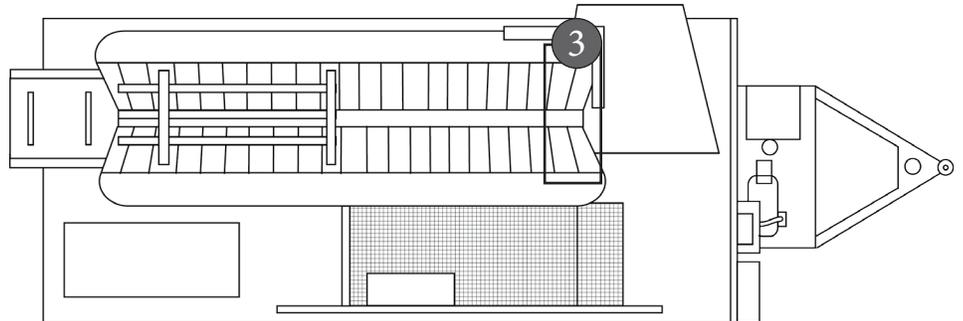
1. A pig is loaded onto the platform and then enters the v-restrainer belt.



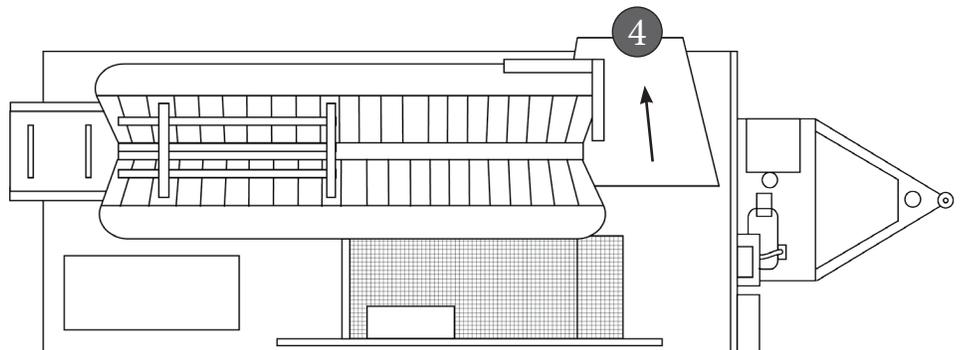
2. The animal is electrocuted by the wand as soon as proper placement is made once animal is past the top gate, and continues to be electrocuted for 5-6 seconds. Depending on belt speed, it may need adjusted to allow proper time.



3. Once wand is removed from the animal and the animal is at the end of the belt, the Jarvis pneumatic bolt gun will be used, ensuring proper placement. Belt may need to be stopped.



4. Animal will slide down chute. Repeat process.

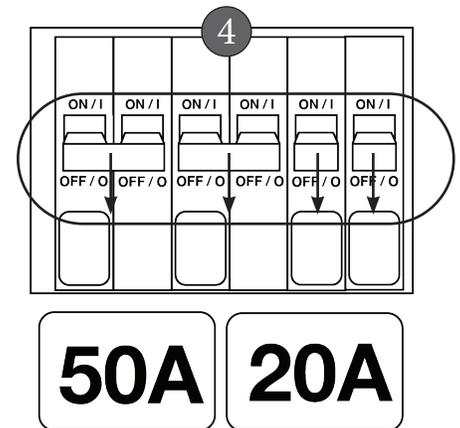
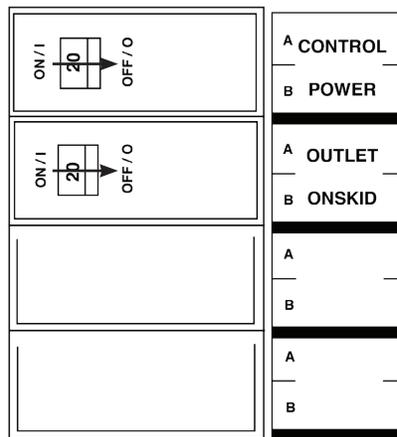
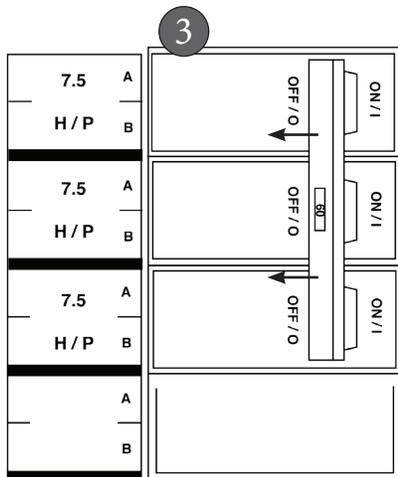
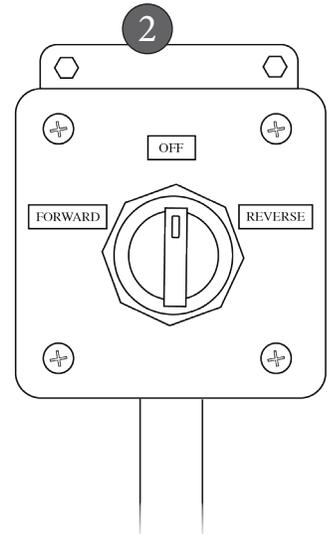
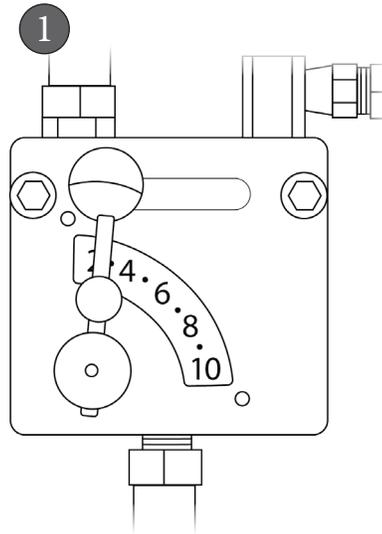


OPERATION INSTRUCTIONS:

TURNING EQUIPMENT OFF

V-RESTRAINER:

1. Ensure the hydraulic speed level is at 2.
2. Turn the switch to off.
3. Turn off the breakers in the circuit breaker box on the v-restrainer trailer.
4. Shut off the breaker switches on the generator.
5. Turn off the generator. (according to the guidelines listed in the generator specific manual).



OPERATION INSTRUCTIONS:

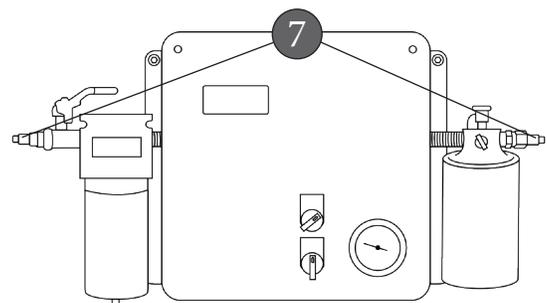
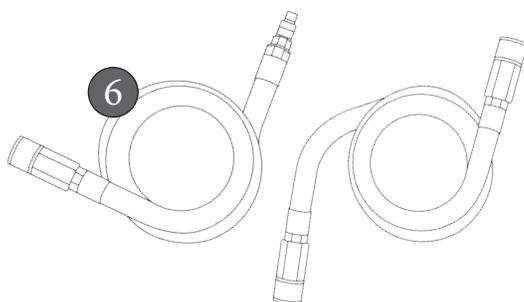
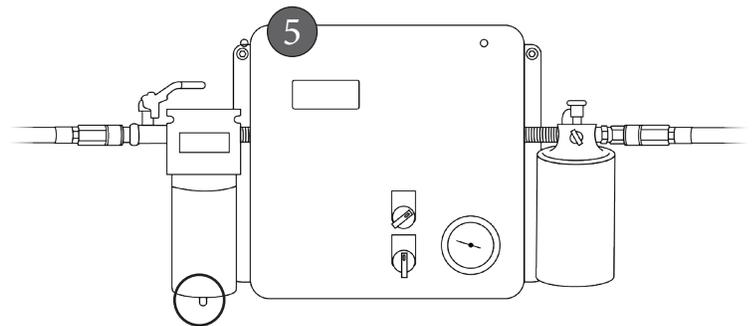
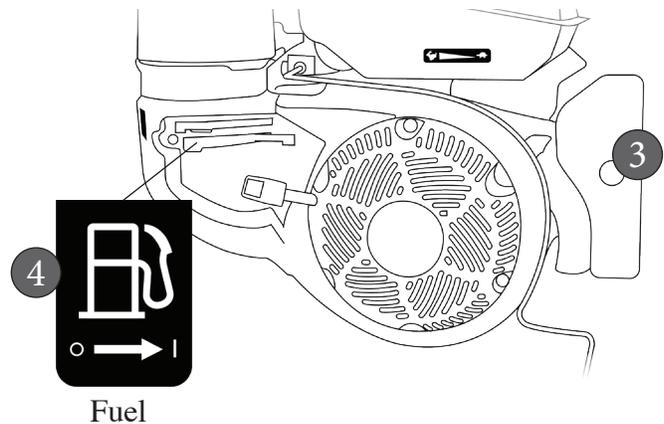
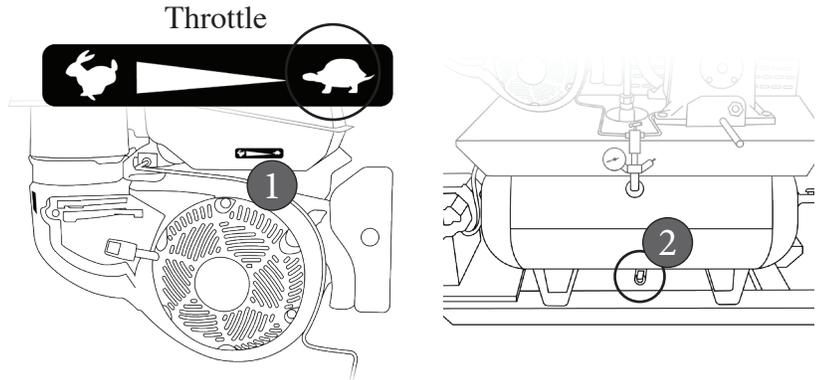
TURNING EQUIPMENT OFF

AIR COMPRESSOR TRAILER:

1. Turn the throttle all the way down by moving the throttle all the way to the right. Allow the engine to cool down for 2 minutes before shutting it off.
2. Open the valve on the underside of the air compressor tank (should hear the air escaping the tank).

NOTE: LEAVE THIS VALVE OPEN WHILE THE UNIT IS IN STORAGE. It prevents the compressed air from rusting out the compressor tank.

3. Turn the key to the OFF position.
4. Push the fuel valve back to the left most position (off).
5. Then go to the fuel filter on the air compressor control box and open the valve on the bottom of the clear plastic case to let any water drain out. Tighten the valve again once the compressor tank has been emptied of air.
6. Remove hoses 1 and 2 from the air compressor trailer and put them away.
7. Tape up the exposed male ends (both ends) on the oiler box.



ROAD READY CHECK LIST

After euthanasia is complete, follow the below check list before leaving the site.

- Counter balance removed
- Jarvis electric stunner box removed from v-restrainer and stored away
- Stunner wand unplugged and stored away
- Pneumatic captive bolt gun cleaned and stored away
- Pneumatic captive bolt gun testing device stored away
- Slide extension ramp put back into its storage place and secured with pins
- Ramp broken down and stored underneath the v-restrainer and secured with pins
- 3-phase electrical cords unhooked from generator and put back on hook on trailer
- Hoses on compressor trailer removed and stored in storage box on trailer
- Tape the ends of the air compressor hookups on the compressor trailer
- Wipe down the foot pedal and store with the electrical stunner
- V-restrainer trailer jacks retracted
- Wash down any manure/blood from the trailer with a garden hose or power washer

COST BREAKDOWN:

Most of the costs are intensive fixed costs due to the costs of the equipment. These costs are estimates of what it would cost to re-build these units and come with an expected variance of 10-15%. Based off 2020 prices.

TOTAL INVESTMENT COST (APPROXIMATE)

Item	Cost
Used V-Restrainer	\$40,000
Trailer, Hydraulic Pump, Stunner and Wand with Fabrication	\$25,000
Trailer Modifications	\$15,000
Estimate of rebuild of PCBG Trailer (Gun, trailer, compressor, oiler)	\$40,000
	\$120,000

TOTAL OPERATING COSTS PER DAY

Item	Cost
Generator rental	\$300
9 people (8 hour day at \$50/hour*)	\$3,600
Miscellaneous supplies	\$200
Carcass removal equipment (8 hours)	\$4,000

* More specialized labor to run machinery, devices and confirm insensibility/death

\$8,100 / day

Cost per pig: **\$6.75 per pig** (in an 8 hour shift)

- Estimating 150 animals per hour (1200 per 8 hour shift)
- Assuming the v-restrainer in the National Veterinary Stockpile can be used free of charge (i.e. no fixed cost associated with v-restrainer).

PERFORMANCE EXPECTATIONS:

- The v-restrainer is designed to work with pigs that range from 200-500 lbs.
- Once the system is fully operational, the rate limiting step will likely be loading the pigs into the v-restrainer in a single file and keeping them lined up one after another.
- If this is achieved, the processing time from electrical stunning, application of the pneumatic captive bolt gun and discharge down the chute is approximately 12 seconds per pig.
- Assuming that pigs are continually lined up to enter the v-restrainer, this would put the theoretical maximum at 300 pigs per hour.
- Due to the challenge of lining the pigs up and getting them into the chute, a realistic expectation would be 100-150 pigs per hour.

DISCUSSION / OBSERVATIONS:

Captive bolt gun euthanasia is an AVMA preferred method of euthanasia for depopulation of pigs. The process works well for a small number of pigs, but there are logistical and mechanical hurdles if ramped up to complete depopulations for entire barns or sites.

The advantage of the pneumatic captive bolt gun is the capability of euthanizing a large volume of pigs without having to change out caps after every pig. The air compressor and oiling box allows for repeated use of the captive bolt gun in rapid succession without frequent cleaning. The electrical stunner was added to the process in order to make the pigs insensible prior to the placement of the captive bolt gun. This helps to ensure that the pig's head is held perfectly still during the captive bolt process, resulting in a higher probability of success during the process.

The process of loading the pigs into the v-restrainer is the rate limiting step. Efficiency will be improved if more people are available for the loading process.

It is important to have enough labor to allow for rotation of duties as the electrical stunner and captive bolt gun operators will need to be changed hourly.

It will be important to have an electrician or electrical/agricultural engineer available to troubleshoot any issues with the generator or v-restrainer. During the demonstrations, there were issues with fuses in the electrical stunner box that were damaged and needed to be replaced. There are spare fuses in the supply box that the electrical stunner is housed in.

PHOTO REFERENCES:

Below are images taken from the pilot study.



Bolt end of the pneumatic penetrating captive bolt gun



Extended bolt from the pneumatic captive bolt gun



Counter balance attached to the counter balance stand



Hose 1 coming from air compressor into oiling box



Air compressor hose 1, coming into the oiling box and on the right, hose 2 coming from the oiling box to the captive bolt gun



Male end coming from oiling box to attach hose 2

PHOTO REFERENCES:



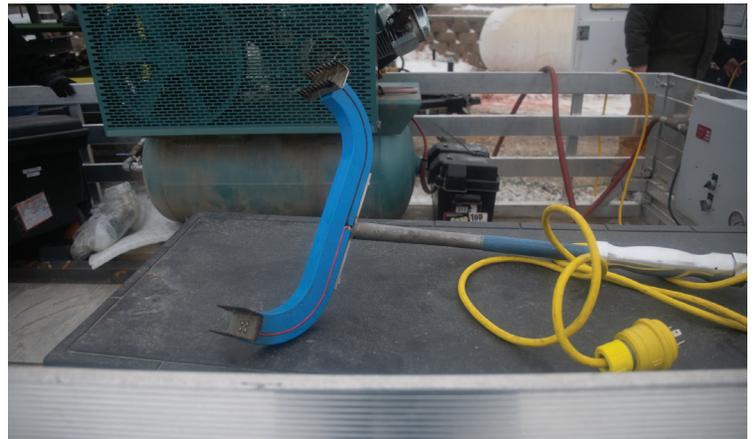
Air compressor unit



Pressure gauge on air compressor tank



Electrical stunning wand, detached from electrical stunning box



Close up of the 2 prongs on the electrical stunning wand

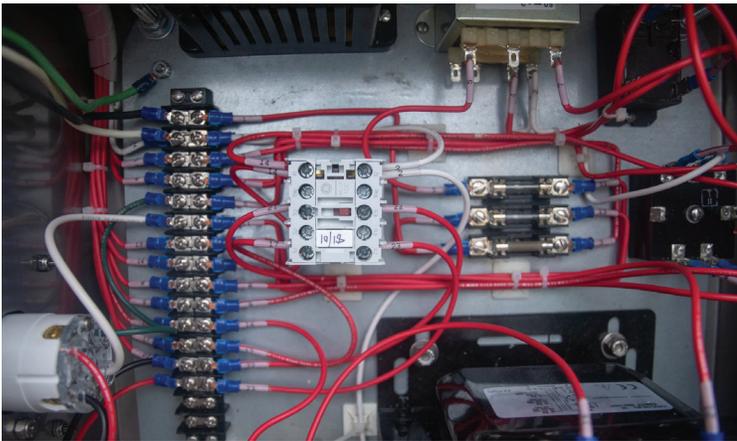


Connection of 3 phase electrical wires into portable generator



Breakers in fuse box on the trailer

PHOTO REFERENCES:



Fuses and wiring inside electrical stunning box



Side view of v-restrainer backed up to loading dock (without the ramp)



Foot pedal for v-restrainer



Electrical stunning time adjustment



7.5 hp electrical motor and hydraulics for v-restrainer



Extension ramp backed up to loading chute

RESOURCES:

Below are additional resources and contact information.

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